

Institutional Effectiveness Report

2019-20

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 14 students in the 2019-2020 academic year. The table below shows the number of graduates per year. The average number of graduates for the last five years was 13.6. Hence, the department has met its goal of 10 graduates per year.

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

Year	Men	Women	Total Number of Graduates
2015-2016	9	4	13
2016-2017	13	3	16
2017-2018	8	5	13
2018-2019	7	5	12
2019-2020	11	3	14

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

	2015	2016	2017	2018	2019
Class Instruction					
iLearn	70	80	85	89	111
Automated Homework	40	52	52	46	32
Table to project lectures	52	55	73	75	88
Archive lectures	35	40	46	49	65
Software Use					
Maple/Maxima/ Mathematica	2	2	0	0	0
Matlab	3	3	0	1	5
R	13	18	5	14	15
SAS	3	3	2	2	0
Excel	7	13	5	8	21
DPGraph, Geogebra, Desmos	5	1	1	11	12

PG 3: Improve initial math course placement

ACCUPLACER is now being used along with the ACT Math subscore as a placement tool for students. Students without an ACT score or those who wish to challenge a placement are given the option to take the ACCUPLACER. Of those who took the ACCUPLACER and were placed into the appropriate math course based on their score, 57.5% (23 out of 40) made a C or better in their math course in Fall 2019 while 48.1% (13 out of 27) made a C or better in their math course in Spring 2020.

As more data comes in, the Department will consider ways to improve the placement of students via the ACCUPLACER.

PG 4: Faculty involved in outreach activities

As mentioned in the previous year's report, numerous faculty were involved in educational outreach activities. As a program goal, it has been reached again because of the number of faculty who have tutored at the high school and local middle schools, the volunteerism for the science fair, TTU STEM Center projects, and presentations at K-12 teacher conferences.

SLO 1: Demonstrate an understanding of mathematics

Six of the nine students who took the ETS Major Field Test in Mathematics in 2019-20 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 was met. In fact, four of the six students whose score was at least at the 75th percentile actually scored at the 90th percentile or higher.

The table below displays the average scores of TTU students who took the Major Field Test in Mathematics in recent academic years.

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
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
2019-20	157.4	9	177	84 th

SLO 2: Mathematically literate

Data from the 2011, 2014, 2017, and 2019 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

	2014 TTU	2014 THEC	2014 Carnegie	2017 TTU	2017 THEC	2017 Carnegie	2019 TTU	2019 Quality Assurance	2019 Carnegie
Freshmen	2.4	2.4	2.3	2.7	2.7	2.6	3.1	2.9	2.9
Seniors	2.0	2.4	2.3	2.9	2.8	2.8	3.3	3.1	3.2

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. For 2020, the numbers indicate some have not taken their final attempt yet.

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

Academic Year	2015-16	2016-17	2017-18	2018-19	2019-20
Number of Test Takers	5	2	1	3	10
First Attempt Pass Rate	2/5 or 40%	1/2 or 50%	0/1 or 0%	0/3 or 0%	8/10 or 80%
Final Pass Rate for Licensure	5/5 or 100%	2/2 or 100%	1/1 or 100%	3/3 or 100%	8/10 or 80%

Modifications for Improvement

PG 1: Recruit and retain a strong number of students

The average number of graduates for the last five academic years will be 15.

SLO 2: Mathematically literate

The PRAXIS II test results indicated that Secondary Education Mathematics students were 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 created a new upper-division mathematics course for SEMA majors. The course utilized portions of the curriculum developed by the partnership and materials developed by departmental faculty. Although the data quite limited, the first-attempt pass rate was much better on the PRAXIS for 2019-20 than all the previous years listed. This is very encouraging and the course was offered again Spring 2021.

As mentioned in last year's report, the faculty planned to developed two assessments for general education mathematics (one in Math 1530-Intro to Statistics; one in Math 1910-Calculus I).

Unfortunately, the assessment development was postponed until Fall of 2020 to be implemented in Spring 2021.

Appendices

1. Math BS Curriculum Map

Appendix 1: Math BA Curriculum Map

The table below is a curriculum map showing how the required mathematics courses relate to learning goals for mathematics majors. The mathematics majors take at least 3 additional courses that reinforce these goals.

Provide Students with Conceptual Understanding and Computational, Reasoning and Communication Skills to Begin a Career or Pursue Graduate Education.												
	Required Courses											
	1910	1920	2010	2110	2120	3400	3430, 4310, or 4410	3810	4010	4110	4470	4530
I. Conceptual Foundation												
a) Students will understand conceptual foundations of calculus, differential equations, and matrix algebra	X	X	X	X	X							
b) Students will understand major concepts in geometry, probability & statistics, abstract algebra, linear algebra, and real & complex analysis							X	X	X	X	X	X

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