Geology BS

Goal 1: Basic skills for geology majors

Goal Description:

Deliver basic skills that geology majors will need to be successful in their subsequent coursework.

After our success in developing a field methods course (GEOL 3301) that does an excellent job of preparing our students for their capstone summer field camp we decided to assess the entire curriculum in terms of student preparation starting with the most basic skills and eventually working our way toward the advanced skills.

Providing Department: Geology BS

Progress: Draft

RELATED ITEMS/ELEMENTS

RELATED ITEM LEVEL 1

Goal 1 Objective 1: Apply Basic Skills Required of a Geology Major

Learning Objective Description:

Students completing the introductory geology courses will demonstrate an understanding of the basic skills required of a geology major to succeed in subsequent coursework.

This is where we want to assess how well we are training students to develop necessary basic skills. We are using student performance for the assessment, but we are really experimenting to find ways to improve our training methods.

RELATED ITEM LEVEL 2

ICF Goal 1 Objective 1: Basic Geology Skills Evaluation

Indicator Description:

All students enrolled in Physical Geology complete two practical exams that measure their ability to apply basic geological skills such as observing mineral properties necessary for mineral identification and being able to read maps and make geological interpretations based on map observations. Certain embedded questions, samples, or problems will be evaluated to measure student performance on specific basic skills.

Criterion Description:

At least 70% of the students will be able to perform 70% of the required skills in the embedded questions, samples, or problems. The remaining 30% of the students will be able to perform 50% of the required skills.

Findings Description:

Below is an example of what we have done in the past. Because of COVID we had to reformat the exams and were unable to obtain comparable information. We had to reformat the entire lab so that even the instruction does not compare to what we did previously. Note in the description below that the information is based on in-person practicals.

On the rock and mineral practical we embedded samples where students had to determine mineral cleavage, a basic skill for identifying minerals. We did this because we had the sense that students were having difficulty determining mineral cleavage and wanted to try measuring their ability to do so. 46% of the students were able to determine the mineral cleavage correctly 70% of the time or better. This is up from last year's 35%. And 23% of the students were able to determine the mineral cleavage less than 50% of the time. Compare this to 45% last year.

On the rock and mineral practical we also embedded samples where students had to determine the texture of an igneous rock, a basic skill for classifying igneous rocks. We had noticed students having issues with this concept, but wanted to get a quantitative measure of student skill levels. Only 31% of the students were able to determine the appropriate texture correctly 70% of the time or better. Compare this to 45% last year. 38% were only able to determine the appropriate texture correctly 50% of the time. Compare this to 45% last year.

On the map skills practical we embedded questions regarding the use of basic coordinate systems. We had observed that students seem to be having difficulty stating locations using various coordinate systems. 67% of the students were able to determine location coordinates correctly 70% of the time or better. Compare this to 0% last year. 22% were only able to determine the correct coordinates 50% of the time. Compare this to 44% last year.

On the map skills practical we also embedded questions where students had to make a geological interpretation based on map observations. Students always seem to struggle with this, but we had not previously quantified their struggle. Only 33% of the students were able to make a correct geological interpretation based on map observations 70% of the time. Compare this to 22% last year. 33% were only capable of making the correct geological interpretation 50% of the time. Compare this to 11% last year.

RELATED ITEM LEVEL 3

ICF Goal 1 Objective 1: Basic Geology Skills Evaluation

Action Description:

2020-2021: Similar to 2019-2020. Still trying to sort out practical formats and how to obtain the information we want from exams on Blackboard. It can be done, but much more labor intensive than getting the information by going through a pile of papers. Our "action" going forward is still along the lines of what is described in the 2018-2019 action. A "silver-lining" to the COVID reformat is a video describing physical properties such as mineral cleavage which generated positive anecdotal responses from students. Students claimed that the video (by Brian Cooper) helped them better visualize and recognize the various types of mineral cleavage.

2019-2020: Below is last year's action. Due to COVID-19, we have had to totally restructure our lab course and have not figured out yet how we will be doing practical exams in order to assess the skills in question.

2018-2019: We will continue with the embedded question format of evaluating specific basic geology skills in the introductory courses. This method provides information that can be used to change our classroom methods for teaching various basic geology skills. The plan is to start with the most basic skills, then look at higher level skills and application of entire sets of skills. This process was initiated when we looked at the success of the field methods class in preparing students for the capstone summer field camp. We realized there was a need to improve student

preparation in prerequisite coursework after observing student performance in the field methods course.
This year we realized that our sample size still needs to be increased. For example, even though we did change the way in which cleavage is taught in the lab, the ability of students to correctly recognize the type of cleavage only improved slightly (from 35% to 46%). Why? Most likely because we only sampled two labs, and both labs had fewer than 20 students. Still not a statistically representative sample. Plus the labs we chose had lower exam averages than a number of the other labs.
The plan this year is to again look at a larger sample during the fall, then introduce a new teaching technique and re-evaluate with a sampling during the spring. Last year students studied ideal cleavage forms and compare those to mineral examples. This year we will include measuring cleavage angles.

Goal 2: Development Of A Geologic Knowledge Base

Goal Description:

Each student is required to have developed a level of knowledge above and beyond the basic skills in various areas of geology prior to attending the capstone geology field course.

This is the follow-on to Goal 1 where advanced skills are to be assessed.

Providing Department: Geology BS

Progress: Draft

RELATED ITEMS/ELEMENTS

RELATED ITEM LEVEL 1

Goal 2 Objective 1: Mineral Recognition

Learning Objective Description:

After completing Geology 3404, students will be able to recognize minerals. Every geology student must take Geology 3404, Mineralogy. One of the objectives of this course is to be able to recognize minerals, which is a skill that will be needed when they take the capstone geology field course. This requires that the students be familiar with the physical properties of minerals.

RELATED ITEM LEVEL 2

ICF Goal 2 Objective 1: Final Mineral Practical Exam

Indicator Description:

Students completing Geology 3404, Mineralogy, must take a final practical exam that requires the recognition of minerals. The recognition process requires an understanding of the physical properties of minerals.

Criterion Description:

60 percent of the students will be able to recognize 15 or more of the 30 minerals presented to them on the final mineral practical. This year's exam will serve as a baseline for measuring student success in regard to using the physical properties of minerals in order to identify the mineral correctly.

Findings Description:

See previous results below. In 2020, 6 out of 9 (67%) were able to recognize 15 or more of the 30 minerals presented to them. The small number of students made the mineral cleavage and mineral formula observations even more statistically insignificant than usual.

Overall practical exam results (2019): 23% of the students (8 out of 35) were able to recognize 15 or more of the 30 minerals presented to them on the final mineral practical. Compared to: 2018 = 18%, 2017 = 53%, 2016 = 52%, 2015 = 79%, 2014 = 90%, 2013 = 70%, 2012 = 57%.

Results comparing 2017 to 2016 are given below. 2019's and 2018's results were so bad (per results above) that they are not really meaningful, other than inspiring some major changes to the class in 2020. There seems to be an improvement, but again the numbers are pretty small and are not statistically significant.

We embedded 8 questions on the final mineralogy practical where students had to determine mineral cleavage, a basic skill for identifying minerals. The students correctly determined the cleavage 61.7% of the time on average. 58.5% last year (41% in 2019). Individual minerals ranged from 29% to 93% correctly determined cleavages. (30% to 87% last year) (0% to 58% in 2019)

We embedded questions on the final mineralogy practical where students had to provide the mineral formula for the sample they were observing. Knowing the composition of the mineral is useful information when trying to determine the minerals in a rock sample since many minerals in a rock sample will have similar compositions. The students provided the correct formula 40% of the time on average. (55% last year) (did not calculate percentage for 2019...less than 50% just glancing at all the scores)

For 2020, there were embedded questions regarding rock-forming minerals. 8 out of 9 missed both plagioclase and augite. 7 out of 9 missed hornblende. 4 out of 9 missed potassium feldspar and quartz. Only one out of 9 missed olivine.

RELATED ITEM LEVEL 3

ICF Goal 2 Objective 1: Final Mineral Practical Exam

Action Description:

We will continue the trend that began with the Fall 2019 Mineralogy class, i.e. a greater emphasis on mineral identification and recognition. The goal here is to better prepare students for Petrology, Field Methods, and Summer Geology Field Camp. We will continue to use a similar approach used in the introductory courses to evaluate very specific skills by using embedded questions in the practical exams. This will help us understand which specific mineral recognition skills are causing the most problems and then we can develop teaching methods to address those problem areas. The Fall 2020 mineralogy class was taught in a Hybrid format, and some interesting new resources were discovered online and with the ability to make videos explaining various lab procedures. The plan is to make greater use of these resources going forward and assess the learning outcomes with the practical exams. We also examined the Fall 2020 mineralogy class's ability to recognize rock-forming minerals. The observations indicate more work is needed on this very important group of minerals to better prepare the students for Petrology.

Goal 3: Sufficient Knowledge Of Geology To Qualify For A Bachelor Of Science

Goal Description:

Students will acquire a comprehensive knowledge of the discipline that encompasses both theoretical and field-based practical skills.

Providing Department: Geology BS

Progress: Draft

RELATED ITEMS/ELEMENTS

RELATED ITEM LEVEL 1

Goal 3 Objective 1: Successful Completion Of An Externally Evaluated Geology Field Camp

Learning Objective Description:

All SHSU Geology majors must attend a six credit, externally evaluated capstone Field Camp as a required component of their degree program. Such field camps are typically open to suitably qualified upper level students from geology programs situated anywhere in the country. They are conventionally evaluated using a letter grade system which the Department of Geography and Geology converted to a ranking system.

SHSU Geology students must be nationally competitive at this capstone task as indicated by at least 60% of our participants achieving at least a Limited Mastery ranking.

RELATED ITEM LEVEL 2

ICF Goal 3 Objective 1: Successful Completion Of Field Camp

Indicator Description:

All students must attend a six credit hour Field Camp that is externally evaluated on the following basis: Mastery, Limited Master, Adequate Comprehension, Limited Comprehension, and Very Low Comprehension. Students are free to choose from a very wide range of applicable courses, each of which offers slightly different emphases in terms of geographical location and course structure. ALL courses offer a capstone-like review with Mastery reflecting mastery of taught and examined modules as well as high levels of precision in final field review stand-alone projects. A ranking of Limited Mastery reflects mastery of one or more modules but with some imprecision; a ranking of Adequate Comprehension reflects broad comprehension but demonstrates a lack of sophistication in the use of basic course material; rankings of Low Comprehension and Very Low Comprehension reflect low levels of understanding and effort and indicate inappropriate general preparation prior to field camp participation.

Criterion Description:

60% of students will achieve at least a limited mastery ranking or better by the external evaluator of the Field Camp.

Findings Description:

Just like last year (2020, see below), except this year (2021) University of Missouri Branson Field Camp did not take students from other universities so we were unable to get any feedback this year. Students did go to other field camps, but no more one or two per field camp so there was not a large group to evaluate. Anecdotally, our students reported that they excelled in their respective field camps and that their field camp instructors were impressed by their performance. But no actionable data was generated this year.

University of Missouri Branson did not have a Field Camp this year. So, our normal source of feedback regarding our student's ability in field methods cannot provide any information.

RELATED ITEM LEVEL 3

ICF Goal 3 Objective 1: Successful Completion Of Field Camp

Action Description:

Last year's (2019-2020) plan of action still pertains...especially the last sentence.

Our response to the feedback from students and field camp directors over the past number of years was to develop our own introductory field methods course. That course has now been offered seven times, with the most recent five offerings including two faculty members. The feedback from students and field camp directors regarding this course has been extremely positive. There is not much more we can do to improve the introductory field methods course. However, now we are looking at ways to improve student preparation for the introductory field methods course. So far we have only focused on a few basic geology skills in the introductory geology courses and mineral recognition in the mineralogy course. We plan on expanding on this type of assessment.

Update to Previous Cycle's Plan for Continuous Improvement Item

Previous Cycle's Plan For Continuous Improvement (Do Not Modify):

Closing Summary

Again, progress is being made, but we are definitely still in the development stage for a number of these assessment processes. We will make use of the many new resources that were discovered as a positive result of having to teach remote and hybrid courses. There will be a new Physical Geology lab coordinator starting this year, so I am not sure whether he will continue using pre-labs or not. The field methods course continues to be a success based on the informal feedback that we have received from students and summer field camp directors. Still working on getting more faculty involved in this assessment process. Committees were set up but did not meet because everyone was scrambling to deal with changes associated with COVID. Hopefully things will start to return to normal.

Update of Progress to the Previous Cycle's PCI:

Again, we will continue with the embedded question format of evaluating specific basic geology skills in the introductory courses. This method provides information that can be used to change our classroom methods for teaching various basic geology skills. The plan is to start with the most basic skills, then look at higher level skills and application of entire sets of skills. This process was initiated when we looked at the success of the field methods class in preparing students for the capstone summer field camp. We realized there was a need to improve student preparation in prerequisite coursework after observing student performance in the field methods course.

Last year we realized that our sample size still needs to be increased. Unfortunately, things went south this year and we were unable to implement our plans for the year. Although, the major changes in instruction did seem to offer some new methods. Again, the plan this year is to look at a larger sample, then introduce new teaching techniques and re-evaluate with a sampling during the spring. We are still experimenting with the use of pre-labs to help lab instructors evaluate student preparedness coming into any particular lab. We are putting the pre-labs on Blackboard. The plan did not work very well in the past because there was a very large DFW rate. An anomalously high rate. Still working on finding a solution to the normalization plan. So far we are just trying to determine which skills appear to be most problematic. The next step is to change up the instruction. That has started with the Fall 2020 mineralogy class. This sounds strange, but a greater emphasis is being placed on mineral identification and recognition than in previous classes. This requires some material regarding crystallography to be put on Blackboard as videos to save time during class to work with minerals.

Our response to the feedback from students and field camp directors over the past number of years was to develop our own introductory field methods course. We did not offer field methods this year, but as of last year that course has now been offered seven times, with the most recent five offerings including two faculty members. The feedback from students and field camp directors regarding this course has been extremely positive. There is not much more we can do to improve the introductory field methods course. However, now we are looking at ways to improve student preparation for the introductory field methods course. So far we have only focused on a few basic geology skills in the introductory geology courses and mineral recognition in the mineralogy course. We plan on expanding on this type of assessment. There is a need to get all faculty involved in this assessment process, and that was initiated last fall by setting up committees to help with the assessment process.

New Plan for Continuous Improvement Item

Closing Summary:

Again, progress is being made, but we are definitely still in the development stage for a number of these assessment processes. We will make use of the many new resources that were discovered as a positive result of having to teach remote and hybrid courses. There will be a new Physical Geology lab coordinator starting this year, so I am not sure whether he will continue using pre-labs or not. The field methods course continues to be a success based on the informal feedback that we have received from students and summer field camp directors. Still working on getting more faculty involved in this assessment process. Committees were set up but did not meet because everyone was scrambling to deal with changes associated with COVID. Hopefully things will start to return to normal.