

Institutional Effectiveness

Department of Earth Sciences

Academic Year: 2018-2019

Program: Geosciences

College: Arts and Sciences

Submission Date: August 2019

I. Program 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.

II. Program Goals and Student Learning Outcomes:

Program Goals:

1. Recruit and retain sufficient majors to maintain an average of 10 graduates/year.
2. Increase the Alumni Endowment so the department can offer more scholarships, domestic and international undergraduate field experiences, and to help fund student research.

Student Learning Outcomes:

1. Graduates will demonstrate proficiency in communication and critical thinking.
2. Graduates will demonstrate sufficient geoscience knowledge that allows them to either pursue a graduate degree or enter the geoscience workforce.
3. Graduates will demonstrate the ability to independently develop, conduct, and complete a novel research project.

III. Assessments

- **Track the number of majors and graduates** (yearly)-Program Goal 1.
- **Monitor donations and endowment growth** (quarterly)-Program Goal 2.

- **Senior-thesis grades with separate grades for communication and critical-thinking skills** (every semester)-Student Learning Outcomes 1 and 3.
- **Presentation of student research** within the department and, if possible, outside the department (e.g., scientific meeting) (every semester)-Student Learning Outcomes 1 and 3.
- **California Critical Thinking Skills Test** (every November and April)-Student Learning Outcome 1.
- **Exit exams for graduating seniors** (upon graduation)-Student Learning Outcome 2.
- **ACAT Geology Exam** (upon graduation)-Student Learning Outcome 2

IV. Rationale for Goals, Outcomes, and Assessments

- Program Goal 1: Programs graduating <10 students/year can be classified as low producing by the Tennessee Board of Regents. Low producing programs have been eliminated.
- Program Goal 2: Since spring 2008, the number of geoscience majors has increased >50%. More students are applying for department scholarships.
- Student Learning Outcome 1: The course grade issued by the advisor 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).

As for students presenting thesis research outside the department, we feel that the communication outcome is achieved, in part, if the student has an abstract accepted and completes a poster or gives a talk.

Lastly, we use the California Critical Thinking Skills Test (CCTST) to compare the skills of our majors to national averages.

- Graduates should achieve a passing score (≥ 70) on the department exit exam and score above the 50th percentile on the national ACAT Geology exam. The exams are used to assess a student's understanding and retention of fundamental knowledge and to help us identify content gaps in our curricula.

- Assessment data are compiled by the chair and discussed with faculty at department meetings.
- Student Learning Outcome 3: Graduates should achieve a passing grade for Senior Thesis 1 and 2 (GEOL 4930 and GEOL 4931).

V. Results

1. The number of majors in the fall 2018 semester was 40; it increased to 42 in spring 2019 (Appendix 3). 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. (Program Goal 1).
2. 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 (Program Goal 2).
3. 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 (Appendix 2). Critical-thinking and communication scores increased, respectively, from last year (80.5 and 79.2).

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% (Appendix 3) (Student Learning Outcome 1).

The **CCTST** results (N=8) from F2018-S2019 show a mean of 20.6—an increase from last year (16.4). The national average for the same time is 15.4 and the TTU average was 16.8 (Appendix 4) (Student Learning Outcome 1).

4. 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 (Appendix 2).
5. 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.

VI. Modifications and Continuing Improvement: Program Changes due to Assessments:

For Program Goal 1: (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 2019, 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.

For Program Goal 2: 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).

For Student Learning Outcome 1: 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.

Link to Assessment: Assessment of thesis communication ability shows the need to continue this activity.

For Student Learning Outcome 2: 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.

Link to Assessment: 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.

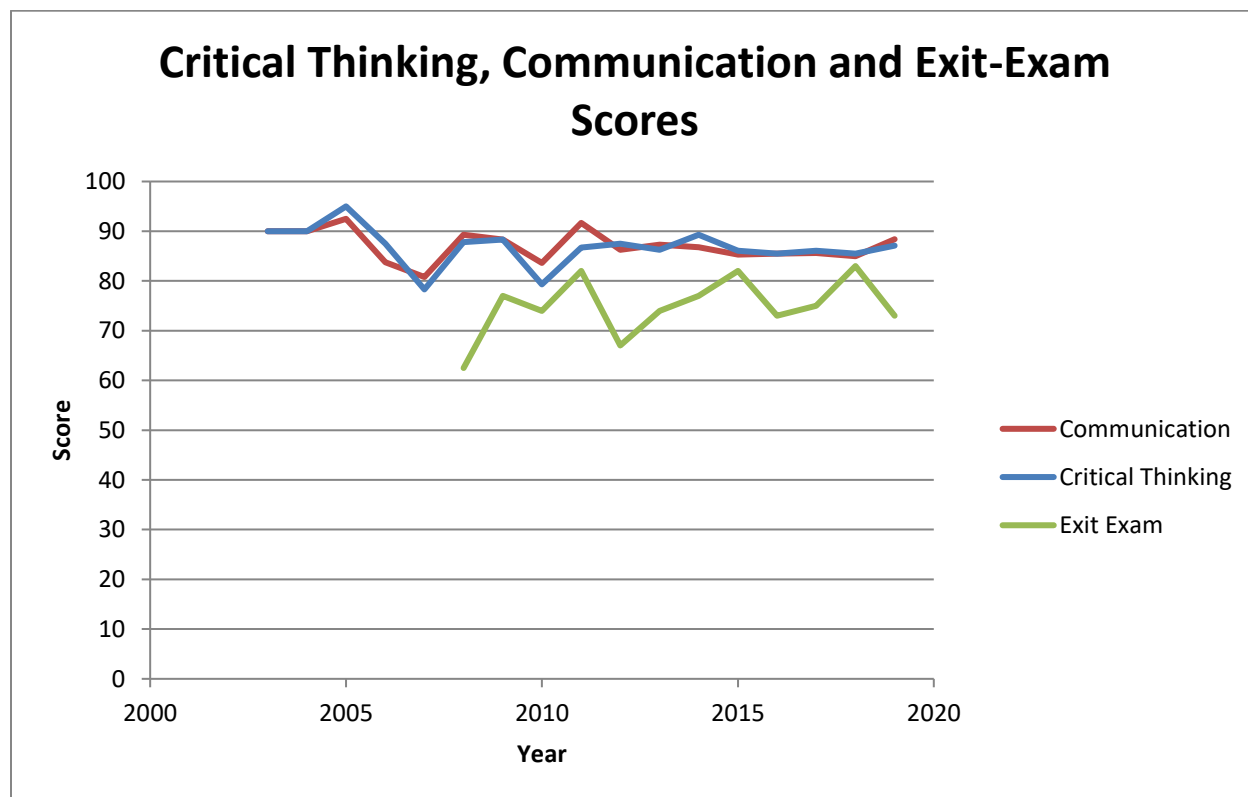
For Student Learning Outcome 3: We have been tracking Senior-Thesis grades for years, but the emphasis has been on communication and critical thinking (SLO-1). We

will now assess the quality and thoroughness of research by the student. This will be reflected in the grades assigned for thesis, as described in the grading rubric (Appendix 1).

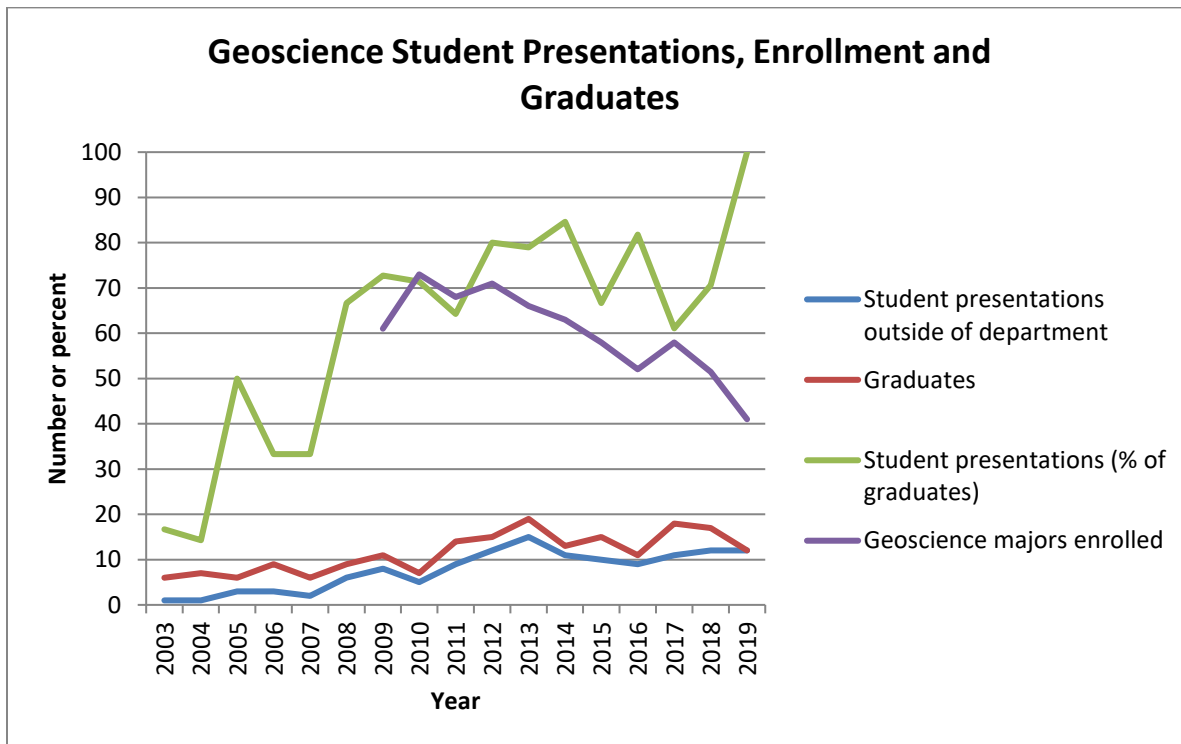
Appendix 1: Grading rubric for assessing senior-thesis research, critical thinking and communication.

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.

Appendix 2: Critical thinking, communication and exit-exam scores through spring 2019.



Appendix 3: Presentations outside the department made by thesis students through spring 2019. Chart includes enrollment and graduates.



Appendix 4: CCTST comparison of geoscience graduates to national and TTU scores.

