Institutional Effectiveness Report

2018-19

Program: Geoscience BS

Unit: Geosciences

Contact: Mike Harrison

Mission

1. To provide a robust undergraduate learning and research experience for geoscience students.
2. To demonstrate the importance of the geosciences to society.
3. To promote faculty research, scholarly activity and interdisciplinary collaboration.

Program Goals

PG 1: The Department will maintain an average of 10 graduates/year.

PG 2: Increase the department's Alumni Endowment to offer more scholarships, experiences, and student research.

Student Learning Outcomes

SLO 1: Graduates will demonstrate sufficient geoscience knowledge that allows them to either pursue a graduate degree or enter the geoscience workforce. Graduates should achieve a passing score (≥70) on the department exit exam and score above the 50th percentile on the national ACAT Geology exam.

SLO 2: Students will demonstrate proficient communication and critical thinking skills on a senior thesis project. Graduates will demonstrate the ability to independently develop, conduct, and complete a novel research project.

SLO 3: Students will demonstrate proficient critical thinking ability by scoring above the institutional mean on the university senior exit exam.

SLO 4: Graduates will demonstrate the ability to independently develop, conduct, and complete a novel research project.

A departmentally developed curriculum map can be found in Appendix 1 that shows the connections between courses and student learning outcomes.

Assessment Methods

PG 1: Number of majors and graduates, reviewed annually.

Programs graduating <10 students/year can be classified as low producing by the Tennessee Board of Regents. Low producing programs have been eliminated.

PG 2: Donations and endowment growth

The Department tracks the size of the endowment as well as the number of scholarships, experiences and student research funded.

SLO 1: Competency

Two exams are used to assess a student's understanding and retention of fundamental knowledge and to help us identify content gaps in our curricula.

ACAT Exam: Graduates should score above the 50th percentile on the national ACAT Geology exam. The ACAT measures multiple areas of geology knowledge including: Geomorphology, Stratigraphy, Physical Geology, and Structural Geology.

Departmental Exam: 90% of graduates will meet or exceed expectations on the departmental exams. The departmental exams evaluate core knowledge for all students and concentration knowledge: Environmental Geology and GIS/GEOG.

SLO 2: Communication and Critical-thinking skills

The California Critical Thinking Skills Test (CCTST) is used to evaluate critical thinking. The test is administered to all graduating students at TTU.

Graduates are required to complete a thesis project: Senior Thesis 1 and 2 (GEOL 4930 and GEOL 4931). The course grade issued by the adviser reflects a student's critical thinking and communication ability, as well as their thoroughness, initiative, and effort. To better assess only the critical thinking and communication components, the faculty adopted a separate grading rubric (Appendix 2).

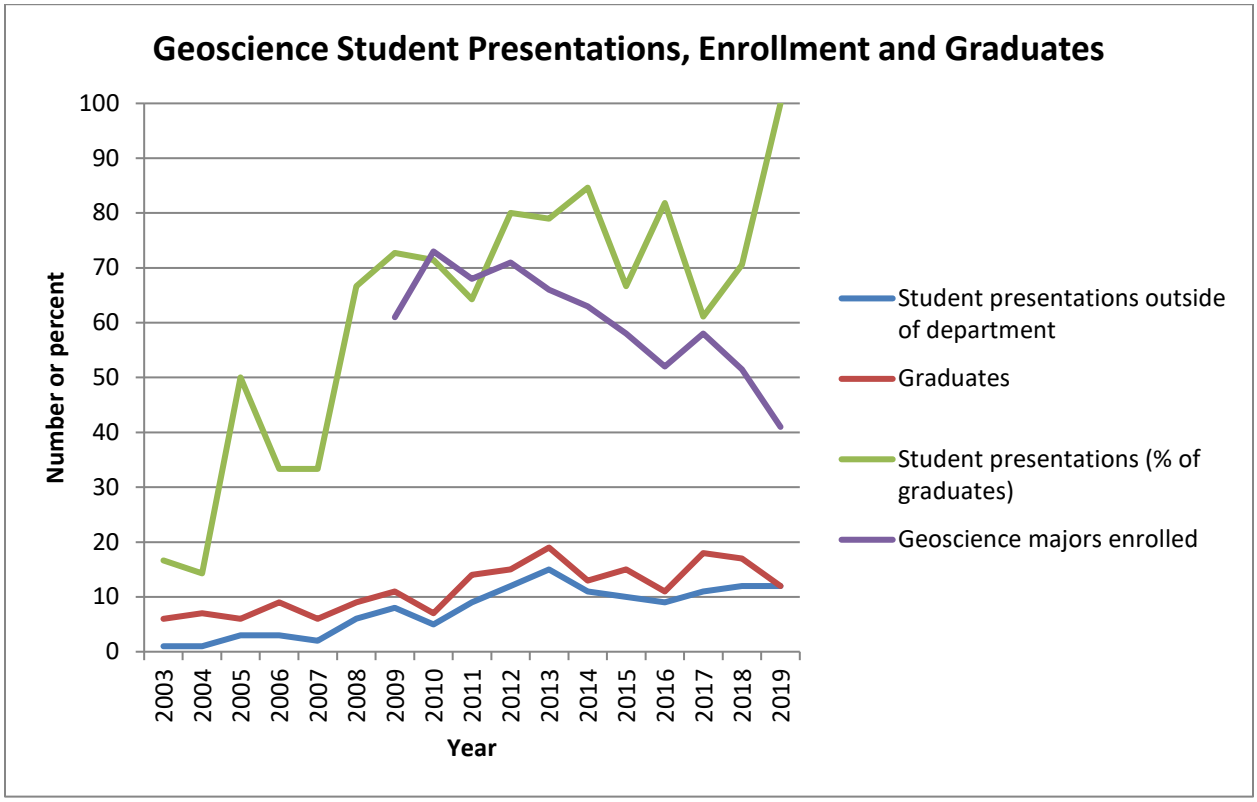
SLO 3: Undergraduate research

The Department tracks the number of students presenting thesis research outside the department.

Results

PG 1: Number of majors and graduates, reviewed annually.

The number of majors in the fall 2018 semester was 40; it increased to 42 in spring 2019. For F2018-S2019, we graduated 12 students. As of Summer 2019, our 5-year graduation average is 16.2 students/year—an increase from last year's 5-year average of 14.8.



PG 2: Donations and endowment growth

As of August 2019, our Alumni Endowment is $40,956, about the same this time last year. Also, we now offer a new scholarship to geoscience students: the Shanks-Moran Scholarship

SLO 1: Competency

From spring 2006-spring 2019, 143 students completed the department exit exam. During this time, 105 students scored ≥70 on the exam (10/14 for F2018-S2019 cohort). The 2018-19 exam average is 73% compared to 83% for 2017-18.

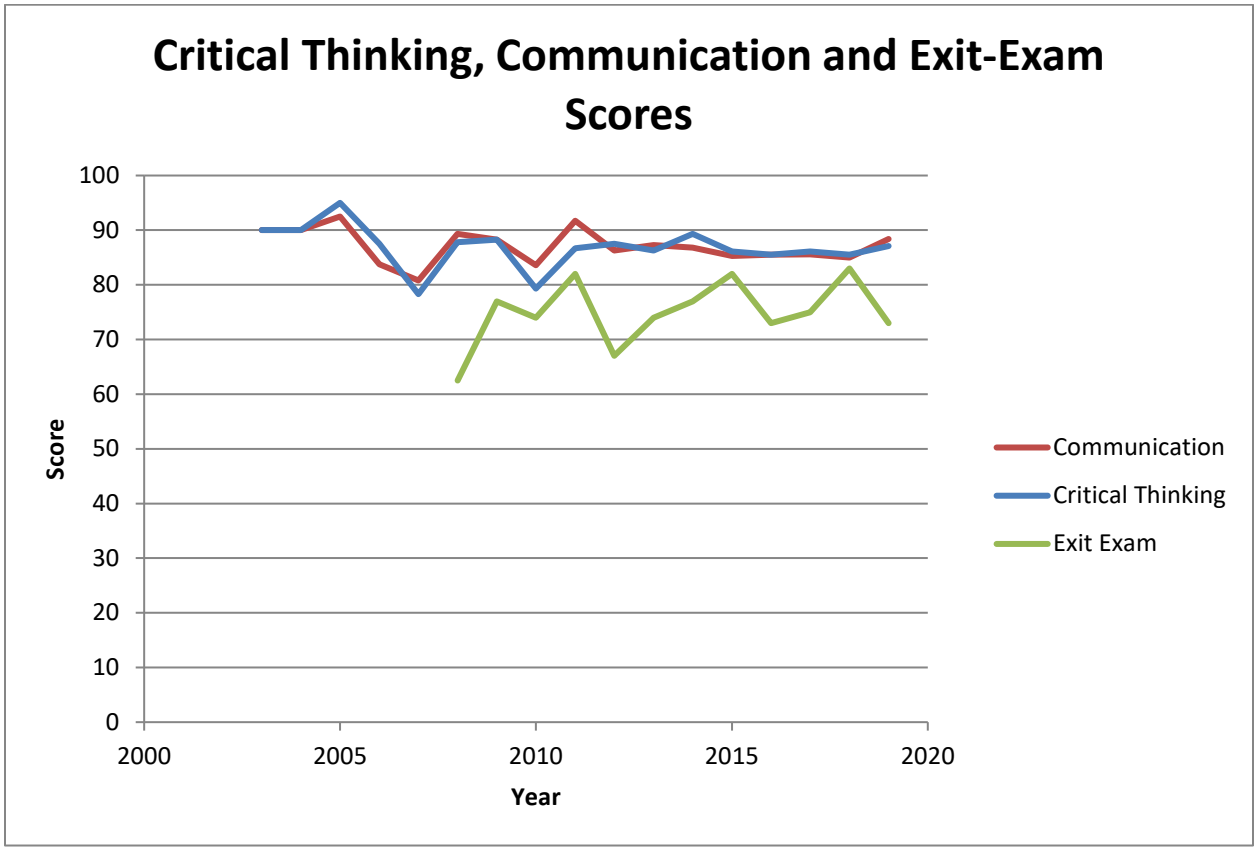
For the 2018-2019 AY, geosciences students (N=6) scored in the 71st percentile on the national ACAT Geology exam compared to 45th last year. This is our fourth year of data for this exam.

SLO 2: Communication and Critical-thinking skills

Senior Thesis: Between spring 2003 and spring 2019, 187 geosciences students have completed senior theses. The average course grade for that time is 91.7. For F2018-S2019, the average is 93.1 (N=13)—an increase from the F2017-S2018 average of 87.9. Critical thinking and communication scores averaged

87.1 and 88.4, respectively, for F2018-S2019. Critical-thinking and communication scores increased, respectively, from last year (80.5 and 79.2).

	2015-2016		2016-2017		2017-2018		2018-2019	
MAJOR	Mean	N*	Mean	N*	Mean	N*	Mean** 34 point /100 point	N*
GEOS	13.5	4	15.1	16	20.2	13	20.6/83	8
TTU Total	16.9	1485	17.0	1767	17.6	1295	16.8/76	1515
CCTST	≈17.1		≈16.2		≈16.2		≈15.4/74	



SLO 3: Undergraduate research

Between spring 2003 and spring 2019, 133 (71%) geoscience graduates who completed a senior thesis have presented senior-thesis research outside the department. For F2018-S2019, 13/13 (100%) students presented their thesis research outside the department—an increase from last year (71%). Although year-to-year percentages fluctuate, the overall trend is positive since 2003-2004, when the percentage was <20%.

Modifications for Improvement

PG 1: Number of majors and graduates, reviewed annually.

(1) Development of new courses such as Paleoclimates and the hiring of a climate scientist has helped recruit new students; and (2) More online courses. As of spring 2018, the department has taught 8 different online courses (GEOG 1120, 1130, 4410, 4510, 4810/4820, 5410, ESS 6510, and GEOL 1045); 3 of these courses are general-education courses (GEOG 1120, 1130, and GEOL 1045). We continue our aggressive recruitment and retention of geoscience majors.

PG 2: Donations and endowment growth

Currently working with department alumni to increase contributions to the Alumni Endowment. This ongoing work resulted in two new geoscience scholarships and the acquisition of an XRD instrument to assist with faculty and undergraduate research. Faculty continue seeking more funding for senior-thesis research on and off campus (e.g., NASA, NSF, TTU URECA and CISE grants)

SLO 1: Competency

Historically, students who completed GEOL 2500 (Geologic Fundamentals) score higher on the exit exam than those who did not. Thus, we will continue to require students to complete GEOL 2500. 2019 marks our fourth year using the national geology ACAT exam. From last year, our percentile increased from 45th to 71st.

Development of the department exit exam in 2006 to assess content knowledge of graduating seniors. The results of the exams have illuminated weaknesses in the curriculum, particularly with map reading, rocks and minerals. The exit exam data suggest that GEOL 2500 contributes to the success of SLO 2. Also, the results of the ACAT exam assess how our majors compare to their peers across the U.S. The results from these assessments guided us in the major revision of our four Geoscience curricula from fall 2018-spring 2019.

SLO 2: Communication and Critical-thinking skills

Requirement of the senior thesis and the greater emphasis on student research and communication in our upper-level courses. Senior-thesis students give an oral presentation of their research to the department faculty and students. We continue to strongly encourage thesis students to present their research outside the department. In addition, more faculty have now made poster sessions or oral presentations a part of their courses. Also, more emphasis on writing abstracts in GEOL 2500, 3230, 4110, 4200 and 3830. Dr. Michel's courses contain multiple writing exercises. Assessment of thesis communication ability shows the need to continue this activity.

Appendices

1. Curriculum Map
2. Senior Thesis Rubric

Appendix 1: Curriculum Map

Alignment of required geoscience courses with student-learning outcomes. Core courses common to all concentrations are shaded in blue. Geology concentration courses (4/5 required) are shaded in red; GIS concentration in green; environmental geology in purple; and geography in orange. The courses at the bottom of the table (unshaded blocks) are regularly offered directive elective courses.

Course	Title	SLO 1: Communication and critical thinking	SLO 2: Geoscience knowledge	SLO 3: Undergraduate research
GEOL 1020	Field Experiences (freshmen only)		x	
GEOL 1040	Physical Geology		x	
GEOL 1045	Earth Environment, Resources and Society		x	
GEOL 2500	Geologic Fundamentals		x	
GEOG 4510	Theory of GIS I		x	
GEOL 4930	Senior Thesis I	x	x	x
GEOL 4931	Senior Thesis II	x	x	x
GEOL 2000	Earth Evolution and Life History		x	
GEOL 3110	Principles of Mineralogy and Petrology		x	
GEOL 3230	Structural Geology and Tectonics	x	x	
GEOL 3830	Field Geology	x	x	x
GEOL 4110	Sedimentation and Stratigraphy	x	x	
GEOG 4210	Cartography		x	
GEOG 4650	Environmental Applications of GIS		x	x
GEOG 4850	Advanced GIS		x	
GEOL 4410	Remote Sensing	x	x	x
GEOL 3200	Water Resources	x	x	

GEOL 4150	Geomorphology	x	x	
GEOL 4200	Geological Exploration Techniques	x	x	
GEOL 4410	Remote Sensing	x	x	x
GEOL 4711	Hydrogeology	x	x	
GEOL 4650	Environmental Applications of GIS		x	x
GEOG 1012	Cultural Geography	x	x	
GEOG 1130	Geography of Natural Hazards		x	
GEOG 2100	Meteorology		x	
GEOG 3200	Water Resources	x	x	
GEOG 4210	Cartography		x	
GEOG 4650	Environmental Applications of GIS		x	x
GEOG 1100	Global Climate Change	x	x	
GEOG 4511	Theory of GIS II		x	x
GEOL 3310	Planetary Geoscience	x	x	x
GEOL 3550	Paleoclimates	x	x	
GEOL 3750	Stable Isotope Geochemistry	x	x	
GEOL 4300	Environmental Aqueous Geochemistry	x	x	
GEOL 4810	Special Problems: Techniques in X-ray Diffraction	x	x	
GEOL 4820	Special Problems: Geobiology Field Trip	x	x	

Appendix 2: Senior Thesis Rubric

Letter Grade	Communication Skills (Written and Oral)	Critical Thinking Skills	Thesis Assessment
A (90-100)	Graduate-school level of communication proficiency, strong technical writing skills, strong oral communication skills.	Student exhibited creativity and independent motivation to complete research.	Journal-quality research with minor revision by the advisor.
B (80-89)	Above-average ability, technical writing required editing, oral communication needed some improvement.	Student needed some guidance with research but generally worked independently.	Near journal-quality research with moderate revision by the advisor.
C (70-79)	Average ability, technical writing required significant editing, oral communication skills needed improvement.	Average research abilities.	Work could only be considered journal quality with significant revision by the advisor.
D (60-69)	Below average ability, weak technical writing skills, weak oral communication skills.	Student required significant guidance throughout the entire research project.	Not journal quality research.
F (<60)	Little to no ability, very weak technical writing skills, very weak oral communication skills.	Abilities below that of a D.	Abilities below that of a D.