

Institutional Effectiveness Report

2020-21

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 15 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: 15 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. For Secondary Math Education Majors, the Praxis II Content Knowledge test in Mathematics was previously used is to assess the mathematical knowledge and competencies necessary for a beginning teacher of secondary school mathematics. In 2021, the Praxis II was replaced by the National Evaluation Series (NES). Secondary education mathematics students must now pass the NES to get their degree.

- For non-math majors, the math faculty designed a simple assessment using three common questions on each of the finals in Math 1530 and Math 1910, respectively. Math 1530 was chosen because engineers do not normally take it while Math 1910 is mostly engineers.

Results:

PG 1: Recruit and retain a strong number of students

The table below shows the number of graduates per year. The BS in Mathematics program did not meet this goal because only 9 students graduated from the program in the 2020-2021 academic year. Yet, the five-year moving average 12.8. Hence, the department is still above the previous goal of 10 graduates per year but is working on plans to improve recruitment and retention.

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

Year	Men	Women	Total Number of Graduates
2016-2017	13	3	16
2017-2018	8	5	13
2018-2019	7	5	12
2019-2020	11	3	14
2020-2021	6	3	9

PG 2: Increase the use of technology

This goal has been obtained and is to be removed. All math faculty now use or require some type of technology in their classes. Also, with the new renovation of Bruner Hall, every classroom is a distance learning classroom.

PG 3: Improve initial math course placement

We continue to use the ACT Math sub-score as a placement tool for students having an ACT score. Students without an ACT score or those who wish to challenge a placement take the ACCUPLACER test. Again, no disparities seem to have arisen based on placement.

PG 4: Faculty involved in outreach activities

This goal has been obtained and is to be removed. As part of faculty evaluations, outreach activities are part of the rubric and, hence, are routinely seen in their effort reports.

SLO 1: Demonstrate an understanding of mathematics

Three of the seven students who took the ETS Major Field Test in Mathematics in 2020-21 scored at the 77th percentile or higher while four of the seven scored at the 73rd 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 this year.

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
2016-17	156.3	12	160.3	75th
2017-18	157.3	12	172	93rd
2018-19	156.2	12	172.8	93rd
2019-20	157.4	9	177	84 th
2020-21	157.5	7	158.6	56 th

SLO 2: *Mathematically literate*

1. 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

	2017 TTU	2017 THEC	2017 Carnegie	2019 TTU	2019 Quality Assurance	2019 Carnegie	2020 TTU	2020 Quality Assurance	2020 Carnegie
Freshmen	2.7	2.7	2.6	3.1	2.9	2.9	2.1	2.2	2.2
Seniors	2.9	2.8	2.8	3.3	3.1	3.2	2.3	2.2	2.2

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

2. The Praxis II Mathematics Subject Assessment data for TTU graduates is shown in the table below. The last column values are for the NES Content Knowledge Test.

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

Academic Year	2016-17	2017-18	2018-19	2019-20	2020-21
Number of Test Takers	2	1	3	10	10
First Attempt Pass Rate	1/2 or 50%	0/1 or 0%	0/3 or 0%	4/10 or 40%	2/10 or 20%
Final Pass Rate for Licensure	2/2 or 100%	1/1 or 100%	3/3 or 100%	4/10 or 40%	9/13 or 69%

As it can be seen, the first time pass rates are dismal. Also, the final pass rates for licensure is quite low for the last two years. All students who earned the degree in secondary education mathematics passed the exam because passing the exam is a degree requirement. Some retake the exam multiple times. However, the number of graduates still is down because of the pass rate. The Math Department has tried to help with a special topics course, Math 4950, which reviews the test material. The Department has again reached out to the College of Education to continue discussions on ways to help.

3. For Math 1530, 144 of the 194 students (74%) who were given the three questions answered them correctly. For Math 1910, 247 of the 411 students (60%) answered the three common questions correctly.

Modifications for Improvement

PG 1: Recruit and retain a strong number of students

The Math Department is actively discussing means of improving the outcome of this goal.

PG4: Improve initial math course placement

One of the issues which will be addressed in next year's report is the DFW rates for Math 1910. Based on the results from the Math 1910 assessment for *SLO 2*, this particular class needs to be reviewed and placement is one item in particular.

SLO 1: Demonstrate an understanding of mathematics

Hopefully the latest scores on the ETS test are an outlier. The Department will be monitoring these scores next year and will encourage the students next spring to do their best!

SLO 2: Mathematically literate

The NSSE numbers were not as good as previous years but TTU seniors still scored better than the norm with 2.3 versus 2.2.

The PRAXIS II and NES test results still indicate that Secondary Education Mathematics students were struggling to pass the math content test on their initial attempt. More discussion is underway with the College of Education as it appears our Math 4950 special topics course did not have the desired effect.

Finally, the Math 1530 common questions were answered by a good percentage of students but increasing this value should and will be our goal. As for the Math 1910 common question results, the 60% pass rate simply go along with the DFW rates seen by the individual sections in 1910. The Math 1910 committee is already discussing ways to improve this course.

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