

Institutional Effectiveness Report

2018-19

Programs: Mathematics BS

College and Department: College of Arts & Sciences - Mathematics

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Mission: All undergraduate degree programs at Tennessee Tech require at least one course in mathematics and many require several courses. The Department of Mathematics provides a variety of general education courses, introductory and advanced undergraduate courses in support of STEM majors, and graduate-level courses for the MS in mathematics and other graduate programs.

As a central part of a STEM-infused comprehensive institution, the Department of Mathematics strives to create successful learners of the subject of mathematics in the university community and in the community where we live. Learning opportunities are provided to students of all disciplines to advance their understanding of mathematical concepts and their effective use of analytic practices and critical thinking as useful in their studies and everyday life. The departmental faculty conduct research in mathematics and as part of interdisciplinary teams and provide service to the department, college, University, and mathematical community.

The mission of the TTU Department of Mathematics is to promote the learning of mathematics through effective teaching, research, and public service. Such learning opportunities are provided to students of all disciplines in support of the mission of the University.

Program Goals:

PG 1: The Mathematics program will grow and continue to recruit and retain a strong number of students.

The undergraduate degree program will average at least 10 graduates per year.

PG 2: Increase the use of technology in mathematics classes.

The number of faculty using technology and the type of technology used in the classroom will increase every year until the unit is saturated with users of technology.

PG 3: Improve initial math course placement for incoming freshmen and transfer/international students by developing a placement procedure involving a mathematics test.

PG 4: Faculty will be involved in outreach activities to spread the appreciation and understanding of mathematics.

Student Learning Outcomes:

SLO 1: Students graduating in mathematics will demonstrate an understanding of mathematics by having 50% of graduates score at or above the 75th percentile on the ETS Major Field Test in Mathematics.

SLO 2: All students graduating from the University will be "mathematically literate" and able to apply their knowledge from the mathematics courses in their curricula.

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: Recruit and retain a strong number of students

1. Count Mathematics graduates in the previous July 1- June 30 time period: Each May the number of graduates earning the BS in Mathematics in the previous year is determined and trends are tracked using a 5-year average of the number of graduates.

Threshold of Acceptability: 10 graduates a year

PG 2: Increase the use of technology

1. Faculty Annual Report: As part of their annual effort report each faculty member list the type of technology used in courses.

PG 3: Improve initial math course placement

1. Math Placement: Each year the department chair determines if a placement procedure is in place and whether it needs to be adjusted.

Threshold of Acceptability: The instances of poor placement should be decreasing.

PG 4: Faculty involved in outreach activities

1. Faculty Annual Report: As part of their annual effort report each faculty member list STEM Center activities.

SLO 1: Demonstrate an understanding of mathematics

1. ETS Major Field Test: The ETS Major Field Test in Mathematics is designed to measure student performance so that meaningful comparisons between similar schools throughout the country can be made. All graduating mathematics majors are expected to take the Major Field Test during their final semester at TTU.

Threshold of Acceptability: 50% of TTU graduates score at the 60th percentile or higher.

SLO 2: Mathematically literate

1. National Survey of Student Engagement: Relevant questions on the NSSE will assess students' confidence in their mathematical abilities.
2. Praxis II Math Content Knowledge: The Praxis Content Knowledge test in Mathematics is designed to assess the mathematical knowledge and competencies necessary for a beginning teacher of secondary school mathematics.

Threshold of Acceptability: 100% of Secondary Education-Mathematics graduates must pass PRAXIS content knowledge exam.

Results:

PG 1: Recruit and retain a strong number of students

The BS in Mathematics program achieved this goal by graduating 12 students in the 2018-2019 academic year. The table below shows the number of graduates per year.

Number of TTU BS in Mathematics Graduates
July 1-June 30 reporting periods

Year	Men	Women	Total Number of Graduates
2008-2009	8	1	9
2009-2010	6	2	8
2010-2011	8	3	11
2011-2012	6	2	8
2012-2013	9	3	12
2013-2014	12	8	20
2014-2015	15	4	19
2015-2016	9	4	13
2016-2017	13	3	16
2017-2018	8	5	13
2018-2019	7	5	12

PG 2: Increase the use of technology

The table below shows the number of sections taught by full-time mathematics faculty members in which instructional technology is used. Since many adjuncts, graduate assistants, and Learning Support mathematics faculty members incorporate instructional technology in their courses, the counts underreport the overall use of instructional technology in mathematics classes at TTU.

The data shows a steady increase in the use of instructional technology.

Number of Sections Using Technology in Instruction

	2014	2015	2016	2017	2018
Class Instruction					
iLearn	60	70	80	85	89
Automated Homework	29	40	52	52	46
Table to project lectures	45	52	55	73	75
Archive lectures	9	35	40	46	49
Software Use					
Maple/Maxima/ Mathematica	3	2	2	0	0
Matlab	1	3	3	0	1
R	8	13	18	5	14
SAS	5	3	3	2	2
Excel	3	7	13	5	8
DPGraph, Geogebra, Desmos	4	5	1	1	11

PG 3: Improve initial math course placement

We continue to use the ACT Math subscore as a placement tool for students having an ACT score. Students without an ACT score or those who wish to challenge a placement have taken the COMPASS test. However, the COMPASS test has been discontinued by the Educational Testing Service. ACCUPLACER is now being used.

Very few instances of poor placement recommendations were noticed. However, there were a few cases of students having an ACT Math subscore granting them entry into Math 1910 without having learned a sufficient amount of trigonometry.

PG 4: Faculty involved in outreach activities

Numerous faculty have been involved in the community. One faculty member tutors regularly at a middle school. Another presented at the Tennessee Math Teachers Association regional conference. When asked to judge at the local science fair, one or two of the faculty are usually picked.

SLO 1: Demonstrate an understanding of mathematics

Six of the twelve students who took the ETS Major Field Test in Mathematics in 2018-19 scored at the 75th percentile or higher. Thus, this learning outcome goal of having at least 50% of our students score at the 75th percentile or higher has been met.

The table below displays the average scores of TTU students who took the Major Field Test in Mathematics in recent academic years and the percentile of TTU's average score to the average score of other institutions using the test.

Average Scores on ETS Major Field Test in Mathematics

	National Average	Number of TTU Math Students Taking the Test	TTU Average	Percentile of TTU Average
2014-15	155.1	18	164.9	80 th
2015-16	155.0	10	174.5	97 th
2016-17	156.3	12	160.3	75 th
2017-18	157.3	12	172	93 rd
2018-19	156.2	12	172.8	93 rd

SLO 2: Mathematically literate

Data from the 2011, 2014, and 2017 National Study of Student Engagement (NSSE) comparing the TTU average to the averages of all Tennessee public universities and our Carnegie peers on a question related to the learning outcome is shown in the table below. Freshman and senior students were asked to what extent their experience at college had contributed to their ability to analyze quantitative data.

TTU Student Response Averages on NSSE Questions Related to Ability to handle Quantitative Data

	2011 TTU	2011 THEC	2011 Carnegie	2014 TTU	2014 THEC	2014 Carnegie	2017 TTU	2017 THEC	2017 Carnegie
Freshmen	2.99	2.97	2.98	2.4	2.4	2.3	2.7	2.7	2.6
Seniors	3.18	3.12	3.10	2.0	2.4	2.3	2.9	2.8	2.8

Scale: 1= Very Little; 2= Some; 3= Quite a Bit; 4= Very Much

The Praxis II Mathematics Subject Assessment data for TTU graduates is shown in the table below. All students who earned the degree in secondary education mathematics passed the exam because passing the exam is a degree requirement. However, in recent year some students required multiple test attempts to pass the exam.

Pass Rate of TTU Students on Praxis II Math Content Knowledge Test

Academic Year	2014-15	2015-16	2016-17	2017-18	2018-19
Number of Test Takers	5	5	2	1	3
First Attempt Pass Rate	2/5 or 40%	2/5 or 40%	1/2 or 50%	0/1 or 0%	0/3 or 0%
Final Pass Rate for Licensure	5/5 or 100%	5/5 or 100%	2/2 or 100%	1/1 or 100%	3/3 or 100%

Modifications for Improvement

PG 1: Recruit and retain a strong number of students

Although this goal was met, the number of BS in Math graduates is trending downward. In addition, the department's move from Bruner Hall to temporary quarters in Foundation Hall may affect its ability to attract and retain mathematics majors. We plan to update some of our recruitment materials and to create an undergraduate student lounge near our faculty offices in Foundation Hall.

PG 3: Improve initial math course placement

The current placement system (ACT Math scores or ACCUPLACER test) seems to be effective at placing students in an appropriate mathematics class in a timely manner. Moreover, since students without an ACT Math score are placed by the ACCUPLACER tool, the department has no need to create its own placement tests.

Faculty noticed a few instances of students with weak backgrounds in trigonometry placing into Math 1910-Calculus I (because of an ACT Math score of at least 27). Faculty will be encouraged to carefully go over the course prerequisites and the fact that a significant amount of trigonometry knowledge is required on the first day of Math 1910 classes.

At a meeting to discuss data related to departmental goals and assessment the faculty decided to delete this goal because it is no longer relevant.

SLO 1: Demonstrate an understanding of mathematics

The mathematics faculty are satisfied with the scores of our students on the ETS Major Field Test. The BS in mathematics curriculum is preparing students well. The faculty will continue to monitor course content and its alignment with the topics on the ETS Major Field Test.

When reviewing the data for this goal the faculty decided to revise statement of the goal slightly. As currently stated the goal focuses on analyzing how our higher test scorers fare against the scores of students at other institutions. By revising the goal to compare the average of TTU test takers with the average scores of other institutions, we will be considering all of our test scores.

SLO 2: Mathematically literate

The PRAXIS II test results indicate that Secondary Education Mathematics students are struggling to pass the math content test on their initial attempt.

In spring 2019 the department offered a Special Topics course based on a curriculum for future high school mathematics teachers developed by the Mathematics Teacher Education Partnership. We plan to create a new upper-division mathematics course for SEMA majors. The course will utilize portions of the curriculum developed by the partnership and materials developed by departmental faculty.

At a meeting to discuss data about departmental goals and outcomes, the faculty expressed dissatisfaction with the NSSE assessment. It is a measure of student confidence in their skills, but not a good measure of student learning. The faculty plan to developing two assessments for general education mathematics (one in Math 1530-Intro to Statistics; one in Math 1910-Calculus I) during the fall 2019 semester. These assessments should give a more direct measure of student learning in some selected general education mathematics classes.

Appendices

1. Math BS Curriculum Map

II. Computational Skill												
a) Students will demonstrate algebraic, computational, & algorithmic skills to determine solutions to mathematical problems and interpret the results	X	X	X	X	X			X			X	X
b) Students will utilize technology to solve problems and interpret results												
III. Reasoning & Communication Skills												
a) Students will write sound mathematical proofs						X	X		X	X		X
b) Students will explain orally or in writing the methodology used to solve math or statistical problems						X	X		X	X	X	X