

## **Institutional Effectiveness**

### **Department of Earth Sciences**

Academic Year: 2017-2018

Program: Geosciences

College: Arts and Sciences

Submission Date: August 2018

Contact: Dr. Mike Harrison; (931) 372-3751; [mharrison@tntech.edu](mailto:mharrison@tntech.edu)

#### **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 ( $\geq 70$ ) 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 has increased from 38 (spring 2008) to 48 (fall 2017) (Appendix 3). For F2017-S2018, we graduated 17 students. As of summer 2018, our 5-year graduation average is 14.8 students/year—a decrease from last year's 5-year average of 15.2. (Program Goal 1).
2. As of August 2018, our Alumni Endowment is \$40,970, a slight decrease from summer 2018. However, it's a substantial increase from 2005, when the amount was \$31,332. We now offer two more scholarships to geoscience students: the Melvin Smith and the Moran Scholarships (Program Goal 2).
3. Between spring 2003 and spring 2018, 174 geosciences students have completed **senior theses**. The average course grade for that time is 91.6. For F2017-S2018, the average is 87.9 (N=17)—a decrease from the F2016-S2017 average of 90.6. Critical thinking and communication scores averaged 80.5 and 79.2, respectively, for F2017-S2018 (Appendix 2). Critical-thinking and communication scores decreased, respectively, from last year (85.6 and 82.1).

Between spring 2003 and spring 2018, 118 (68%) geoscience graduates who completed a senior thesis have presented senior-thesis research outside the department. For F2017-S2018, 12/17 (71%) students presented their thesis research outside the department—an increase from last year (67%). 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=16) from F2017-S2018 show a mean of 16.4—an increase from last year (15.1). The national average for the same time is 16.2. The TTU average was 17.6 during the same time. Normally, our students score above the national average (Appendix 4) (Student Learning Outcome 1).

4. From spring 2006-spring 2018, 129 students completed the department **exit exam**. During this time, 95 students scored  $\geq 70$  on the exam (9/9 for F2017-S2018 cohort). The 2017-18 exam average is 83% compared to 75% for 2016-17 (Appendix 2).

5. For the 2017-2018 AY, geosciences students (N=9) scored in the 45<sup>th</sup> percentile on the national ACAT Geology exam compared to 56<sup>th</sup> last year. This is our third 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 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.

**For Program Goal 2:** Currently working with department alumni (Berny Ilgner) to increase contributions to the Alumni Endowment. This ongoing work resulted in two new geoscience scholarships and the acquisition of XRF and XRD instruments to assist with faculty and undergraduate research. Faculty continue seeking more funding for senior-thesis research on and off campus (e.g., TTU URECA 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. 2018 marks our third year using the national geology ACAT exam. Our percentile dropped from 56<sup>th</sup> to 45<sup>th</sup>. We will monitor this to see if the decrease is an anomaly or a trend. Also, we dropped the target percentile for the ACAT exam from 70<sup>th</sup> to >50<sup>th</sup> as this denotes scores above the median which is more consistent with an average of >70% (letter grade C) on the department exit exam.

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

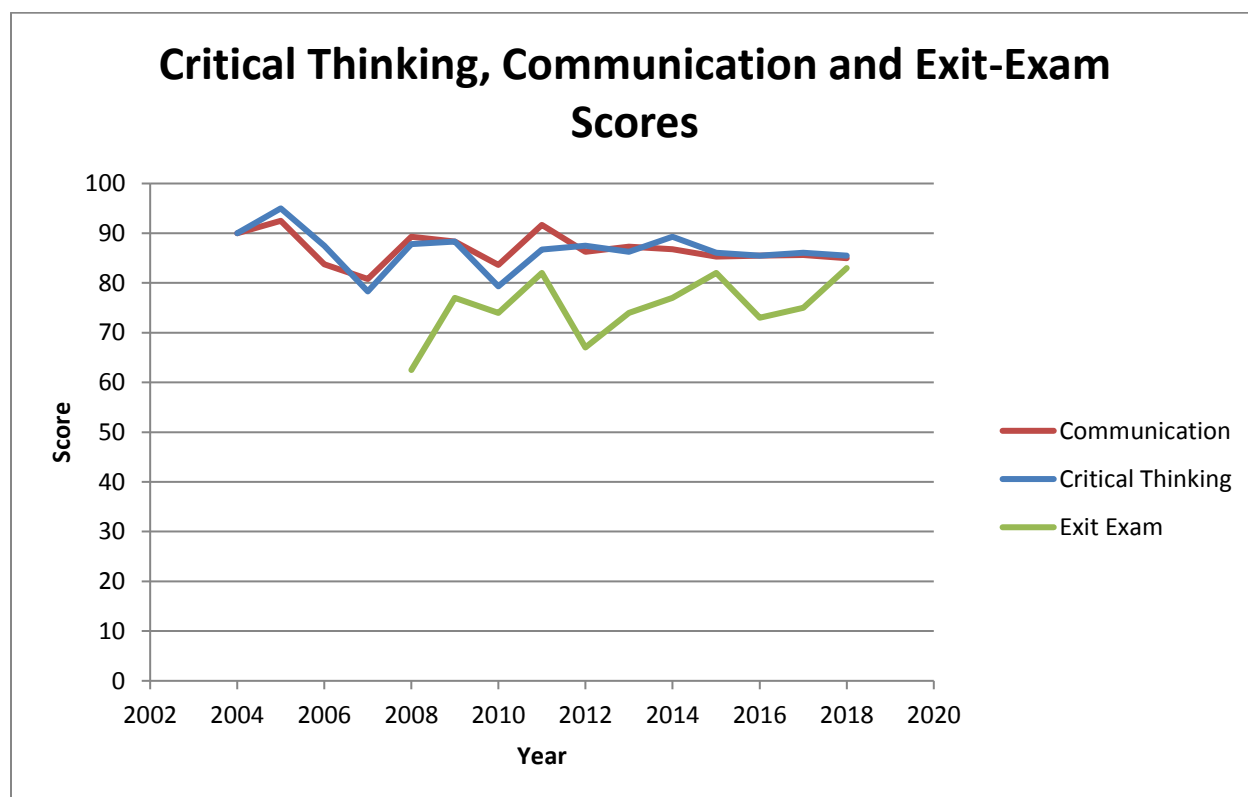
results of the ACAT exam assess how our majors compare to their peers across the U.S.

**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 modified grading rubric (Appendix 1).

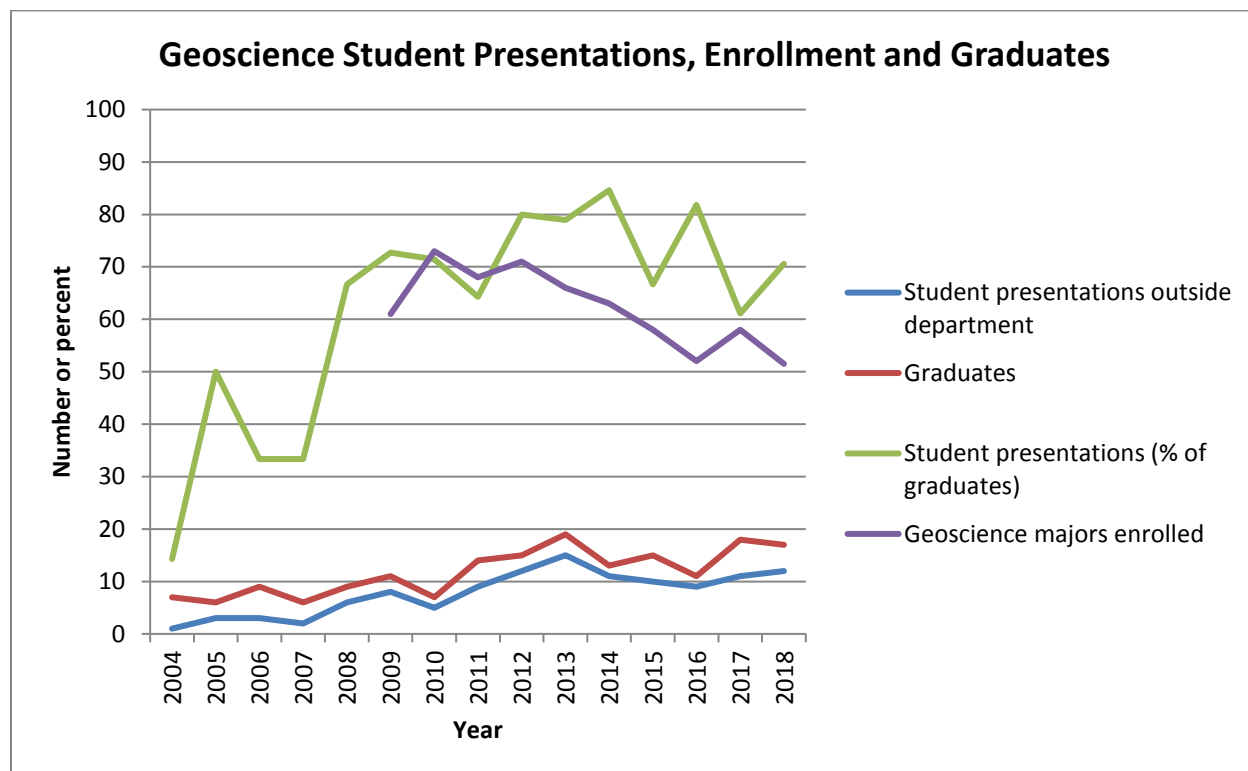
Appendix 1: Grading rubric for assessing senior-thesis research, critical thinking and communication.

Letter Grade	Communication Skills (Written and Oral)	Critical Thinking Skills	Thesis Assessment
<b>A (90-100)</b>	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>B (80-89)</b>	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.
<b>C (70-79)</b>	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.
<b>D (60-69)</b>	Below average ability, weak technical writing skills, weak oral communication skills.	Student required significant guidance throughout the entire research project.	Not journal quality research.
<b>F (&lt;60)</b>	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 2018.



Appendix 3: Presentations outside the department made by thesis students through spring 2018. Chart includes enrollment and graduates.



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

