Institutional Effectiveness Report

2019-20

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 1).

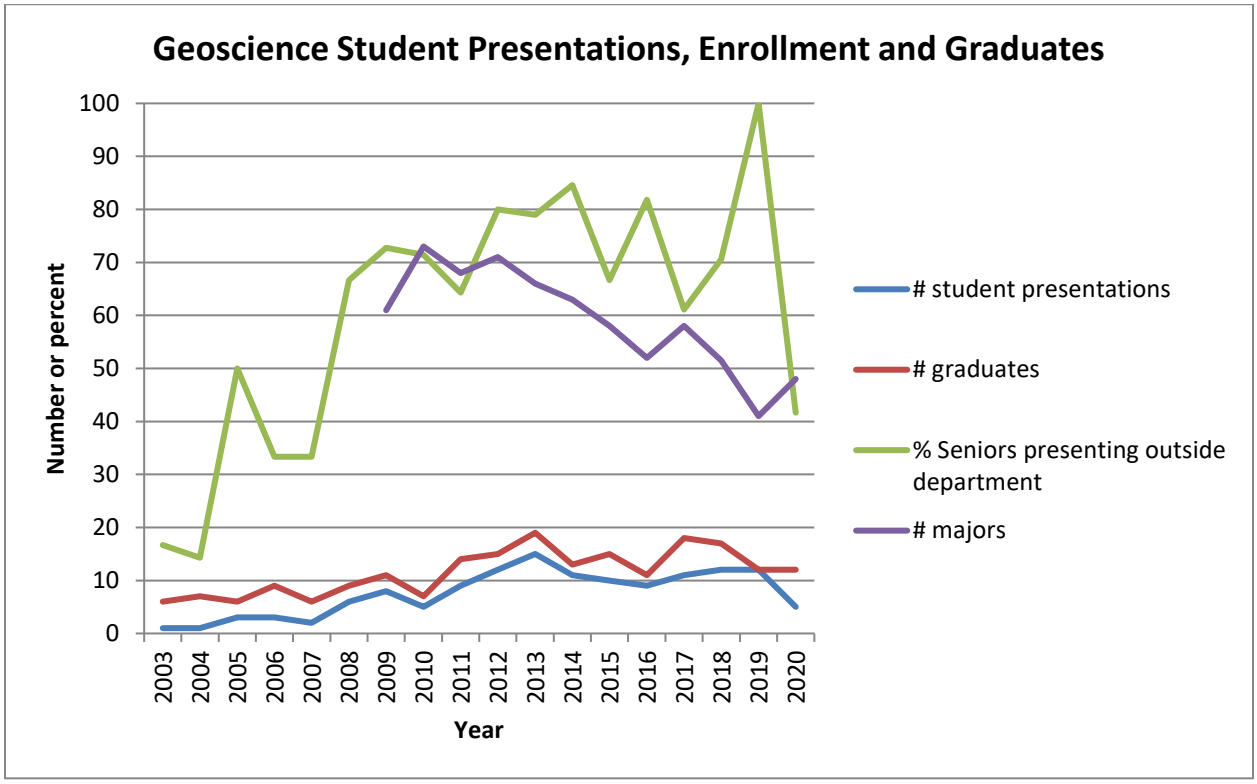
SLO 3: Undergraduate research

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 2019 semester was 48 (an increase of 20% from the Fall 2018). For F2019-S2020, we graduated 12 students, the same number as last year. As of summer 2019, our 5-year graduation average is 14.0 students/year—a decrease from last year's 5-year average of 14.6.



PG 1: Donations and endowment growth

As of August 2019, our Alumni Endowment is $39,240, a decrease of 4%. Also, we now offer a new scholarship to geoscience students: the Shanks-Moran Scholarship. Donations from department alumni now are added to our Restricted account, not to the Endowment. In calendar year 2019, we received over $11,010 in donations. As of August 2020, we have received $8125. The restricted account can be used for field trips.

SLO 1: Competency

ACAT Exam: For the 2019-2020 AY, geosciences students (N=5) scored in the 40th percentile on the national ACAT Geology exam compared to 71st last year. This is our fifth year of data for this exam. The percentile range on this exam for 2019-2020 students was from 4 to 96, indicating a great disparity that does not likely reflect student aptitude.

2019-2020	Geomorphology	Stratigraphy	Physical Geology	Structural Geology	Overall	Percentile
Student 1	489	212	416	402	354	7
Student 2	504	618	482	427	530	62
Student 3	629	652	609	598	670	96
Student 4	469	465	543	347	457	33
Student 5	375	284	327	422	324	4
TOTAL	**493.2**	**446.2**	**475.4**	**439.2**	**467**	**40.4**

Departmental Exam: From spring 2006-spring 2020, 156 students completed the department exit exam. During this time, 116 students scored ≥70 on the exam (11/13 for F2019-S2020 cohort). The 2019-20 exam average increased slightly, from 77% compared to 73% for 2018-19. We have begun breaking down the results on the departmental exam to get a better picture of our students' performance.

2020	Common Core	Environmental Geology	GIS/GEOG
A: Exemplary	15%	0%	67%
B: Above Expectations	38%	50%	0%
C: Meets Expectations	31%	50%	0%
D: Below Expectations	0%	0%	0%
F: Unacceptable	15%	0%	33%

SLO 2: Communication and Critical-thinking skills

	2015-2016		2016-2017		2017-2018		2018-2019		2019-18	
MAJOR	Mean	N*	Mean	N*	Mean	N*	Mean** 34 point /100 point	N*	Mean** 34 point /100 point	N*
GEOS	13.5	4	15.1	16	20.2	13	20.6/83	8	18.7/79	6
TTU Total	16.9	1485	17.0	1767	17.6	1295	16.8/76	1515	16/75	1365
CCTST	≈17.1		≈16.2		≈16.2		≈15.4/74		≈15.4/74	

Senior Thesis: Between spring 2003 and spring 2020, 199 geosciences students have completed senior theses. The average course grade for that time is 92.4. For F2019-S2020, the average is 92.5 (N=12)—a slight decrease from the F2018-S2019 average of 93.5. Critical thinking and communication scores remained good with averages of 85.9 and 86.9, respectively.

Communication	2019	2020
A: Exemplary	69%	50%
B: Above Expectations	23%	31%
C: Meets Expectations	8%	8%
D: Below Expectations	0%	8%
F: Unacceptable	0%	0%

Critical Thinking	2019	2020
A: Exemplary	38%	42%
B: Above Expectations	54%	42%
C: Meets Expectations	8%	8%
D: Below Expectations	0%	8%
F: Unacceptable	0%	0%

SLO 3: Undergraduate research

Thesis and Research Scores:

Research	2019	2020
A: Exemplary	77%	67%
B: Above Expectations	23%	33%
C: Meets Expectations	0%	0%
D: Below Expectations	0%	0%
F: Unacceptable	0%	0%

Students presenting research:

Between spring 2003 and spring 2020, 139 out of 200 (70%) geoscience graduates who completed a senior thesis have presented senior-thesis research outside the department. For F2018-S2019, 5/12 (42%) students presented their thesis research outside the department—a decrease from last year (100%). Although year-to-year percentages fluctuate, the overall trend is positive since 2003-2004, when the percentage was <20%. (Also, due to COVID-19, few students were able to present outside the department, although many were planning to until the lockdown.

Our department participated in the 5-year review in Spring 2020. We received high marks from the outside reviewer, especially with regard to Presentation of Student Research. Apparently, our requirement of senior thesis and our high rate of student presentations at outside meetings, is a exceptional for a program of our size.

Modifications for Improvement

Program Goal 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). In 2019 and 2020, the Department Chair met twice with representatives from University Advancement to discuss ways to better reach alumni and gain their support. In Fall of 2019, the Department hosted an alumni event during homecoming, showcasing our newly remodeled building.

Student Learning Outcome 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.