

Department of Mathematics and Statistics

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East Tennessee State University

Self-Study Report

for

Academic Program Review 2016-17

<http://www.etsu.edu/cas/math/>

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III. Executive Summary

This document and the subsequent site visit are required for academic programs at East Tennessee State University and are part of the program review process, a standard of Quality Assurance Funding for the Tennessee Higher Education Commission (THEC). More importantly, the program review process provides academic programs with the opportunity to assess their strengths, weaknesses, needs, and opportunities for growth. The Mathematics and Statistics self-study report was compiled by the department chair, with help from a number of faculty members and the executive aide.

IV. Introduction

This school started in 1911 as "East Tennessee State Normal School" with 19 faculty and 200 students. The Mathematics Department became part of the university in 1926, but it is unclear when undergraduate degrees in mathematics were first offered. In 1951, the "Graduate Division" was introduced and a master's of arts in education degree was initiated. This degree included math as a minor field. The first graduate of the program with the minor field of math was Lora McCormick, who graduated in 1955. More advanced math classes were added to the curriculum throughout the 1950s. In 1960, several upper level classes were added which are still on the books, including abstract algebra, analysis, and topology. In February 1963, the school attained university status. It is unclear when master's of science degrees were first offered. Currently, a B.S. degree with options for four possible concentrations (Computational Applied Mathematics, Mathematical Sciences, Mathematics Education, and Statistics), and an M.S. degree in mathematics are offered. The department also offer undergraduates with a different major the option of getting a minor in statistics or mathematics.

In 2012, the department began participating in the Learning Support program. The Learning Support program offers academic support, such as labs and tutoring, to students whose college entrance scores indicated academic need. Students with an ACT-Math score that is less than 19 must take MATH-1530-LS (3 credit hour course + 2 hour lab). Learning Support was instituted by the Tennessee Board of Regents to replace the former Developmental Studies Program, which offered academic support courses to students with low entrance scores. Six faculty members came to the department from the Division of Developmental Studies (DDS) in 2003. Currently, we have five full-time faculty remaining from DDS that now teach MATH 1530 Probability and Statistics, MATH 1710 Precalculus I (Algebra), MATH 1720 Precalculus II (Trigonometry), MATH 1840 Analytical Geometry and Differential Calculus, MATH 1850 Integral Calculus for Technology, MATH 1910 Calculus I, and MATH 1920 Calculus II. MATH 1530, 1840, and 1910 are general education courses.

Since the previous program review in 2010, the department has implemented several positive changes. In Fall 2012, a minor in Statistics was established. Students at ETSU had expressed an

interest in taking statistics courses or getting a minor in statistics. In addition, the experience and opinions of our faculty from the department and other departments indicated that a minor in statistics was needed at ETSU. Additionally, the previous Program Review Team strongly recommended that we rapidly institute a minor in statistics. The objective of the program is to provide a solid foundation in statistics education and training and enhance the student's preparation in their own field of study. As a result of this addition, the department formally converted all statistics courses from the MATH rubric to the STAT rubric. The purpose of this editorial change was to better distinguish between mathematics and statistics courses and align our rubrics with other TBR universities.

As previously mentioned, the Bachelors program has four concentrations (Mathematical Sciences, Mathematical Education, Computational Applied Mathematics, and Statistics). These concentrations were modeled after the four "tracks" (Mathematical Sciences, Mathematical Education, Quantitative Modeling, Statistics) that students were able to focus on prior to the implementation of the concentrations, which occurred in Fall 2014. Appendix N compares the curriculums of the tracks and the concentrations. The impact of the "track" in the mathematics major had been significant for over a decade. Renaming the tracks provided us with names that are more recognizable outside of academia, expanded them to include more courses, allowed them to better serve their purpose, and made concentrations that provide better evidence of acquired skills. Students pursuing the B.S. in Mathematics will also have the focus of their studies formally recognized as a concentration on their transcripts.

Officially, we have two concentrations (Mathematical Sciences, Precollegiate Mathematics) at the graduate level but we haven't had any students in the Precollegiate Mathematics program since 2007. The Precollegiate Mathematics concentration was designed for in-service teachers and consists of an eight-course sequence with two tracks – a K-8 mathematics track and a 7-12 track – with the aim of producing an in-depth, profound understanding of the mathematics taught in elementary, middle, and high school. The program started in 2004 and within 3 years approximately 15 students had completed their Master's degree.

Since 2010 the department has hired four tenure-track faculty members (Drs. Michele Joyner, Nicole Lewis, JeanMarie Hendrickson, and Rodney Keaton) and one lecturer (Mr. John Hicks). These faculty members have had a very positive impact on all undergraduate mathematics/statistics education. The four tenure-track faculty members were hired into positions that were vacated. The lecturer position was previously a full-time adjunct position.

Most graduate students with department assistantships work in the Center for Academic Achievement (CAA) as mathematics and statistics tutors. For several years, the department had problems with graduate students being unable to fill this role because they were not knowledgeable in basic statistics. Therefore, the department created the [Statistics Proficiency Exam](#) which went into effect spring semester 2015. All graduate students receiving an assistantship funded by the Department of Mathematics and Statistics are required to take this proficiency exam on MATH 1530. Since this class meets the general education requirement in math, the department processes over 1,000 students per semester in this class. As a

consequence, this requires a heavy involvement with this class by most faculty and graduate assistants.

The Department's first newsletter was emailed to all mathematics alumni May 2015. We felt that this a good way to reconnect with our graduates. The chair received many positive responses from alumni. We also shared the letter with president Noland who responded with a complimentary note to the department.

The Mathematics and Statistics program at ETSU strives to offer students, both undergraduate and graduate, unique and innovative opportunities. A research requirement is part of the undergraduate curriculum. This is in line with the Mathematical Association of America which encourages research by undergraduate students at a variety of levels. We hope that this helps students develop critical thinking skills along with written and oral communications skills. In addition, the visibility that our students bring to the program when they publish or present at conferences. We've had two undergraduate students win the MAA Outstanding Student Presenter award in the 2014 and 2016 Joint Mathematics Meetings. Several undergraduate mathematics majors attended the NIMBioS Undergraduate Research Conferences in 2014 and 2015.

At East Tennessee State University, the mathematics curriculum for the elementary education program that prepares students to teach mathematics in grades 3-8 has experienced changes over the years. The department has been active in this area through in-service presentations and a specially funded project sponsored by Eastman Chemicals and East Tennessee State University. **The Eastman Scholar MathElites** project is built on a strong partnership among East Tennessee State University and seven school districts in Northeast Tennessee: Bristol, TN City, Hawkins County, Johnson City, Kingsport City, Rogersville City, Sullivan County and Washington County. (These school districts represent Eastman's *Putting Children First* (PCF) partnership.) The project seeks to address the changing and more challenging state math standards by increasing teacher content and pedagogical knowledge, increasing student learning, increasing the number of teachers participating in standards-based professional development, providing training on standards-based resources and materials, and increasing the number of highly-qualified mathematics teachers. The project consists of a summer component and an academic year component. The summer component trains 65 elementary and middle school math teachers (grades 3-8), during a ten-day, 55 hours of instruction, summer institute on the campus of East Tennessee State University, followed by on-going, sustained follow-up professional development and training activities for each participant during the academic years. Dr. George Poole, Professor of Mathematics & Statistics, has been involved in this project for many years.

This coming summer the Center of Excellence in Mathematics and Science Education will have a STEM Conference on Computing in Mathematics. Thirty high school math teachers will participate, and will be trained to seamlessly incorporate R into the teaching of the Statistics portion of their Algebra 2 or similar classes using data sets that relate to science and

engineering. Dr. Hendrickson, Assistant Professor of Mathematics & Statistics, a specialist in Statistics Education, will be a trainer of this workshop.

The School for Scientific Models and Data Analysis is a five-week program that broadens a student's appreciation and knowledge by exposing him or her to a wide range of topics in the biological and statistical sciences, and to scientists who are active researchers in these areas. Model building and data analysis play a critical role in the school curriculum. Career exploration and choice are woven throughout the program, as are cognate activities such as Science, Technology, Engineering and Mathematics (STEM)-focused field trips. Students are introduced to practical scientific methodology and data analysis via student directed research projects. Thus, the **Governor's School for Scientific Models and Data Analysis** at ETSU provides a series of courses, laboratories, projects, field trips, seminars, lectures and other activities centered on statistics and biology. Dr. Nicole Lewis, Assistant Professor of Mathematics & Statistics, has been teaching the statistics course (MATH 1530) for the past few years.

The graduate certificate in **Mathematical Modeling in Bioscience** provides those with a traditional background in science, mathematics, or technology the skills and content knowledge needed for work in the high-demand, highly-relevant area of mathematical and computational bioscience. Five online courses are required for the completion of the certificate, which will cover the fundamentals of predictive modeling, data mining and visualization, mathematical modeling in biomedicine and the study of computational complexity that is required for data science. A student can use the certificate as a stand-alone achievement or to enhance a graduate degree in a related field.

The department offers several scholarships for undergraduate students in mathematics. Approximately \$30K was awarded to students for this academic year. See [scholarships](#) for more details.

The department draws its strength from

1. A student population of stable size, with several good students.
2. A strong faculty that effectively manages to meet the demands of research, teaching, and service.
3. The visibility that our extramural funding brings to the program.
4. The increasing quality of, and increasing faculty participation in undergraduate research.
5. Acknowledgement and support from the administration for all that we do.

V. Learning Outcomes

Mission

The mission of the Department of Mathematics and Statistics is to promote the goals of East Tennessee State University by offering high quality educational programs in Pure and Applied Mathematics, Statistics, and Mathematics Education, conducting original research in Discrete

Mathematics, Mathematical Modeling and Computation, and Statistics, and providing service to the university and the community.

East Tennessee State University's mission is to prepare students to become productive, enlightened citizens who actively serve their communities and the world. Education is the university's highest priority, and the institution is committed to increasing the level of educational attainment in the state and region. The university conducts a wide array of educational and research programs and clinical services and is the only Academic Health Sciences Center in the Tennessee Board of Regents System. Through research, creative activity and public service, ETSU advances the cultural, intellectual and economic development of the region and the world.

We thus consider the departmental mission to be fully supportive of, and complementary to, the university mission.

Program Learning Outcomes and Results

The educational purpose of the department is to enable our undergraduate students to acquire and critically apply quantitative, computational, and logical skills in the problem-solving process and prepare graduate students for professional careers by additional training beyond the bachelor's degree level through an intensive program of advanced study, including a research experience. The department is assigned or identifies learning outcomes for its general education courses, undergraduate degree program, graduate degree program, and graduate certificate. These outcomes are measured annually and results are discussed at departmental and University committee meetings. Improvement initiatives are discussed during these meetings and implementation of improvements are decided amongst the faculty.

In addition to these learning outcomes, the Mathematics and Statistics undergraduate program measures and improves other learning areas that are related to the ETSU Quality Enhancement Plan (QEP). The QEP is an initiative created by the Southern Association of Colleges and Schools Commission on Colleges (SACS-COC) and participation is required by all SACS-COC accredited institutions. The QEP is defined as a carefully designed course of action that enhances student learning. East Tennessee State University's QEP, established in 2010, is INtopFORM: Insightful Questions, Informed Answers. INtopFORM aims to promote excellence in information fluency, a core critical thinking skill. Learning outcomes related to the ability to seek, evaluate, and use diverse sources of information when resolving difficult questions, addressing challenging problems, achieving creative aims, and pursuing new lines of inquiry in scholarly and real-world contexts are developed and measured annually.

(1) General Education

General Education at ETSU and other state colleges and universities in Tennessee, consists of 41-42 hours of coursework in a variety of subjects that address critical and creative thinking, effective communication, lifelong learning, conflict resolution, problem solving, and understanding and appreciating cultural diversity. Students at ETSU are required to take one of the following mathematics courses as part of their general education: Math 1530 (Probability

and Statistics - Noncalculus), Math 1840 (Analytic Geometry and Differential Calculus), or Math 1910 (Calculus I). The Tennessee Board of Regents (TBR) requires general education courses in Mathematics, English, and Speech to measure and report on specified learning outcomes each semester. The department has included some additional learning outcomes that we also measure. The Spring 2016 general education report is available in Appendix A.

(2) Undergraduate and Graduate Degree Program

The Southern Association of Colleges and Schools Commission on Colleges (SACSCOC) requires ETSU to identify learning outcomes in each degree program, assess the extent to which we achieve these outcomes, and provide evidence of improvement based on analysis of the results. From 2008 to 2012, programs reported on these areas in TracDat via the PIE (Planning and Institutional Effectiveness) process. The PIE report is in Appendix B1. In 2014, the University improved the way programs identified and measured student learning outcomes. Academic programs now report these items through word templates that are sent to the dean of the college and approved through the college's reporting structure. An evaluation team was created to review both the format and content of each unit's submission. In Fall 2015, the department submitted the following new learning outcomes and evaluation methods for the four new undergraduate concentrations, as well as the graduate program.

Undergraduate Program Learning Outcomes

Undergraduate Student Learning Outcomes for all four Concentrations:

1. Students ask questions that facilitate the solution of mathematical modeling problems and the pursuit of opportunities.
2. Students apply critical thinking skills in analyzing mathematical/statistical concepts.

Specific Learning Outcomes within Concentrations:

Mathematical Sciences:

Students demonstrate proficiency in mathematical communication.

Mathematics Education:

Students use print and electronic materials to produce resources related to mathematics teaching or evaluate and synthesize existing mathematics education research on a chosen topic.

Computational Applied Mathematics:

Students model real world situations using mathematics and solve these systems employing analytical and numerical techniques.

Statistics:

Students demonstrate a working knowledge of the core concepts in probability and/or statistics.

The department uses the required capstone course, MATH 4010 Undergraduate Research, to conduct the assessment of all undergraduate student learning outcomes. MATH 4010 is offered

each fall and spring semester. Students are required to complete a final research paper in the course and faculty evaluate each student using a rubric. The undergraduate coordinator then compiles the data in May of each year. The Word templates for each concentration with outcomes, assessment methods, and results are available in Appendix B2. The rubric used to evaluate final research papers is also included with the templates. In 2015/2016, the first reporting year, students in the Computational Applied Mathematics concentration were the only ones to meet or exceed the criteria goals established by the department in the common and concentration specific student learning outcomes.

Graduate Program Learning Outcomes

Graduate Student Learning Outcomes in both the no concentration program and the Pre-Collegiate Mathematics program:

1. Students assemble information from various sources when conducting mathematical/statistical research.
2. Students write in a way that successfully communicates mathematical/statistical content.

Specific Learning Outcomes within Concentrations:

No Concentration Program:

Students evaluate mathematical/statistical information and criticism effectively.

Pre-Collegiate Mathematics Program:

Students speak in a way that successfully communicates mathematical/statistical content.

The department uses MATH 5960 Thesis, a required course in the graduate curriculum, to conduct the assessments of all the graduate student learning outcomes. The course is offered each fall and spring semester. Students are required to complete their thesis during this course, which is evaluated according to a grading rubric. The graduate coordinator then compiles the data in May of each year. The Word templates for each concentration with outcomes, assessment methods, and results are available in Appendix B3. The rubric used to evaluate a student's thesis is also included with the templates. In 2015/2016, the first reporting year, there were no students in the Precollegiate Mathematics concentration. In the graduate program with no concentration, 100% of students performed at or above the criteria level in all three graduate student learning outcomes.

Graduate Certificate Learning Outcomes

Although the graduate certificate is not evaluated as part of this program review process, it is important to note that faculty in Mathematics and Statistics teach courses, identify learning outcomes, collect data, and implement improvements associated with this certificate program. A copy of the Institutional Effectiveness template is available in Appendix B4.

(3) Quality Enhancement Plan (INtopFORM)

The department chair made the decision that the department would take part in the QEP. Select Mathematics and Statistics faculty have been involved with INtopFORM from its inception, with three of the program's faculty volunteering to take part in the training and

implementation of INtopFORM. The program's learning outcomes related to INtopFORM are:

QUESTIONING: Students ask questions that facilitate the solution of problems and the pursuit of opportunities.

SEEKING: Students locate and create information needed to accomplish their purpose.

EVALUATING: Students apply critical thinking skills in evaluating sources, information and search processes.

USING: Students assemble and synthesize information to accomplish their purposes.

COMMUNICATING: Student communicate information effectively.

RECOGNIZING: Student recognize the responsibilities and consequences related to information ethics and intellectual property.

The QEP outcomes in questioning and evaluating parallel the common undergraduate student learning outcomes. The department uses the same assessment methods (rubric on final research paper) for these outcomes. Results from Years 2 (2013-14) and 3 (2014-15) are available in Appendix C.

Use of Outcome Data

Between 2008 and 2012, students performed well on the assessment methods used to evaluate student learning outcomes. In the undergraduate program (concentrations had not been created during this period), some improvements were made based off of the data received:

- i. It is now recommended that students take MATH 4257 Numerical Analysis or MATH 4267 Numerical Linear Algebra the semester after MATH 2010 Linear Algebra. Faculty members found that students forget much of the information covered in MATH 2010 that is needed in MATH 4257 or MATH 4267 if they wait more than a semester between the courses. It is difficult to cover new topics while trying to catch them up on old topics.
- ii. Additional hands-on group activities were added to MATH 4257 and MATH 4267. Students require repetition and practice to improve performance on computational assignments. A jump in performance was seen when these activities were added.

The department's participation in the QEP has resulted in the following improvements:

1. Faculty members teaching Math 3000 train future mathematicians to evaluate mathematical proofs, and to understand the difference between a fallacious argument and a valid argument. In class, students are required to present a proof on the board. Instead of stepping in as the instructor and correcting a student's mistakes, the faculty members plan to let the class comment on the proof, giving feedback on which parts of the proof are less than perfectly clear, which parts may say too much, giving more information than is really

necessary and distracting from the overall plan of the proof, and which parts convey information well.

2. Most students in Undergraduate Research, Math 4010, worked individually with their instructors. To improve their evaluating skills, instructors will bring students together as a group, early in the semester, in Sherrod Library, where one of the library staff will help them understand the resources available, both in the library and online.
3. To improve our student's abilities to evaluate sources, instructors in MATH 2110 Calculus III plan to have students use the CRAAP Test and SMELL Test to evaluate three mathematical websites.

Based off of the data from 2015-16, the department plans on making no changes at this time. We will wait until one more full cycle of data to determine if changes need to be implemented to improve student learning.

VI. Curriculum

Program Overview and Core Requirements

Undergraduate

The Department of Mathematics and Statistics at ETSU offers a B.S. degree (four years of study). The mathematics major must satisfy the General Education Core Requirements and College of Arts and Sciences B.S. requirements. Students can choose from four concentrations: Mathematical Sciences, Computational Applied Mathematics, Statistics, or Mathematics Education. Students in the Mathematics Education concentration must minor in Secondary Education, but students in the other three concentrations are not required to have a minor.

The undergraduate program requirements are comprised of 19 core credit hours common to all concentrations and courses specific to the concentration. The 19 hours of core courses are:

- MATH 1920 – Calculus II (4 credit hours)
- MATH 2110 – Calculus III (4 credit hours)
- MATH 2010 – Linear Algebra (3 credit hours)
- MATH 2050 – Probability and Statistics Calculus Based (3 credit hours)
- MATH 2090 – Mathematical Computing (2 credit hours)
- MATH 3000 – Mathematical Reasoning (3 credit hours)

Note: Math 1910 – Calculus I satisfies the mathematics general education requirement and it is not counted in the core.

In addition, all mathematics majors must take MATH 4010 (Undergraduate Research).

Required courses in each concentration can be viewed in the ETSU course catalog:

[Mathematics Education](#)

[Computational Applied Mathematics](#)

[Statistics](#)
[Mathematical Sciences](#)

Graduate

As described in the 2016/17 course catalog, students obtaining a graduate degree in Mathematics must complete 30 hours of graduate course work with no more than 9 of the 30 hours involving “cross-listed” classes (which can be taken by both undergraduate and graduate students). The 30 hours must include the classes Real Analysis 1 (MATH 5210), Modern Algebra 1 (MATH 5410), Thesis (MATH 5960), and a 2-course graduate only sequence.

A proposal is in the works to modify this somewhat to accommodate students with an interest in statistics. Such students will be given the option of taking *either* Modern Algebra 1 *or* Statistical Methods 1 (STAT 5710). This choice is currently being honored by the graduate coordinator even though it does not yet appear in the university catalog.

The present graduate catalog (2016-2017) also requires students to take “at least two of the following”:

- Graph Theory I (MATH 5340)
- Introduction to Topology (MATH 5357)
- Complex Analysis 1 (MATH 5510)
- Applied Mathematics I (MATH 5610)
- Statistical Methods I (STAT 5710)

This is a relic of the 1990s when graduate student numbers were much smaller and we were attempting to corral our limited number of students into particular classes to maximize student numbers (as opposed to having the students thinly spread out among several classes). The graduate coordinator is not currently enforcing this requirement and it will be removed from the catalog when the modified core goes through.

The current catalog (and several past ones) is online at:

<http://www.etsu.edu/reg/catalog/graduate.aspx> .

A very detailed webpage for the graduate program is online at:

<http://www.etsu.edu/cas/math/programs/grad.php> .

The Thesis (MATH 5960) class is common to all students in the M.S. program. Original research results are not absolutely required in this work, but it is usually the result of the thesis work. Easily half of the departmental theses result in refereed research publications. Though students normally only register for 3 hours of Thesis, the process takes up most of the second academic year. Students are required to give a “preliminary thesis presentation” to their committee early in the thesis process (in the first semester of their second year). The idea is to get the thesis committee involved early and to let them voice any concerns they may have about the proposed thesis topic; the thesis work is usually performed by close collaboration between the

student and the thesis advisor(s), with only peripheral involvement of the rest of the committee. The preliminary presentation also protects the student from committee member objections late in the process and encourages the student to see where the proposed topic fits in with the existing literature.

Curricular Mapping

Undergraduate

Our curriculum is consistent with the recommendations of the Mathematical Association of America Committee on the Undergraduate Program in Mathematics (CUPM) (www.maa.org/cupm). All the mathematics courses encourage critical thinking, especially Mathematical Reasoning and Undergraduate Research. We should stress that the Department of Mathematics and Statistics requires that all its students participate in research through a course that is part of the core requirements. Thus, research is not an experience for a selected few but the totality of students.

Graduate

Each graduate student is required to pass (with a grade of 'B' or better) two comprehensive exams: one in freshman calculus and one in linear algebra. The purpose of these tests, as stated on the study guides, is “to force students to recall material from sophomore level calculus and linear algebra.” The intent is to prepare students for classes that involve abstractions and generalizations of the concepts of these lower level classes. Namely, a review of Riemann integration prepares students for (the required core course covering) Lebesgue integration, concepts of sequences prepare one for convergence theorems in graduate analysis, review of the topics of linear algebra prepare students for the study of Banach and Hilbert spaces, eigenspaces (in applied math), and, of course, matrix theory. By departmental policy, students are not allowed to register for Thesis until they have passed both exams. The exams are offered twice each fall and spring semester, and once over summer. Registered students are required to attempt at least one test each time they are offered until both have been passed. The facts that the tests cover (admittedly, the more theoretical aspects of) rather elementary mathematical topics and that the students seem to dread these tests, lead the graduate coordinator to believe that the tests are providing a valuable service.

The department offers a flexible program of study leading to a master’s degree in mathematical sciences. After completing a core program, the student can focus their course work in theoretical mathematics, applied mathematics, discrete mathematics, or statistics.

Advanced Content (Graduate)

The level of course work is consistent with math graduate standards. This can be seen by the textbooks recently used:

- i. Analysis 1 and 2 (MATH 5210 and 5220) - *Real Analysis* by Royden and Fitzpatrick.
- ii. Modern Algebra 1 and 2 (MATH 5410 and 5420) - *Algebra* by Hungerford.

- iii. Complex Analysis 1 and 2 (MATH 5510 and 5520) - *Functions of One Complex Variable* by Conway.
- iv. Statistical Methods 1 and 2 (STAT 5710 and 5720) - *Applied Linear Statistical Models* by Kuttner, Nichtsheim, Neter, and Li.

MATH 5210 and 5220, Analysis 1 and 2, covers the traditional Lebesgue measure and integration, followed by the classical L^p spaces and abstract measure. Therefore, this moves beyond the standard undergraduate analysis topics of Riemann integration and, for example, the Riemann integral of the limit of a sequence of functions.

MATH 5410 and 5420, Modern Algebra 1 and 2, covers the same topics as the undergraduate Introduction to Modern Algebra (MATH 4127/5127 and 4137/5137), but in a much deeper, theoretical way. When following Hungerford's book (in the Springer-Verlag "Graduate Texts in Mathematics" series), the classes take the very traditional group/ring/field approach. Advanced topics beyond the undergraduate class which may be covered include categories, arbitrary products of groups, and modules.

MATH 5510 and 5520, Complex Analysis 1 and 2, goes much deeper than our undergraduate Complex Variables (MATH 4337/5337) class. The techniques of undergraduate analysis are applied to functions of a complex variable, with particular attention to series and integration. This is the graduate class where metric spaces are usually given an in-depth coverage. Conway's book is also in the Springer-Verlag "Graduate Texts in Mathematics" series.

STAT 5710 and 5720, Statistical Methods 1 and 2, is a sequence of courses, which go into greater depth of linear regression, non-linear regression, and ANOVA models through the use of matrices, theory, and advanced methods needed for modeling building and/or alternative methods when assumptions are not satisfied. Some of the methods discussed in these courses are methods normally not found in an undergraduate course such as nonparametric regression, ridge regression, robust regression, and weighted least squares regression.

Distance Education (Graduate)

In Fall 2013, five online courses were added as part of the graduate certificate program in mathematical modeling in biosciences: Analytics and Predictive Modeling (MATH 5830), Complex Networks and Systems (MATH 5840), Mathematical Modeling Using Graph Theory (MATH 5870), Modeling of Infectious Diseases and Social Networks (MATH 5880), and Stochastic Modeling (MATH 5890). The primary purpose of this program is to provide an option for those seeking a career in industry such as a position in pharmaceutical R&D or biomedical analytics. It is not aimed at ETSU M.S. students, but is intended to draw in students from outside the university. It is too early in the program to determine if it has been successful in this agenda. Course level learning outcomes for the online courses are the same as those for the "on-ground" version of the course. Students will be able to effectively apply their knowledge of graph-theoretic principles and demonstrate their ability to create a graph-theoretic model for a given data set.

Communication Proficiency

Prior to fall 2016, undergraduate students were required by the university to complete a minimum of two oral communication intensive courses, a minimum of one information technology intensive course, and a minimum of four writing intensive courses for a B.S. degree. Courses that qualified as writing, technology, or oral intensive had to follow a set of guidelines. Our program had designated the following courses as oral, technology, or writing intensive:

- Writing Intensive Courses: MATH 2090 (Mathematical Computing), MATH 3040 (History of Mathematics), STAT 4307 (Sampling and Survey Techniques), and MATH 4010 (Undergraduate Research)
- Oral Intensive Courses: MATH 3040 (History of Mathematics), MATH 4010
- Technology Intensive Courses: MATH 2090, MATH 4257 (Numerical Analysis), MATH 4267 (Numerical Linear Algebra)

In Fall 2016, the University modified the oral, written, and information technology intensive requirements. Instead of requiring students to take a specific number of hours in courses designated as an intensive, programs were able to become responsible for developing a plan for how these areas would be addressed within the curriculum. The department decided that undergraduate students should be able to do the following in terms of oral and written communication:

- Students are able to write a technical report following the format of articles published in leading mathematics and statistics journals.
- Students are able to communicate mathematical research findings orally in a clear, organized, and logical manner.

These definitions are evaluated in MATH 4010 (Undergraduate Research), which is required for graduation. Students must have at least 35 credit hours in mathematics to enroll in MATH 4010. In Undergraduate Research, students give at least three 10-minute oral presentations to their instructor individually; however, if more than one student is working with that instructor, then the presentation would be with the group and the instructor. The oral presentations are supported by slides in either Power Point or LaTeX (Beamer). The instructor provides feedback following each presentation. At the end of the course, the student will give a 10 to 15 minute oral presentation to everyone enrolled in MATH 4010, conveying their research project with the following outline:

- Background
- Research Problem
- Mathematical Model Results
- Concluding Remarks

Students submit a plan and four drafts of the technical report before a final grade is given. First, an outline of the work is developed in conjunction with the instructor. After that, a review of the literature is used to create an introduction, a problem statement, and a bibliography for the report. Once approved by the instructor, partial or preliminary results are developed and submitted to the instructor for revision.

Technology Proficiency

The department decided to maintain MATH 2090 (Mathematical Computing) as the technology-based course. In MATH 2090, students develop skills in implementing algorithms efficiently and are introduced to software tools (e.g., Python, R, Matlab, Sage, Maple, SAS, Minitab, SPSS) that are used in computational science.

Students are introduced to mathematical problems which are addressed computationally-- Benford distributions of digits, the Hailstone conjecture, empirical distributions and resampling, Newton's method, accelerating the convergence of a limit, fractals, graph theoretic algorithms, etc.--as well as the computational (software) tools used to address them. Students must learn how to use the given software tool and then use the tool to solve the given mathematical problem. The course culminates with a comprehensive project in which they choose a mathematical problem and create a software solution to the problem.

Graduate students obtain technology proficiency through coursework. All students are required to write their theses using LaTeX. Most students in the program take an applied course where the software tools list above are used. On occasion, there are students who study theoretical mathematics only and don't develop skills in any of the software tools listed above.

Research in the Curriculum

Undergraduate

MATH 4010 Undergraduate Research is considered a capstone experience because students use their mathematical background, acquired in previous courses, to solve an open problem. They work individually or in groups and have to make an oral presentation at the end of the semester. Several student projects have led to papers that were submitted and accepted by refereed journals. The table below represents the number of published articles in which students appeared as coauthors and the number of presentations.

Undergraduate	2011-12	2012-13	2013-14	2014-15	2015-16
Published	4	16	16	4	4
Presentations	13	16	10	0	2

Graduate

Some instructors include original contemporary research as part of their graduate classes. For example, Graph Theory 2 (taught by Teresa Haynes) requires students to read and present a recent research paper.

The main source of exposure to research in the graduate program occurs when the student is working on a thesis. Though original research is not required for thesis work, it usually results. Occasionally, students select an issue to use for their thesis; but usually, students select a general area of interest and their mentor assigns them a problem in that area to focus their

thesis on. Students do a “preliminary thesis presentation” the semester before they start thesis work. This is intended, in part, to have the student do preliminary reading of the literature relevant to the thesis topic and to see how the problem relates to the existing research topics. The intention is for the student to see “the big picture” of what their problem is and how it fits into current research efforts of others. The preliminary presentation, as a result, usually develops into the first chapter of the thesis. The thesis research is then usually done in close collaboration with their thesis adviser, though additional members of the thesis committee may have a role. Once the committee chair agrees, the student schedules a (required) oral presentation of the thesis work to the committee and others interested in attending. With approval from the thesis committee, the written version of the thesis is passed to the School of Graduate Study for final review and ultimately for addition to the online thesis database in the university's Sherrod Library. The table below represents the number of published articles in which students appeared as coauthors and the number of conference presentations.

Graduate	2011-12	2012-13	2013-14	2014-15	2015-16
Published	8	13	7	2	7
Presentations	4	2	2	2	4

Critical Thinking (Undergraduate)

The Department’s program offers courses that gradually progress through beginning levels to advanced levels of critical and analytical thinking. The final capstone experience, MATH 4010, serves as the culmination of the mathematics curriculum.

For the last couple of years, the Department has participated in the University’s Quality Enhancement Plan (QEP) called INtopFORM. INtopFORM aims to promote excellence in information fluency. Information fluency encompasses six abilities: Questioning, Seeking, Evaluating, Using, Communicating, and Recognizing. Assessment data is collected from each student enrolled in MATH 4010 using a rubric form that was developed in the Department. (Appendix C).

INtopFORM also uses scores from the California Critical Thinking Skills Test (CCTST). Results from the past five years are found in Appendix D. The Department’s majors scored higher, on average, than other college students (National or ETSU) on each of the thinking skills subtest areas (Analysis, Deduction, Evaluation, Induction, Inference) and the total score of the test.

Curriculum Revision and Currency

Undergraduate and graduate curriculum is reviewed on an annual basis by faculty. Ideas or needs for revisions are presented at faculty meetings and discussed before a decision for a revision is made. Recommendations from the Mathematical Association of America Committee on the Undergraduate Program in Mathematics (CUPM) (www.maa.org/cupm) and graduate-level mathematics standards are reviewed annually to ensure that the program’s at ETSU are relevant. Faculty also keep their undergraduate and graduate courses current by using relevant journal articles and textbooks in their classes.

ETSU has an online curriculum process that allows faculty to complete the required forms online and upload syllabi into the proposal. The chair first reviews completed proposals then the college committee reviews all proposals from each department. Proposals approved by the college committee are signed off by the dean and forwarded to the University Curriculum Committee. If the course is a graduate course, the Graduate Council reviews the proposal. If the proposal deals with significant changes in a curriculum, TBR approval is required.

Undergraduate

In the past five years, the only major change to the undergraduate curriculum has been the conversion from tracks to concentrations. Appendix N displays the similarities and differences between the tracks and concentrations. Renaming the tracks provided us with names that are more recognizable outside of academia, expanded them to include more courses, allowed them to better serve their purpose, and made concentrations that provide better evidence of acquired skills. Students pursuing the B.S. in Mathematics will also have the focus of their studies formally recognized as a concentration on their transcripts.

Graduate

In the last 5 to 7 years, the M.S. program has remained largely unchanged, apart from the fact that it has grown in the number of students enrolled. As previously described, there are efforts in progress to modify the core to allow a substitution of Statistical Methods 1 (STAT 5710) for Modern Algebra 1 (MATH 5410). The “at least two of the following” requirement mentioned in the Program Overview subsection will also be removed, since the requirement dates from a time when the number of M.S. students was significantly smaller.

To keep the statistics component of the department current and close to the interests and specialties of the faculty, the upper level statistics classes will require a curricular revision. Two of the departmental statisticians recently left the department and we have two new hires in statistics (one hired in 2013 and the other in 2016). It has been proposed that the extant class Time Series Analysis (STAT 4327/5327) be replaced with Statistical Machine Learning (which was taught in fall 2017 as a Special Topics class, MATH 5947/5957). Also, graduate faculty discussions have recently involved a non-thesis option, in connection with the statistics students in particular, and is spreading to a discussion of a non-thesis option in general for the M.S. in Mathematical Sciences.

Therefore, the addition of the following as formal classes is planned in the near future: (1) “Statistical Machine Learning” as a cross-listed class, (2) “Preparation for Industrial Careers in Mathematics” as a cross-listed class, and (3) Introduction to Functional Analysis (as a graduate-only class, MATH 5740). Each course is already being taught, either as a Special Topics class or as an experimental class.

Preparation for Industrial Careers in Mathematics is described below in the “Professional and career opportunities” subsection and the role played by Introduction to Functional Analysis is

described below in the “Schedule of offerings” subsection.

These classes show that the department is actively maintaining a current curriculum, while still building on classical areas of math (the addition of Intro. to Functional Analysis completes the analysis component of the program which will then include a year of real analysis, a year of complex analysis, and a semester of functional analysis, each at the graduate-only level).

Schedule of Offerings

Undergraduate

Courses are offered regularly to ensure that students can make timely progress. Most of the mathematics core requirements are offered twice per year, such as MATH 1910, 1920, 2110 (Calculus I-III), MATH 2010 (Linear Algebra), MATH 2050 (Calculus Based/Stats), and MATH 3000 (Mathematical Reasoning). The only mathematics core requirement not offered in both fall and spring is MATH 2090 (Mathematical Computing), which is offered only in the Spring. All of the concentration specific courses are only offered in either Fall or the Spring, except for MATH 2120 (Differential Equations), which is offered both fall and spring. A chart appears in the [undergraduate catalog](#) wherein students can find the suggested sequence of courses necessary to graduate in four years. A list of course offerings (both undergraduate and graduate) from the last three years is available in Appendix E.

Graduate

All of the cross-listed undergraduate/graduate courses are offered annually, except for Introduction to Topology (MATH 5357) which is offered when there is demand. Most of the on-ground graduate only classes are offered every other year, with the exception of Graph Theory 1 and 2 (MATH 5340, MATH 5450), since there is sufficient demand annually, Modern Algebra 1 (MATH 5410), and Real Analysis 1 (MATH 5210). A previous external review suggested that we offer the core courses (Modern Algebra 1 and Real Analysis 1) annually. Based on the number of graduate students in the program, it is sufficient to offer these courses once per year. Some students need to take the prerequisite class Introduction to Modern Algebra (MATH 4127/5127), which is offered every fall. Several students (around half) need to take the prerequisite class Analysis 2 (MATH 4227/5227), which is offered every spring. With the annual offering of the core courses, this allows them to complete the core courses in the two year time frame. In an even-odd academic year (like 2016-17), we offer the Real Analysis sequence and the Modern Algebra 1 class in the spring. In an odd-even academic year (like 2017-18), we offer the Modern Algebra sequence and the Real Analysis 1 class in the spring. The only formal prerequisite for Statistical Methods 1 is Linear Algebra (MATH 2010), so when it is added as an alternative to Modern Algebra 1, the every other year offering of it can continue without delaying any statistics students in the M.S. program.

We rarely have a student enter the program in a spring semester and still be required to take Analysis 1 and Analysis 2 before taking Real Analysis 1. Since Analysis 1 is only offered in fall semesters, this means that the student cannot complete this background work until their third semester in the program. If this third semester occurs in an odd-numbered year, then the Real Analysis 1 core class will not be offered until after they have completed four semesters (and

they may only hold an assistantship for four semesters, as required by the School of Graduate Studies, unless special permission is granted). When this occurs, we allow students to register for Introduction to Functional Analysis (MATH 5740; see below) over the summer and the graduate coordinator (Robert “Old Bob” Gardner) does a one-hour Independent Study (MATH 5900) on measure theory and Lebesgue integration for these students. Usually, there is one such student every two years.

The five online certificate classes are offered annually, allowing students to complete that program in one calendar year. At least one online class is offered over the summer (so far; the certificate program is still only a couple of years old), usually during the second summer term. During the first summer term, we have recently followed a plan of offering Differential Geometry (MATH 5310) during even numbered years and a new class, Introduction to Functional Analysis (MATH 5740), during odd numbered years.

This gives students course options throughout the summer. We have four assistantships which require students to take summer classes. These assistantships are given out in such a way that four first year students are required to take the first summer term class (so that the number of students in this class can be maximized) and second year students are supported during the second summer term so that they can either start initial thesis work or take the online class.

VII. Student Experience

Critical Mass (Graduate)

Our graduate program currently has 25 full time students and 2 to 3 part time students (the part time students are those who have completed their course work and are working to complete their thesis work). This is an increase of about 25% over the numbers from 5 years ago. The number of graduate faculty members has not increased in the last five years. This has caused the department to be at or near capacity with the current number of graduate students. In order to grow the graduate program, the department will need to hire additional graduate faculty members.

We are at a critical mass of graduate students and run an average of four on-ground graduate-only classes per semester. These classes probably average around 8 to 10 students each. The recently added online certificate classes are still new and are averaging 6 students per class. Our largest class is MATH 5019, Supervised Teaching, which has approximately 25 students enrolled each semester where students get together with the graduate coordinator and discuss a variety of topics. More detail about this course can be found in part c of this section.

The number of graduate students is greatly affected by the number of assistantships we have available. We have 14 assistantships and 4 tuition scholarships. The assistantship stipends range from \$7,600 (per nine months) to \$10,650 (per twelve months) and all come with a tuition waiver. Students on assistantships are obligated for 20 hours per week of work. This time is

usually spent tutoring or doing administrative chores in our [Center for Academic Achievement](#), but some of the time may be devoted to assisting professors in the classroom (running study sessions, grading, and administering tests) or with their research. If, in the judgment of the graduate coordinator and the department chair, a second-year student is prepared to teach their own class, then the student is assigned a single class to teach, usually Introduction to Probability and Statistics, but also possibly Pre-Calculus 1, Pre-Calculus 2, or Technical Calculus. Tuition scholarship recipients receive no stipend but get a tuition waiver. They are obligated to work eight hours per week, with duties like those of a first-year teaching assistant. There are four scholarships available for Mathematics graduate students. The scholarships cover tuition for fall and spring semesters. The scholarships are restricted to first time graduate students (a rule imposed by the state of Tennessee) and are hard to fill. During fall 2016, only two of the four scholarships were filled, but it looks like all four will be filled in spring 2017.

Other funding opportunities are available to our graduate students. Learning Support often provides funding for assistantships related to the teaching of the Learning Support enhanced general education statistics classes. They often fund three such positions, but are funding four positions during academic 2016-17. We also have students on assistantships through the Center for Academic Achievement, University Advancement, and the College of Education. Since we have more students than assistantships, applicants are encouraged to pursue funding outside of the department and are directed to the webpage of the School of Graduate Studies on which other units list available assistantship positions.

Professional and Career Opportunities (Undergraduate & Graduate)

A new class taught by Dr. Michele Joyner, "Preparation for Industrial Careers in Mathematics," (offered during spring 2016 and spring 2017 as a Special Topics class, MATH 5957) is available to both undergraduates and graduates. In this class students get to work on an industry-related project. The projects are done jointly with members of the industrial community, most often Eastman Chemical Company but there are plans to include Chick-Fil-A during spring 2017. Students collaborate as a group, give presentations, and write reports (all useful skills for future employment). Students have benefitted from this experience. Eastman hired one of the undergraduate students who worked on one of Eastman's projects during spring 2016. Eastman is also in the process (as of November 2016) of trying to hire a second student from that same class and they are expressing an interest in one of our graduate students who is doing a thesis project with Eastman's input.

ETSU has an active chapter of the national math honor society Kappa Mu Epsilon. Each student in the master's degree program is offered membership in the American Mathematical Society. An AMS membership gives access to resources for the discipline and careers.

Publication of research by graduate students while in the M.S. program is rare (though not unheard of). However, roughly half of the M.S. theses lead to an original research publication after graduation. Students are also exposed to career opportunities by attending Math/Stat Club meetings, undergraduate research, REU participation, and attending conferences.

Students have the opportunity to attend conferences if there is sufficient funds in the budget. A student should be presenting at a conference to receive funding from the department.

Application of Learning

Undergraduate

There have been a few opportunities for students to engage in hands-on research, external to the classroom, and beyond the traditional scope of the undergraduate 4010 course. We have students who have participated in internships for the U. S. Census Bureau and Eastman Chemical Company. During spring 2016, some students in MATH 4010 participated in Dr. Michele Joyner's Preparation for Industrial Careers in Mathematical Sciences (PIC Math) course. One group of students had a hands-on project from Eastman Chemical and another group of students worked on a problem from the MIT Lincoln Laboratory.

Graduate

All graduate students on assistantship or scholarship (which includes at least 90% of our students) are required to take a one hour class titled "Supervised Teaching," "Supervised Research," or "Supervised Service." The department offers a section of Supervised Teaching (MATH 5019) each fall and spring. All of our departmental graduate students have taken this class. The class meets weekly and usually has a population of around 25 students. During the first week, the instructor (the graduate coordinator) gives a presentation on the mechanics of teaching and university policies related to teaching. Each student gives a presentation on a topic covered on the Comprehensive Exams (freshman calculus and linear algebra) as a "sample lecture." In this way, the class acts as an introductory mini-course on giving a lecture and preparation for teaching at the community college or university level. Presentations are critiqued by the instructor and students are encouraged to critique each other in terms of presentation, style, appropriateness of level, and accuracy. The quality of student presentations is a factor in determining which students might be considered for teaching their own class during their second year on departmental assistantship.

All graduate students on a departmental assistantship or an assistantship funded by Learning Support (this is the population of students who will be involved in tutoring or teaching our general education class Introduction to Probability and Statistics [MATH 1530]) are required to take a Statistics Proficiency Exam at the end of their first semester (and subsequent semesters, if they do not pass). As part of their assistantship, they are required to attend a section of Intro to Probability and Stats during their first semester (and again if they fail the exam). The exam is a factor in deciding which students will be assigned a section of the class to teach during their second year in the program. So both the Supervised Teaching class and the Statistics Proficiency Exam are opportunities for students to apply their classroom knowledge and to make the case for getting a classroom teaching experience while in our program. It should be commented that the graduates of our M.S. program go on to (1) Ph.D. programs, (2) jobs in industry, and (3) teaching at the community college level, at roughly the same percentages. It is the department's desire to get all students funded by the department a teaching experience in

the classroom since this benefits the department in terms of staffing and it benefits the students in terms of making them more marketable to Ph.D. programs (which might offer them a teaching assistantship), industry jobs (where they have experience in giving presentations and explaining complicated ideas), and teaching.

The department runs a sporadic seminar series in which faculty present their research or interests. The seminar is scheduled to meet right after the Supervised Teaching class (which all departmental graduate students must attend) and in the same room, with the hope of students remaining in the room to attend the seminars. The institute "Computation and Research in Data Science" (or "CaRDS") runs a seminar which meets about twice per month and has presentations by departmental faculty members, faculty members from the Department of Computer Science, faculty members from other universities, as well as members of the industrial community. Graduate (and undergraduate) students with an interest in applied or computational math are encouraged to attend these talks. Dr. Melissa Bowers, Director of the Master's in Business Analytics Program and the Beaman Professor of Business in the Department of Business Analytics and Statistics at the University of Tennessee, has accepted an invitation to give a seminar in February for CaRDS at ETSU. She is scheduled to talk about an Operations Research-related scheduling paper and describe UT's Master's program in Business Analytics.

Diversity

The department enjoys a great deal of diversity in terms of the nationalities of our students. In the last 5 years, our undergraduate population has changed from being 43% female in Fall 2011 to almost 60% in Fall 2015. The number of minority undergraduate students ranges from 8-12 percent each semester. Unfortunately, female graduate students, although remain consist in number, has decreased in percentage as the number of graduate students has grown. In Fall 2011 the percentage of female graduate students was 33%, but dropped to around 20% the last two years. Consistent with recent years, during fall 2016 we have five graduate students from Nigeria, seven graduate students from Ghana (one female), one graduate student from China, one graduate student from Bangladesh, one graduate student from Saudi Arabia (part time), and one graduate student from the United Kingdom (female). In addition, the graduate program has one transgender student this fall 2016 semester and a second has been admitted for spring 2017. Both of these students who identify as female are counted as such.

The majority of our domestic graduate students are from the region. Since our assistantship stipends are not very competitive, we mostly bring in regional students and students from Africa.

Student Assessment of Instruction

Students are provided the opportunity to evaluate faculty members and their courses through a survey called the SAI, or Student Assessment of Instruction, at the end of each semester. This process moved from hard-copy evaluations conducted at the end of a class period to an online only evaluation (using CoursEval) in Fall 2013. The survey consists of 9 instructor related

questions, 4 course related questions, and 5 self-reflection questions. Students and instructors receive an email from the CoursEval system announcing the opening of the surveys. Students will also receive three reminder emails during the three week time period that SAIs are open. Emails to students include a list of surveys to be completed. Students will have one survey for each course in which they are enrolled. All emails sent from the CoursEval system include a link to the site where students can complete the survey. The student's ETSU username and password should be used to log into the site. Both the Tennessee Board of Regents and ETSU require all faculty members with teaching assignments to participate in SAIs. Faculty members will not have access to results until at least two days after the deadline for submitting final grades has passed. In order to comply with FERPA, results for course sections with less than five students will not be made available. The chair reviews the SAIs and looks for any trends that may appear through time. Although, it is difficult to draw any conclusions from the data since the response rate is usually quite low.

Academic Support Services

Mathematics students have access to a great deal of academic support services at East Tennessee State University. Students have access to the Charles C. Sherrod Library, ETSU's main campus library, where a large variety of journals, texts, and other educational material is available. The library performed an assessment of the holdings related to Mathematics and Statistics, which can be viewed in Appendix G. Current collections and services of the Sherrod Library adequately support the areas of Mathematics and Statistics for our students and faculty.

Located on the first floor of the Sherrod Library is the Center for Academic Achievement (CFAA) which includes Learning Services (Tutoring) and Testing Services. The mission of the CFAA is to present students with opportunities to learn and demonstrate their learning in a secure and supportive environment that encourages creative thinking, collaborative learning, and self-direction. Learning Services provides tutoring in a variety of subject matters, including math and writing. The department also uses the testing center to administer the "gateway exam." Some faculty members use the testing center throughout the semester.

The department currently has 13 graduate students assigned at least part time to the CFAA. The total number of hours worked per week is 142. During the spring 2016 semester there were 15 students that worked 151 hours.

The Library also houses the Graduate Student Success Specialist Service, which is sponsored by the School of Graduate Studies and offers students confidential advice concerning life issues that impact their academics. Other workshops and programs that are available to graduate students through the School of Graduate Studies include Thesis and Dissertation preparation workshops, Thesis and Dissertation Boot Camp, Research Grants as well as professional development courses (e.g. Teaching Pedagogy for the Graduate Assistant, Responsible Conduct of Research, The Art of Self-Marketing, and Leadership for Professionals). Due to the high utilization rate of the Graduate Student Success Specialist, an Undergraduate Student Success Specialist was added in Fall 2016. This person is located in the Culp Center.

Advisement for undergraduate mathematics students with 0-59 earned credit hours is provided by Jessica Houston in the Center for Advisement and Student Excellence (CASE). Students with 60 or more hours are advised by one of the following faculty advisors, based on the student's chosen concentration:

- Mathematical Sciences
 - Robert Beeler
 - Jamie McGill
- Statistics
 - Robert Price
 - Nicole Lewis
- Computational Applied Mathematics
 - Jeff Knisley
 - Michele Joyner
- Mathematics Education
 - Daryl Stephens

All students are advised prior to registration each semester. Mathematics minors are advised by Daryl Stephens. Nicole Lewis advises Statistics minors.

All new graduate students are initially advised by the graduate coordinator. It is the graduate coordinator who admits all students to the program and helps them arrange their first and second semesters of classwork, with attention to any work that must be completed for prerequisite or conditional admission reasons. Students are to complete their Program of Study near the end of their second semester. At this stage, the classes to be offered during their third semester are known and plans for the required 30 hours of course work can be reliably completed. After the second semester, students may still consult the graduate coordinator for advice, as well as their thesis advisor.

VIII. Faculty

Teaching Load

The faculty teaching loads in the Department varies depending on the faculty's designated research workload. Listed below are the different levels of the Department's full-time faculty and the approximate percentage of their time devoted to teaching, research, and service.

- Lecturers: Teach 12 to 15 credit hours per semester (80% to 100% teaching, 0% to 20% service)
- Teaching Faculty: Teach 10 to 15 credit hours (67% to 100% teaching, 0% to 33% service)
- Teaching/Research Faculty: Teach 9 to 10 credit hours per semester (60% to 67% teaching, 23% to 30% research, 10% service)
- Research/Teaching Faculty: Teach 6 to 9 credit hours per semester (45% to 60% teaching, 30% to 45% research, 10% service)

There are currently 27 instructors in the Department of Mathematics and Statistics. Of those 27, 19 are full-time tenured/tenure-track faculty members, 3 are lecturers, and 5 are adjuncts. Adjunct instructors teach MATH 1530, 1910, and 1920. The number of credit hours that the adjuncts teach ranges from 3 to 8. We are currently down two full-time tenured/tenure-track faculty members since 2015.

Faculty Preparation

All tenured, tenure-track, lecturers, part-time adjuncts, and graduate students in the department have the credentials to teach mathematics or statistics. The table in Appendix H lists all faculty members along with their credentials. Faculty members who do not have a terminal degree in Mathematics or Statistics have a master's degree along with 18 graduate hours in Mathematics or Statistics.

Out of 22 faculty members (19 tenured/tenure track and 3 Lecturers), 14 have graduate faculty status. Graduate faculty status is obtained through the School of Graduate Studies. To obtain graduate faculty status, faculty must submit an application and, after review and at the discretion of the Graduate office, may be appointed graduate faculty status at one of four potential levels ranging from Temporary Member to Senior Member level. According to ETSU School of Graduate Studies Policy No. 212, criteria for appointment to graduate faculty status may include the following:

- Possession of the terminal degree (as defined by the discipline) from an appropriately accredited institution. If the faculty member does not hold the appropriate terminal degree, or otherwise does not meet accreditation standards for graduate faculty status in that discipline, the highest level of membership for which this faculty member may apply is Affiliate Member.
- An identified programmatic connection with graduate course work and a commitment to participation in the graduate program, including advising responsibilities and directing student research.
- Competency in teaching, as evaluated by the department chair.
- Professional productivity as demonstrated by publications, grants, research, or other scholarly and creative activities.
- Evidence of leadership at the department, college, university, or professional level.

Particular attention will be given to the quality and depth of the faculty member's contributions to graduate education and to the quality and depth of his or her scholarship. The graduate program coordinator, department chair, and dean are all asked to provide narrative comments on these qualitative criteria.

For the purposes of periodic review, ETSU School of Graduate Studies Policy No. 212 states: Appointment to the Graduate Faculty is dependent upon the ongoing performance of the activities required for membership. Thus, each member of the Graduate Faculty will be reviewed according to documented evidence of active participation and competence in graduate teaching, direction of student research, service on graduate student advisory

committees, advising of graduate students, professional productivity, and/or providing department, college, university, or professional leadership prior to the initial appointment for new applications or since the last Graduate Faculty appointment for re-applicants. The review is conducted by the Graduate Council and, for new applicants, must take place prior to teaching any graduate classes or serving on any graduate student advisory committees; for re-applicants the review occurs just prior to the expiration of the current appointment. The review may result in a recommendation for appointment or reappointment at the senior member, the member, or the affiliate member level, or in the recommendation for removal from the Graduate Faculty.

Faculty Diversity

The Department of Mathematics and Statistics has a relatively diverse faculty population. Out of 22 faculty members, 9 members are white females, 11 members are white males, and 2 members are minority males. The table in Appendix I summarizes the faculty diversity for the past 7 years.

Per the latest survey results (2014) from the Annual Survey of the Mathematical Sciences in the U.S., females accounted for 31% of the full-time faculty. The table in Appendix H shows that females accounted for 36% to 43% of the full-time faculty over the past 7 years.

Faculty Evaluation

Once a year in the fall, all full-time faculty submit their Faculty Activities Report/Evaluation (FAR) of their work to the Department Chair. The Chair then evaluates the performance of the faculty for Teaching, Research, and Service. If the faculty member agrees with the Chair's evaluation, then the FAR is signed by the faculty member and is sent to the Dean for evaluation. If the faculty member doesn't agree with the Chair's evaluation, then a meeting between the faculty member and Chair takes place to discuss the evaluation. Over the past five years, the Department has used two FAR documents (see Appendix J).

All full-time faculty that are applying for tenure and/or promotion in the future are peer reviewed by another faculty member in the Department at least once per year. The peer reviewed letter typically summarizes preparedness, organization, and overall impression of teaching abilities.

Faculty Development

Professional development opportunities available to faculty include travel to professional conferences, host and attend workshops, and opportunities for research. When the Department receives a return on funds generated from on-line courses, summer school, and cohorts it is used to support faculty (and student) travel to conferences to give presentations or participate in workshops. A table in Section VIII shows the history of money spent on travel. In addition, all travel requests by faculty for the last five years has been granted. Faculty have attended the Joint Mathematics Meetings, Southern International Conference on

Combinatorics, Graph Theory & Computing, SIAM conference, NIMBIOS workshop, etc.

Faculty regularly take advantage of instructional development opportunities. The University offers workshops in Desire2Learn (D2L), Classroom Technologies (like Tegrity Lecture Capture and TurningPoint) and Teaching Online, as well as courses like Faculty Technology Leadership. One such opportunity came about in 2014, when the undergraduate program was one of a handful of programs across campus to take part in the Quality Enhancement Plan, INtopFORM, during its first year. The Office of the QEP provides a number of instructional development opportunities throughout a program's participation. During the first year, Mathematics faculty attended a three day workshop on what INtopFORM was and how to implement it in the program. Participating faculty in the programs are also required to attend Faculty Learning communities during the first year of participation.

Faculty members are very active in research and involve students as much as possible. Many faculty believe that research has a potential to make significant contributions to the quality of undergraduate/graduate education. Appendix K summarizes research and scholarly activities by faculty for the last 5 years. The faculty have been very active these past few years, managing to meet the demands of research, teaching, and service.

Faculty Involvement

Mathematics and Statistics faculty are very active with regard to program and student success. Faculty are involved in the planning, evaluation, and improvement processes related to the program and student success. For example, the Department felt like Math 4010 (undergraduate) and thesis (graduate) would be the appropriate courses to measure student learning outcomes. Since the student learning outcomes are relatively new in Math 4010 not enough data is available yet to determine if improvements are needed. At the graduate level, stronger students are needed to handle the rigors of writing a thesis. The satisfaction level of the faculty member is associated with the type of student that they are working with. If the student is fairly strong then the current results of the learning outcomes are usually quite positive.

IX. Learning Resources

Equipment and Facilities

The Department of Mathematics and Statistics is located on the third floor of Gilbreath Hall, one of only three buildings still in existence today that are original to the ETSU campus since its inception in 1911. Each full-time faculty member has an individual office, and part-time adjunct faculty or graduate teaching assistants either have an individual office or share office space. There are three classrooms on the third floor of Gilbreath (304, 305/306, and 314) that are primarily used by Mathematics and Statistics. These are multi-media classrooms, with "smart room" computer technology available to instructors at the podium. One of these

classrooms (305/306, the “Stat Cave”) has 50 student computers (plus the instructor’s smart podium) to facilitate the teaching of MATH 1530 (Probability and Statistics—Noncalculus). The Math Laboratory, located on the second floor of Gilbreath Hall in room 205, has 24 student computers, and is designed to provide support to many undergraduate and graduate courses. In addition, there are two additional dedicated computer labs (Gilbreath 105 and 106), each containing 24 student computers, that are used to teach MATH 1530L, which are Learning Support sections of MATH 1530. Lastly, there is a computer lab, located on the third floor of Warf-Pickel Hall (room 308) that offers 36 student computers, and is designed to provide further support to many undergraduate math courses.

Computers are widely used by undergraduate students, especially in MATH 1530 and upper division courses like Mathematical Modeling, Statistical Modeling, Applications of Statistics, Numerical Analysis and Numerical Linear Algebra. Graphing calculators are optional in Calculus I and Calculus II, but they are used to supplement mathematical learning, not to supplant it. To make sure that Calculus students have a basic knowledge of “paper and pencil” techniques, the Department of Mathematics requires them to pass a Gateway exam of basic skills in calculus.

The following lists other changes to equipment/facilities that have occurred over last few years that the department has paid for from its budget:

- i. Tables and chairs in classrooms (Gilbreath 205, 305/306) and many offices were purchased to replace old furniture.
- ii. The department’s main office was renovated – flooring, paint, and furniture.
- iii. We typically replace Dell computers every few years that are used by adjunct faculty and graduate students who serve as instructors.
- iv. A number of dry erase whiteboards have been replaced with glass markerboards, both in classroom and faculty offices.
- v. Many laptop computers have been purchased for faculty use.
- vi. A classroom license for thirty-five licenses of Matlab was purchased and is renewed every year.
- vii. A license for Survey Monkey is purchased every year.
- viii. The Department’s funds have covered computer upgrades for those faculty that need more computing power.

The University supplies office computers running Microsoft Windows to each tenured or tenure-track faculty member, and also Lecturers. These computers are swapped out with newer models every four years. If a faculty member wishes to have a MAC, the department will

supplement the additional cost in purchasing this computer in lieu of the standard-issue Dell. In addition, when the new replacement computers are ordered, faculty have three different “levels” of computers that are made available to them. After evaluating the need for a Level 1, 2, or 3 computer, the department will also supplement the additional cost for the Level 2 or 3 computers.

The Department owns a 10-year old poster printer that needs to be repaired or replaced.

The Department of Mathematics and Statistics has an Executive Aide who functions as an office manager. She is responsible for monitoring department budgets, hiring and training student workers, assisting with class scheduling, procuring supplies, helping faculty navigate various ETSU forms and procedures, and many other varied tasks. There are also seven student workers that help with answering telephones, mail distribution, copying, and running errands.

Learning Resources

Mathematics and Statistics faculty have access to many materials and services that support teaching and learning at East Tennessee State University. Faculty have access to the same material as students, a list of which is available in Appendix G. The library also offers several services that support teaching including library instruction, workshops, equipment use, interlibrary loan, distance learning library support, ADA/Disability services, and study/classroom space.

In addition to library services, faculty enjoy teaching and learning support from Academic Technology Support (ATS). ATS provides training, resources, and support for technology use in teaching and research. Their services include support for online course development and maintenance in the Desire2Learn (D2L) learning platform used at ETSU, multimedia support, website development, equipment loans, and a vast array of technical training and workshops.

D2L is the online learning environment used at ETSU. It is used for both online courses or as a technological enhancement for traditional classroom use. For traditional classroom use, D2L provides a platform to host discussions, create gradebooks, communicate with students, offer quizzes and exams, and post news items or materials such as lecture notes, documents or media links. D2L can also be used to create workgroups to facilitate in-class group assignments.

Support for Faculty Research and Publication

The primary means of support for research and publication at ETSU is through the [Office of Research and Sponsored Programs](#), which exists to help faculty, staff, and students secure and manage external funding for research, creative, instructional, and service activities.

Faculty members in the Department of Mathematics and Statistics carry out a great deal of research using the University supplied computers. In addition, the department has purchased five academic Matlab licenses for research use. Typically, mathematics and statistics journals do not carry any publication fee; if the faculty member should publish in a journal that does charge

a fee, the department generally can support the fee.

The available materials for research and publication are sufficient at this time.

x. Support

Budget - Operating

Over the last five years, the Department’s Operating Expenses budget has remained fairly constant. We have been fortunate to receive additional, substantial money for summer, online, ITV (Instructional Television), and cohort courses. The table below shows the assigned budget for the department (Budget) and the Augmented Budget, which are the additional funds received from summer, online, ITV, and cohort courses taught in the department.

Fiscal Year	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Budget	\$14,910	\$11,380	\$11,380	\$11,380	\$12,380	\$12,380	\$12,380
Augmented Budget	\$74,026	\$80,993	\$36,980	\$13,510	\$35,740	\$26,250	\$19,290

If we had more money then we would replace the carpet in Gilbreath 205, create an undergraduate study area in the back of Gilbreath 305/306, replace windows in the 308 suite, regulate the HVAC, and buy a poster printer and other equipment.

Budget - Travel

The table below shows the history of the money spent on travel. Our current Travel Budget, supplied by the College and University, is \$13,650. We have either augmented this budget with various sorts of income (i.e., summer, online, etc.), or we have moved dollars from travel to pay for other needs. This is a sufficient amount at this time. There was a large drop in travel spent between 2010-11 and 2013-14 due to faculty not traveling and/or they had used grant money and not the department’s funds to travel.

Fiscal Year	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Travel Spent	\$28,307	\$20,791	\$14,432	\$9,458	\$7,707	\$8,918	\$3,059 YTD

Budget - Adjunct

The following table shows costs incurred by the College of Arts and Sciences (working in tandem with the Vice Provost for Academic Affairs) associated with employing part time/adjunct mathematics and statistics instructors over the past several years. The University pays \$600 per credit hour, which is supplemented by the Department by an additional \$100 per credit hour.

Some courses are paid, but not primarily so, by other monies at the University, such as Learning Support or Continuing Studies cohort funds, but those figures are not included in this table. We feel that the adjunct pay should be increased but at the same time the number one priority should be hiring tenure-track faculty.

Fiscal Year	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Temp & Part Time	\$118,800	\$54,600	\$18,600	\$21,000	\$20,200	\$21,600

Enrollment and Graduation Rates

The Department of Mathematics and Statistics has over 100 undergraduates, around 30 graduates, and approximately 30 minors. Although graduate data is accurate, undergraduate data depends upon the student to declare his or her major or minor. If a student has not declared a major or minor, he/she will not show up in the data. Also, students with double majors will only be counted in a programs data if that program is listed as the students first degree. The department's undergraduate retention rates have remained steady, averaging about 82%. There were 29 undergraduate degrees and 10 graduate degrees conferred last academic year. Appendix L provides additional data on enrollments, credit hours per faculty, retention, degrees conferred, and the number of full-time, part-time, and graduate faculty in the Department.

Additional highlights of the data:

- There is a decline in credit hours (Credit Hours per Faculty table) from 2011-12 to 2012-13 due to Developmental Mathematics no longer being offered.
- There are many sections of 4000 level courses since there are many independent study courses and/or Math 4010 sections.
- Excluding the 2011-12 academic year the average number of credit hours per faculty member is around 514.
- The number of undergraduate mathematics majors has been holding steady – average number of majors is 115.
- Graduation rate of undergraduate majors has more than doubled since the 2012 academic year. The 2014-15 academic year had nearly 30% of our majors graduating.
- The number of undergraduate minors (mathematics & statistics) is up.
- The number of graduate mathematics majors has increased since 2011.
- Graduation rate of graduate majors has slightly decreased over this period. This may be due to losing two graduate faculty members (Anant Godbole, Yali Liu).

Responsiveness to Needs

Many different sources have projected a rapidly increasing need for those in science, technology, engineering, and mathematics (STEM) fields to have skills in computational and applied (modeling) mathematics. The THEC supply/demand analyses indicate that while the

growth in mathematics and related CIP's will be modest over the next 10 years (33%), teacher education CIP growth is in the top 10 (375%). However, new initiatives with deep national and regional support, such as the CodeHS project that seeks to increase programming (coding) content in high schools, envision the mathematics teacher of the near future to have well-developed computational and modeling skillsets. This is reflected in Tennessee by the fact that there is expected to be an oversupply of traditionally trained scientists and mathematicians – a 19.42 supply to demand ratio – whereas the undersupply of computationally capable STEM graduates is well- documented both within the state and within the nation as a whole. Indeed, the National Academy of Science report “The Mathematical Sciences in 2025” (via the Board on Mathematical Sciences and its Applications) states that “Scientific computing has grown to be an area of study in its own right, but often it is not pursued in a unified way at academic institutions, instead existing in small clusters scattered in a variety of science and engineering departments.

Mathematical sciences departments should play a role in seeing that there is a central home for computational research and education at their institutions. Beyond this, because computation is often the means by which the mathematical sciences are applied in other fields and is also the driver of many new applications of the mathematical sciences, it is important that most mathematical scientists have a basic understanding of scientific computing.”

The importance of statistics has been recognized in both academia and industry. In a wide variety of fields, graduates with statistical knowledge and skills are in high demand. Many jobs in business, psychology, biology, sociology and political science require that applicants have a strong background in data analysis. Employers rate the ability to analyze quantitative data as an important skill they look for in new graduates (NACE's Job Outlook 2013 survey). In addition, students who plan on further graduate study in statistics will greatly benefit by completing this program since our program provides a solid foundation in mathematics.

According to the 2014 Occupational Outlook Handbook from the Bureau of Labor Statistics (https://www.bls.gov/emp/ep_table_103.htm), “employment of statisticians is projected to grow 33.8 percent from 2014 to 2024, about as fast as the average for all occupations. The demand for individuals with a background in statistics is projected to grow, although some jobs will be in occupations with titles other than a statistician.” Regarding the job prospects of statisticians, the handbook said: “For example, many jobs involve the analysis and interpretation of data from economics, biological science, psychology, computer software engineering, education, and other disciplines. Additional job openings will become available as currently employed statisticians transfer to other occupations, retire, or leave the workforce for other reasons.”

The concentrations in Computational Applied Mathematics and Statistics within the Department are appropriate response to these critical needs of the state and nation. The concentrations in Mathematical Sciences and Mathematics Education intentionally includes courses that are part of the concentrations in computational applied math, statistics, and education, but the central focus on mathematics itself deserves to be distinguished from these

pursuits.

Employment of mathematicians is projected to grow 21 percent from 2014-2024, much faster than the average for all occupations. Though an undergraduate degree is beneficial, mathematicians typically need at least a master's degree.

Graduate Alumni

At East Tennessee State University, there are several offices responsible for tracking data concerning alumni. The Alumni Office, in conjunction with the Advancement Office, collects and maintains a database of contact information for ETSU alumni. As part of their services, the Alumni Office connects with alumni via e-newsletters and requests for updates. They also host a website where information on events, news, updating contact information is located. They also provide alumni with ways to engage and give back to the University.

Another office on campus which tracks alumni is the office of University Career Services. This office tracks alumni and maintains a database of career related data. Alumni are annually requested to provide information on their employment status, type of job, salary, benefits and other related career data to the office of University Career Services. This information may be used for program improvement and allows University Career Services to help solicit internship, career, and networking opportunities to current students who utilize their services. Like the Alumni Office, the office of University Career Services hosts a website which provides news and services to alumni.

In the last five years, the Department of Mathematics and Statistics has had 109 undergraduate students and 47 graduate students complete their degree at ETSU. A listing of some of our alumni (undergraduates, graduates) is given on our Department Web Site at <http://www.etsu.edu/cas/math/alumni.php>. The graduate coordinator has maintained contact with many of the graduate alumni, many of whom have gone on to pursue Ph.D.s, teaching positions, and careers in industry.

The Department began producing and emailing a newsletter to all mathematics alumni in May 2015 as part of an effort to reconnect with graduates. As a result, the Chair of the Department heard back from many alumni. Additionally, a recent issue of ETSU Today, the University's alumni magazine, which is mailed to over 85,000 alumni and friends each semester, featured a story on the Department being a STEM Leader. See Appendix M for the newsletter and article that appeared in the ETSU Today magazine.

Policies and Procedures

Information and guidelines for the graduate program can be found at <http://www.etsu.edu/cas/math/programs/grad.php> and <http://math.etsu.edu/grad/>.

The Department's graduate faculty meets at least once per year to review the graduate program, including its policies and procedures. Proposed changes are discussed by the graduate

faculty and those changes deemed appropriate are revised on the website.

xI. Conclusions and Recommendations

The program review process has allowed the department chair and faculty members to reflect upon and evaluate the undergraduate and graduate programs, as well as the department as a whole. The following areas have been identified as needing improvement over the next 5-7 years.

1. Improve quality of the graduate program by attracting better prepared graduate students.

This can be accomplished by increasing the stipends available to graduate students. Higher stipends would enable the department to recruit higher quality graduate students nationally and internationally. The department also needs to research additional methods of recruiting top graduate candidates.

2. Even distribution among faculty of directing masters theses and leading undergraduate research.

Currently, a few faculty advisors handle the majority of the research advisement. It would be good for the faculty if the distribution was more spread out, so that each faculty member had at most three students at a time. It would be good for the students to have more faculty and projects from which to choose.

3. Add new degree programs. For example, a concentration in Statistics for the graduate program, an undergraduate Statistics degree based on the current concentration, and a 5-year program (BS+MS).

The undergraduate Statistics concentration has been rapidly growing to the point of independence. Given the employment needs in the future, allowing students to have a degree in Statistics on their diploma rather than a degree in Mathematics would be beneficial. Adding a concentration in Statistics to the graduate degree would help with recruitment while fulfilling this highly desired need for employment.

4. Hire new faculty members.

Hire faculty members to fill positions that have been vacated without replacement over the past three years. Also hire faculty for new positions to enhance our program, like a director of theses and undergraduate research.

5. Have a study area for undergraduate students. We have observed on many occasions mathematics majors sitting out in the hall on the third floor of Gilbreath working/studying

together. We feel that having a dedicated study area would be very beneficial for our majors.

6. Explore ways to maintain high standards for the graduate courses and theses while dealing with unprepared students.
7. Develop plans that prevent prepared students from being hindered by unprepared students. This may include developing methods to test a student's aptitude for doing graduate level work when they apply or are accepted into the program.

xii. Appendix Items

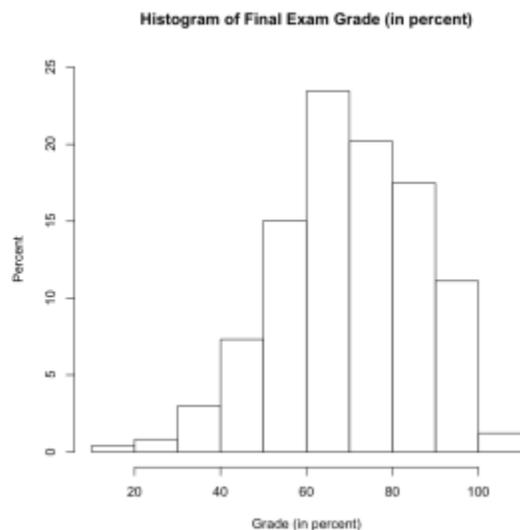
Appendix A: General Education Mathematics Reports

MATH 1530 FINAL EXAM Spring 2016 Final Exam Summary

I. All Sections of MATH 1530

Here are the summary statistics and the distribution of the 738 final exam scores in Spring 2016. The statistics are the percent correct.

Variable	N	Mean	StDev	Minimum	Q1	Median	Q3	Maximum
Final Exa	738	71.14	16.27	17.5	60	71.25	85	105



Mathematics Outcomes Assessed	Superior Number (100) and Percent	Satisfactory Number (100) and Percent	Unsatisfactory Number (100) and Percent
Students are able to use mathematics to solve problems and determine if results are reasonable	3 Q (42%)	2 Q (42%)	0 or 1 Q (16%)
Students are able to use mathematics to model real-world behaviors and apply mathematical concepts to the solution of real life problems.	3 Q (38%)	2 Q (34%)	0 or 1 Q (28%)
Students are able to make meaningful connections between mathematics and other disciplines.	3 Q (47%)	2 Q (36%)	0 or 1 Q (17%)
Students are able to use technology for mathematical reasoning and problem solving	Mean = 86.8	83% > 72.6	
Students are able to apply mathematical and/or basic statistical reasoning to analyze data and graphs.	3 Q (39%)	2 Q (38%)	0 or 1 Q (23%)
ETSU Additional Learning Outcomes			
Students are able to conclude when a relationship is one of cause and effect and when it cannot be.		2 Q (93%)	0 or 1 Q (7%)
Students know the difference between statistical significance and practical significance, especially when using large sample sizes.		2 Q (38%)	0 or 1 Q (62%)
Students know the difference between finding “no effect” or “no difference” and finding no statistically significant effect or difference, especially when using small sample sizes.	3 Q (12%)	2 Q (43%)	0 or 1 Q (45%)
Students are able to identify common sources of bias in		2 Q (84%)	0 or 1 Q (16%)

surveys and experiments.			
Students are able to distinguish the conditional probability of A given B with the inverse, the conditional probability of B given A.		2 Q (70%)	0 or 1 Q (30%)

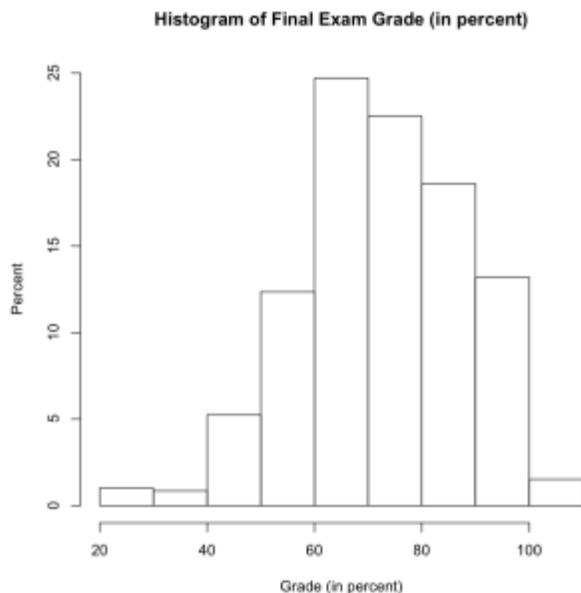
Student Attainment of General Education Mathematics Outcomes
East Tennessee State University, Spring 2016
(N = 738, Final Exam; N = 543 Capstone Project)

TBR Learning Outcomes	Item & Percent Answered Correctly or Mean Score
Students are able to use mathematics to solve problems and determine if results are reasonable	Q2 (56%) Q5 (84%) Q11 (83%)
Students are able to use mathematics to model real-world behaviors and apply mathematical concepts to the solution of real life problems.	Q15 (59%) Q34 (81%) Q40 (64%)
Students are able to make meaningful connections between mathematics and other disciplines.	Q8 (72%) Q16 (65%) Q28 (92%)
Students are able to use technology for mathematical reasoning and problem solving	Capstone Project: Mean Score = 86.8
Students are able to apply mathematical and/or basic statistical reasoning to analyze data and graphs.	Q7 (83%) Q13 (75%) Q43 (54%)
ETSU Additional Learning Outcomes	
Students are able to conclude when a relationship is one of cause and effect and when it cannot be.	Q18 (99%) Q26 (94%)
Students know the difference between statistical significance and practical significance, especially when using large sample sizes.	Q24 (43%) Q25 (81%)
Students know the difference between finding “no effect” or “no difference” and finding no statistically significant effect or difference, especially when using small sample sizes.	Q30 (79%) Q41 (39%) Q42 (40%)
Students are able to identify common sources of bias in surveys and experiments.	Q20 (94%) Q22 (88%)
Students are able to distinguish the conditional probability of A given B with the inverse, the conditional probability of B given A.	Q36 (80%) Q38 (82%)

II. Regular Sections of MATH 1530

Here are the summary statistics and the distribution of the 591 final exam scores in Spring 2016. The statistics are the percent correct.

Variable	N	Mean	StDev	Minimum	Q1	Median	Q3	Maximum
Final Exa	591	72.5	15.07	20	65	72.5	85	105



Mathematics Outcomes Assessed	Superior Number (100) and Percent	Satisfactory Number (100) and Percent	Unsatisfactory Number (100) and Percent
Students are able to use mathematics to solve problems and determine if results are reasonable	3 Q (47%)	2 Q (39%)	0 or 1 Q (14%)
Students are able to use mathematics to model real-world behaviors and apply mathematical concepts to the solution of real life problems.	3 Q (41%)	2 Q (37%)	0 or 1 Q (22%)
Students are able to make meaningful connections between mathematics and other disciplines.	3 Q (52%)	2 Q (34%)	0 or 1 Q (14%)
Students are able to use technology for mathematical reasoning and problem solving	Mean = 86.4	82% > 72.6	
Students are able to apply mathematical and/or basic statistical reasoning to analyze data and graphs.	3 Q (44%)	2 Q (37%)	0 or 1 Q (19%)
ETSU Additional Learning Outcomes			
Students are able to conclude when a relationship is one of cause and effect and when it cannot be.		2 Q (96%)	0 or 1 Q (4%)
Students know the difference between statistical significance and practical significance, especially when using large sample sizes.		2 Q (39%)	0 or 1 Q (61%)
Students know the difference between finding “no effect” or “no difference” and finding no statistically significant effect or difference, especially when using small sample sizes.	3 Q (12%)	2 Q (43%)	0 or 1 Q (45%)
Students are able to identify common sources of bias in surveys and experiments.		2 Q (86%)	0 or 1 Q (14%)
Students are able to distinguish the conditional probability of A given B with the inverse, the conditional probability of B given A.		2 Q (75%)	0 or 1 Q (25%)

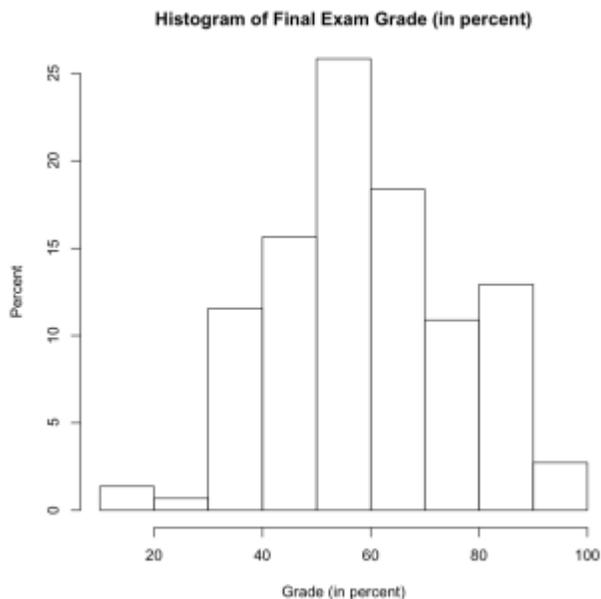
Student Attainment of General Education Mathematics Outcomes
 East Tennessee State University, Spring 2016
 (N = 591, Final Exam; N = 442 Capstone Project)

TBR Learning Outcomes	Item & Percent Answered Correctly or Mean Score
Students are able to use mathematics to solve problems and determine if results are reasonable	Q2 (59%) Q5 (87%) Q11 (86%)
Students are able to use mathematics to model real-world behaviors and apply mathematical concepts to the solution of real life problems.	Q15 (61%) Q34 (85%) Q40 (69%)
Students are able to make meaningful connections between mathematics and other disciplines.	Q8 (73%) Q16 (70%) Q28 (95%)
Students are able to use technology for mathematical reasoning and problem solving	Capstone Project: Mean Score = 86.4
Students are able to apply mathematical and/or basic statistical reasoning to analyze data and graphs.	Q7 (84%) Q13 (78%) Q43 (59%)
ETSU Additional Learning Outcomes	
Students are able to conclude when a relationship is one of cause and effect and when it cannot be.	Q18 (99%) Q26 (96%)
Students know the difference between statistical significance and practical significance, especially when using large sample sizes.	Q24 (45%) Q25 (83%)
Students know the difference between finding “no effect” or “no difference” and finding no statistically significant effect or difference, especially when using small sample sizes.	Q30 (82%) Q41 (37%) Q42 (42%)
Students are able to identify common sources of bias in surveys and experiments.	Q20 (95%) Q22 (89%)
Students are able to distinguish the conditional probability of A given B with the inverse, the conditional probability of B given A.	Q36 (82%) Q38 (87%)

III. LS Sections of MATH 1530

Here are the summary statistics and the distribution of the 147 final exam scores in Spring 2016. The statistics are the percent correct.

Variable	N	Mean	StDev	Minimum	Q1	Median	Q3	Maximum
Final Exa	147	60.99	16.98	17.5	50.0	60.0	72.5	100



Mathematics	Superior	Satisfactory	Unsatisfactory
Outcomes Assessed	Number (100) and Percent	Number (100) and Percent	Number (100) and Percent
Students are able to use mathematics to solve problems and determine if results are reasonable	3 Q (20%)	2 Q (53%)	0 or 1 Q (27%)
Students are able to use mathematics to model real-world behaviors and apply mathematical concepts to the solution of real life problems.	3 Q (26%)	2 Q (23%)	0 or 1 Q (51%)
Students are able to make meaningful connections between mathematics and other disciplines.	3 Q (28%)	2 Q (43%)	0 or 1 Q (29%)
Students are able to use technology for mathematical reasoning and problem solving	Mean = 88.9	87% > 72.6	
Students are able to apply mathematical and/or basic statistical reasoning to analyze data and graphs.	3 Q (22%)	2 Q (44%)	0 or 1 Q (34%)
ETSU Additional Learning Outcomes			
Students are able to conclude when a relationship is one of cause and effect and when it cannot be.		2 Q (82%)	0 or 1 Q (18%)
Students know the difference between statistical significance and practical significance, especially when using large sample sizes.		2 Q (31%)	0 or 1 Q (69%)
Students know the difference between finding “no effect” or “no difference” and finding no statistically significant effect or difference, especially when using small sample sizes.	3 Q (10%)	2 Q (42%)	0 or 1 Q (48%)
Students are able to identify common sources of bias in surveys and experiments.		2 Q (76%)	0 or 1 Q (24%)
Students are able to distinguish the conditional probability of A given B with the inverse, the conditional probability of B given A.		2 Q (52%)	0 or 1 Q (48%)

Student Attainment of General Education Mathematics Outcomes
 East Tennessee State University, Spring 2016
 (N = 147, Final Exam; N = 101 Capstone Project)

TBR Learning Outcomes	Item & Percent Answered Correctly or Mean Score
Students are able to use mathematics to solve problems and determine if results are reasonable	Q2 (46%) Q5 (71%) Q11 (69%)
Students are able to use mathematics to model real-world behaviors and apply mathematical concepts to the solution of real life problems.	Q15 (48%) Q34 (64%) Q40 (48%)
Students are able to make meaningful connections between mathematics and other disciplines.	Q8 (67%) Q16 (45%) Q28 (82%)
Students are able to use technology for mathematical reasoning and problem solving	Capstone Project: Mean Score = 88.9
Students are able to apply mathematical and/or basic statistical reasoning to analyze data and graphs.	Q7 (80%) Q13 (65%) Q43 (36%)
ETSU Additional Learning Outcomes	
Students are able to conclude when a relationship is one of cause and effect and when it cannot be.	Q18 (95%) Q26 (86%)
Students know the difference between statistical significance and practical significance, especially when using large sample sizes.	Q24 (36%) Q25 (78%)
Students know the difference between finding “no effect” or “no difference” and finding no statistically significant effect or difference, especially when using small sample sizes.	Q30 (69%) Q41 (48%) Q42 (31%)
Students are able to identify common sources of bias in surveys and experiments.	Q20 (88%) Q22 (82%)
Students are able to distinguish the conditional probability of A given B with the inverse, the conditional probability of B given A.	Q36 (74%) Q38 (63%)

- Summarize your impressions of the results reported in part III. Based upon your interpretation of the data, what conclusions emerge about student attainment of the learning outcomes?

Generally, the students continue to have problems with reading and understanding long passages.

The students in MATH 1530 L had an average final exam score about 12 percentage points below the regular Math 1530 average final exam score. The learning support students scored 20 points lower than the regular math 1530 students on the 2015 final exam.

30% of the students were able to determine the sampling distribution of the sample for a large sample.

Students have difficulty with cause-and-effect problems.

- Do you plan to implement strategies to correct any deficiencies that emerged from the data obtained? If yes, please explain.

Starting spring 2015 we require all mathematics graduate students that receive an assistantship from the department to attend a Math 1530 class and take a competency exam on Math 1530 at the end of the semester.

- Did you implement strategies proposed in the general education assessment report submitted in fall 2013? If yes, please explain.

Implementation of Proposed Improvements in MATH 1530
East Tennessee State University, Fall 2013-Summer 2015

Proposed Action, Fall 2015	Action Taken, Fall 2013-Summer 2014
<p>We will continue utilizing the capstone project in MATH 1530, which we began in 2009-10 in response to assessments of students learning. The project is an end-of-semester data analysis of a class survey that requires technology to analyze data. This project supports statistical thinking and the use of technology (i.e. Minitab) by allowing students to apply what they have learned during the semester. It also serves as a review for the final exam. The project supports statistical thinking: think, show, and tell where as the final exam focuses on thinking and telling. Thinking about a problem involves stating the problem in its real-world context and planning the statistical work in detail. Showing involves solving the problem by making the necessary graphs and calculations using Minitab. Telling is explaining what your findings say about the real-world setting. We make regular use of this process so that we can go beyond graphs and calculations and ask, "What do the data tell me?"</p>	<p>A capstone project was assigned on various student responses of a class survey. Students were required to use Minitab for data analysis and to type their responses in addition to obtaining the Minitab output. In the spring semester, the project was divided into two parts. The first part includes basic data analyses and random sampling. The second part included mainly statistical inferences.</p>
<p>We will work more conditional probability problems that have some meaningful value to improve students' understanding of this concept.</p>	<p>We used two-way tables with real-life data to teach students conditional probability. It is easier for students to understand the topic. The project had questions dealing with conditional probabilities.</p>
<p>We will be using the quizzing activity through LaunchPad, which is a formative assessment activity that uses a game-like interface to guide students through a series of questions catered to their individual level of understanding. Students' task in this is to score 200 points by answering questions. Once students reach the target Activity Score of 200, they receive full credit (a grade of 100%) for completing the activity, but they continue answering questions to review the material.</p>	<p>The Learning Curve assignments were given to students through statsportal. Students could take any of these assignments thought the end of semester with unlimited attempts. A total of 50 points were given if a student reached the target scores for all chapters. Partial credits were granted if they complete part of the assignments.</p>

Results of Assessment of General Education Learning Outcomes Spring 2016 Subject Area: Mathematics

Identify the course used in the assessment. Include prefix, number, and title of

MATH 1840, Analytic Geometry and Differential Calculus

2. The following is background information about the exam administered in Analytic Geometry and Differential Calculus

Selected final exam questions were used to evaluate students' performance.

3. Here are the results of the final exam.

Evaluation of students' performance on selected items on the final exam in MATH 1840	Analytical Geometry with Differential Calculus Data for Spring 2016
Students are able to use mathematics to solve problems and determine if results are reasonable.	I used the final to evaluate this performance. Descriptive Statistics: Final Grades Number of Students: 14 Maximum Grade: 106 Mean: 79.43 Standard Deviation: 21.34
Students are able to use mathematics to model real-world behaviors and apply mathematical concepts to the solution of real life problems.	Numbers 1 on exam Descriptive Statistics: Solution of Real World Problems Maximum Points: 6 Mean: 4.286 Standard Deviation: 1.939
Students are able to make meaningful connections between mathematics and other disciplines.	Number 2 on exam Descriptive Statistics: Integrating Math and Physics Maximum Points: 6 Mean: 3.429 Standard Deviation: 3.081
Students are able to use technology for mathematical reasoning and problem solving.	Number 3 "calculator was used" Descriptive Statistics: Technology and Mathematical Reasoning Maximum Points: 6 Mean: 4.071 Standard Deviation: 2.526
Students are familiar and will be able to use derivatives of trigonometric, exponential, and logarithmic functions as well as polynomials when applicable.	Numbers 4,5 14, and 15 on exam Descriptive Statistics: Derivatives (Expo,Log,etc.) Maximum Points: 24 Mean: 19.71 Standard Deviation: 5.61
Students are able to develop a general strategy to solve problems involving related rates.	Number 4 on exam Descriptive Statistics: Related Rates Maximum Points: 6 Mean: 5.031 Standard Deviation: 1.542

Students are able to understand a number of applications of conic sections, including constructing the equations.	Numbers 8 and 9 on exam Descriptive Statistics: Conic Equations Maximum Points: 12 Mean: 9.357 Standard Deviation: 3.177
Students will be able to use derivative techniques to solve geometric applications of minima and maxima.	Numbers 1 and 9 on exam Descriptive Statistics: Maxima and Minima Maximum Points: 12 Mean: 8.14 Standard Deviation: 4.31
Students are able to use to use implicit differentiation to find derivatives of non-functions.	Number 10 on exam Descriptive Statistics: Derivatives of Non-functions Maximum Points: 6 Mean: 5.357 Standard Deviation: 1.737
Students will be introduced to Definite and Indefinite Integrals	Numbers 11 and 12 On exam Descriptive Statistics: Definite and Indefinite Integrals Maximum Points: 12 Mean: 7.29 Standard Deviation: 5.36

Dr. Davidson continues to have study sessions throughout the term where he is able to work more problems.

Students improved in the area of derivatives of trigonometric, exponential, and logarithmic functions as well as polynomials.

There was a decline in performance from the previous year on solving definite and indefinite integrals.

Results of Assessment of General Education Learning Outcomes
Spring 2016
Subject Area: Mathematics

1. Identify the course used in the assessment. Include prefix, number, and title of

MATH 1910, Calculus I, Spring 206

2. The following is background information about the exam administered in Calculus I.

Calculus I cannot be passed until the Gateway exam is passed.

Since we now require the powerful TI-89 calculator and encourage its use throughout calculus, Gateway exams in calculus have been established to insure that students are still developing pencil and paper computational skills.

In Calculus I, Math 1910, the gateway exam covers limits and derivatives of polynomials, algebraic functions, and trigonometric functions, as well as implicit differentiation. Once the latter topic has been covered in Calculus I, a date will be set for an in-class version of the gateway exam. Those students that do not pass it can take the electronic version of the test once per week for 6 weeks and 4 times the week before final's week (a total of 10 attempts). The electronic version of the test is administered in the Testing Center (Main Library, first floor).

Gateway Exams can be taken the last week of class only by permission of the Calculus coordinator. No gateway testing will be offered in the Center for Academic Achievement during the last week of class.

The examination consists of 10 multiple choice questions and has a 45-minute time limit. A score of 7 out of 10 is required and the $\frac{2}{3}$ and $\frac{5}{7}$ rule has to be met in order to pass the test. That is to say, students have to solve correctly at least 2 of the 3 problems on limits and 5 of the 7 questions on derivatives.

The purpose of the examination is to assess each student's acquisition of the basic skills in Calculus. Therefore, **NO CALCULATORS OF ANY KIND MAY BE USED DURING THE EXAMINATION.**

NOTE: Passing the gateway examination does not guarantee a passing grade for the course.

A sample gateway exam and more information is available at

<http://math.etsu.edu/calculus/>

3. Here are the results of the in-class gateway exam. The table below summarizes the results of the subtests for the 76 students that took the in-class exam with pencil and paper.

Learning Outcome/Subtest	Related test items and number of items that must be answered correctly to subtest	Percentage of students attempting test who passed subtest, overall mean, and standard deviation
Students are able to solve problems about limits using only "paper and pencil" techniques.	At least 2 of the 3 problems on limits must be solved correctly.	69% 2.02 0.85
Students are able to solve problems about derivatives using only "paper and pencil" techniques.	At least 5 of the 7 problems on derivatives must be solved correctly.	60% 4.72 1.76

Overall, 35/76 or 46% of the students passed the in-class gateway exam. The mean and standard deviation of the in-class gateway exam for all 76 students was 6.7 and 2.44, respectively.

There were 5/76 or 6.6% of the students that scored 7 on the exam but did not pass due to 2/3 and 5/7 rule.

It appears that the students did a little better on limits than they did on derivatives.

4. Here are the summary results of the electronic version of the gateway exam.

Raw data with regard to the number of attempts among those students that

passed the test: 1 attempt: 35 students

2 attempts: 13 students

3 attempts: 8 students

4 attempts: 7 students

5 attempts: 2 students

6 attempts: 1 student

8 attempts: 1 student

Overall, 97.01% of the students needed 5 or less attempts to pass the test.

Note

Among those students that did not pass the test, it is noteworthy to mention that 3 students used only one attempt, 2 used two attempts, 2 used three attempts, 1 used four attempts, and 1 used five attempts. None of them took advantage of the fact that ten attempts (one per week and four the last week of classes) were allowed.

Appendix B1: IE Report 2008-2012
 East Tennessee State University
 (AA/CAS) - Mathematics and Statistics

Educational - The Department of Mathematics seeks to provide each undergraduate student with a general education experience that effectively develops their quantitative skills.

(AA/CAS) - Mathematics and Statistics: 1.1.1 MATH (GE)

Students acquire quantitative skills in a timely fashion early in their undergraduate career.

Definition Type: PIE

Start Date: 08/13/2008

End Date: 11/12/2012

Definition Status: Inactive

Assessment Method

Assessment Method	Criterion	Cycle	Active
Analyzing data concerning pass rates in Probability and Statistics and in Calculus I. The evaluation will be conducted by the coordinators of Probability and Statistics and Calculus I, respectively.		Triennial	No

Findings and Interpretation

Findings and Interpretation	Improvement Plan	Action on Plan	Response
<p>05/22/2012 - PROCEDURE: We computed the percentage of students who succeeded in MATH 1530 and MATH 1910. Success, as always, is defined as getting a grade of C- or better. FINDINGS: MATH 1530: In Fall 2011, we found that 1035/1561, or 66%, of the students succeeded. This number was 725/1208, or 60%, in Spring 2012. MATH 1910: In Fall 2011, we found that 226/374, or 60%, of the students succeeded. This number was 148/213, or 69%, in Spring 2012.</p> <p>INTERPRETATION: The success rate in MATH 1530 for Spring dropped slightly which follows the historically and well-researched fact that Spring students in a predominantly Fall class do not do as well. The students did quite well using technology to do their data analysis. The students did quite well when determining cause and effect relationships. The students did fair on the conditional probability problems. Generally, the students have problems with reading and understanding long passages. The students struggle with using the Normal table, p-value interpretation, and sampling distribution of the sample mean.</p> <p>The success rate in MATH 1910 for Spring actually increased from the Fall semester. The success rates, though, are very satisfactory indeed and better than those at sister schools. The Gateway Calculus test is an exam that somehow measures the lower bound of knowledge. An electronic version has been implemented in the last two years, and the results are quite satisfactory. Very few students fail it but pass the regular tests given by their instructors, thus showing that the Gateway is a reliable test (in the sense that it measures the above-mentioned lower bound of knowledge). In addition, students must get 2 out of 3 questions correct</p>			Sustain existing improvement plan

Findings and Interpretation

Findings and Interpretation	Improvement Plan	Action on Plan	Response
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on limits and 5 out of 7 correct on derivatives to pass the Gateway Exam.

focused on the topics that we will cover in the

Evaluation:

Findings Satisfactory

Related Documents:

[Math 1530 Final Exam Spring 2012](#)

[Math 1530 Project1 Spring 2012](#)

[Math 1530 Project2 Spring 2012](#)

[Math 1910 Gateway Fall 2011](#)

[Math 1910 Gateway Spring 2012](#)

[Math 1530 Spring Final Report](#)

09/12/2011 - PROCEDURE: We computed the percentage of students who succeeded in MATH 1530 and MATH 1910. Success, as always, is defined as getting a grade of C- or better. FINDINGS: MATH 1530: In Fall 2010, we found that 1044/1575, or 66%, of the students succeeded. This number was 876/1393, or 63%, in Spring 2011. MATH 1910: In Fall 2010, we found that 248/390, or 64%, of the students succeeded. This number was 150/211, or 71%, in Spring 2011.

INTERPRETATION: The success rate in MATH 1530 for Spring dropped slightly which follows the historically and well-researched fact that Spring students in a predominantly Fall class do not do as well. The students did quite well using technology to do their data analysis. The students did quite well when determining cause and effect relationships. The students did fair on the conditional probability problems. Generally, the students have problems with reading and understanding long passages. The students struggle with using the Normal table, p-value interpretation, and sampling distribution of the sample mean.

The success rate in MATH 1910 for Spring actually increased from the Fall semester. The success rates, though, are very satisfactory indeed and better than those at sister schools. The Gateway Calculus test is an exam that somehow measures the lower bound of knowledge. An electronic version has been implemented in the last two years, and the results are quite satisfactory. Very few students fail it but pass the regular tests given by their instructors, thus showing that the Gateway is a reliable test (in the sense that it measures the above-mentioned lower bound of knowledge).

Evaluation:

Findings Satisfactory

01/25/2012 - MATH 1910: We are committed to the task of improving the test as well as to raise the overall learning of Calculus students. Moreover, this past fall we were pleasantly surprised on the Gateway Exam that only a tiny fraction of students did not pass by the 2/3 (2 questions on limits needed to be correct out of a total of 3) and 5/7 (5 questions on derivatives needed to be correct out of a total of 7) new policy.

Our immediate task is to improve the percentage of students that pass the Gateway. In the Fall of 2011, 220 Calculus I students passed either the in-class version or the electronic version (76% of registered students). It should be noted that passing the Gateway is no guarantee of passing the course.

01/23/2012 - MATH 1530: A student survey is given at the beginning of the semester to help spark an interest in studying statistics. A capstone project that requires technology is assigned to analyze the student survey data. The students are required to include the appropriate graphs, summary statistics in their report. This project supports statistical thinking and the use of technology (i.e. Minitab) by allowing students to apply what they have learned during the semester. It also serves as a review for the final exam. The project supports statistical thinking: think, show, and tell where as the final exam focuses on thinking and telling. Thinking about a problem involves stating the problem in its real-world context and planning the statistical work in detail. Showing involves solving the problem by making the necessary graphs and calculations using Minitab. Telling is explaining what your findings say about the real-world setting. We make regular use of this process so that we can go beyond graphs and calculations and ask, "What do the data tell me?" We have a custom textbook that is more

None planned

Findings and Interpretation

Findings and Interpretation	Improvement Plan	Action on Plan	Response
	<p>many short quizzes during the semester over topics that are covered in a lecture. We need to continue working Normal distribution problems. Basically, the students have difficulty distinguishing between "at least" and "at most." The "at least" problems are dealing with finding area under the Normal curve to the right. The "at most" problems are dealing with finding area under the Normal curve to the left. We will work more conditional probability problems that have some meaningful value so that maybe the students will have a better understanding of this concept.</p> <p>Finally, the "binomial" can be a difficulty for students, so there will be several worksheet/class activities on this topic.</p>		
<p>12/03/2010 - PROCEDURE: We computed the percentage of students who succeeded in MATH 1910 (the process will be repeated next year for MATH 1530 -- a course that is in a state of major flux). Success, as always, is defined as getting a grade of C- or better.</p> <p>FINDINGS: In Fall 2009, we found that 268/357, or 75.1%, of the students succeeded. This number was 132/203, or 65%, in Spring 2010.</p> <p>INTERPRETATION: The lower success rate in Spring follows the historically and well-researched fact that Spring students in a predominantly Fall class do not do as well. The success rates, though, are very satisfactory indeed and better than those at sisterschools.</p> <p>Evaluation: Findings Satisfactory</p>			None planned
<p>12/15/2009 - PROCEDURE: Success rates, defined as the percentage of students receiving a grade of C- or better, will be reported and analyzed for our two major general education classes, namely MATH 1530 and MATH 1910.</p> <p>FINDINGS: In Fall 2008, 75% of students got a grade of C- or better in MATH 1530. This figure dropped to 65% in Spring 2009, due, possibly, to the fact that there are more weaker students in Spring sections. Data for MATH 1910 will be reported next year, as will be the effect on passing rates due to new efforts such as Learning Support.</p> <p>INTERPRETATION: We will use the numbers above, higher than we had expected, as baseline data</p> <p>Evaluation: Findings Satisfactory</p>	<p>12/15/2009 - We will continue to report percentages of students who get a C- or better, thereby avoiding the issues mentioned last year about F vs. FN etc</p>		Obtain more information
<p>10/20/2008 - PROCEDURE: No findings as yet due to lack of data on passing rates. A process has been set up to harvest passing rate information in a statistically sound manner (i.e., making sure everyone is reporting the same information the same way, as in one instructor reporting W's as failures while another doesn't).</p> <p>FINDINGS: NONE</p> <p>INTERPRETATION: NONE</p> <p>Evaluation: Findings Inconclusive</p>	<p>10/21/2008 - PROPOSAL: Utilize a standard protocol and recording instrument to obtain data on passing rates during the 2008/2009 academic year.</p> <p>RATIONALE: Without a uniform method for reporting passing rates -- such as how to consider FN versus F versus W, whether D is passing, and so on -- the results will be flawed regardless of the analysis applied.</p>		Obtain more information

Educational - The educational purpose of the Department of Mathematics is to enable our majors to acquire and critically apply quantitative, computational, and logical skills in the problem solving process.

(AA/CAS) - Mathematics and Statistics: 1.2.1 MATH (BS)

Majors must demonstrate quantitative skills related to limits, integrals and derivatives.

Definition Type: PIE

Start Date: 08/13/2008

Definition Status: Active

Assessment Method

Assessment Method	Criterion	Cycle	Active
Analyzing data concerning performance on a gateway examination administered in Calculus II, MATH 1920. Test items to include limits, integrals and derivatives.			Yes
Analyzing data concerning pass rates in Calculus I and performance on the Gateway examination. The evaluation will be conducted by the coordinator of Calculus I.		Biennial	No

Findings and Interpretation

Findings and Interpretation	Improvement Plan	Action on Plan	Response
<p>01/17/2014 - PROCEDURE: In Calculus II, Math 1920, the gateway exam covers limits evaluated with L'Hopital's Rule, and techniques of integration. Once the latter topic has been covered in Calculus II, a date will be set for an in-class version of the gateway exam. Those students that do not pass it can take the electronic version of the test once per week for 6 weeks and 4 times the week before final's week (a total of 10 attempts). The electronic version of the test is administered in the Testing Center (Main Library, first floor). The examination consists of 10 multiple choice questions and has a 45-minute time limit. A score of 7 out of 10 is required and the 2/3 and 5/7 rule has to be met in order to pass the test. That is to say, students have to solve correctly at least 2 of the 3 problems on limits and 5 of the 7 questions on techniques of integration. During spring 2013, 47 student took the in-class exam and 64 students took the electronic version. FINDINGS: On the in-class exam, 13/47 or 28% of the students passed the in-class gateway exam. The mean and standard deviation of the in-class gateway exam for all 47 students was 5.6 and 1.9, respectively. There were 3/47 or 6% of the students that scored 7 on the exam but did not pass due to 2/3 and 5/7 rule. On the electronic exam, 49/64 or 77% of the students passed the electronic version of the gateway exam by the end of the semester. For the 49 students that passed the exam we have the following summary statistics: limits (mean = 2.4, sd = 0.50), techniques of integration (mean = 5.45, sd = 0.54), and overall score (mean = 7.86, sd = 0.82). INTERPRETATION: Student performed a little better on limits compared to integration techniques. Performance on derivatives and techniques of integration improved throughout the semester.</p> <p>Evaluation: Findings Satisfactory</p> <p>Related Documents:</p>			None planned

Findings and Interpretation

Findings and Interpretation	Improvement Plan	Action on Plan	Response
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[Calc2 report Spr13.docx](#)

01/17/2014 - PROCEDURE: In Calculus II, Math 1920, the gateway exam covers limits evaluated with L'Hopital's Rule, and techniques of integration. Once the latter topic has been covered in Calculus II, a date will be set for an in-class version of the gateway exam. Those students that do not pass it can take the electronic version of the test once per week for 6 weeks and 4 times the week before final's week (a total of 10 attempts). The electronic version of the test is administered in the Testing Center (Main Library, first floor). The examination consists of 10 multiple choice questions and has a 45-minute time limit. A score of 7 out of 10 is required and the 2/3 and 5/7 rule has to be met in order to pass the test. That is to say, students have to solve correctly at least 2 of the 3 problems on limits and 5 of the 7 questions on techniques of integration. During fall 2012, 57 student took the in-class exam and 34 students took the electronic version. FINDINGS: On the in-class exam, 15/57 or 26% of the students passed the in-class gateway exam. The mean and standard deviation of the in-class gateway exam for all 57 students was 5.8 and 2.1, respectively. There were 7/57 or 12% of the students that scored 7 on the exam but did not pass due to 2/3 and 5/7 rule. On the electronic exam, 32/34 or 94% of the students passed the electronic version of the gateway exam by the end of the semester. For the 32 students that passed the exam we have the following summary statistics: limits (mean = 2.3, sd = 0.46), techniques of integration (mean = 5.56, sd = 0.67), and overall score (mean = 7.81, sd = 0.74). INTERPRETATION: Student performed better on the integration techniques compared to limits. Performance on the derivative subtest improved throughout the semester.

Evaluation:

Findings Satisfactory

Related Documents:

[Calc2 Report Fall12.docx](#)

students out of 41 who passed the electronic version.

03/07/2013 - PROCEDURE: Study the number of attempts and eventual pass rates in the Gateway calculus 1 and 2 Exams. From Fall 2012, we report subscores as follows: Calculus 1: Limits (3 questions, 2 correct is a satisfactory score) and derivatives (7 questions, 5 correct is a satisfactory score). Students who pass the test overall, with 7 correct answers out of 10, but who do not have a satisfactory subscore, will be made aware of this fact and offered self-study resources. Calculus 2: Limits (3 questions, 2 correct is a satisfactory score) and integrals and derivatives (7 questions, 5 correct is a satisfactory score). Students who pass the test overall, with 7 correct answers out of 10, but who do not have a satisfactory subscore, will be made aware of this fact and offered self-study resources. FINDINGS: Fall 2012 on first attempt of the in-class Calculus 1 Gateway Exam: There were 228 registered students in the course. Of these students, 196 took the in-class test of which 109 (56%) passed. There were 40 (95.24%) out of 42 students that took the electronic version of the Gateway Exam and passed. There was 2 students that did not pass the test since their total score was less than 7. See attached report for more details. Calculus 2: There were 68 registered students in the course. There were 15 (26.32%) out of 57 students that passed the in-class version. There were 39 (95.12%)

None planned

None planned

Findings and Interpretation

Findings and Interpretation	Improvement Plan	Action on Plan	Response
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INTERPRETATION: Our well designed Gateway Exam series is working well for us and helping student learning. For both Calc 1 & 2, a total of 4 students were unable to pass the electronic version of the exam after many attempts.

test was 75.3%. It is worth mentioning that 13 Calculus I students got a

Evaluation:

Findings Satisfactory

Related Documents:

[Calc 1 & 2 Report](#)

05/21/2012 - PROCEDURE: Study the number of attempts and eventual pass rates in the Gateway calculus 1 and 2 Exams. From Spring 2012, we report subscores as follows: Calculus 1: Limits (3 questions, 2 correct is a satisfactory score) and derivatives (7 questions, 5 correct is a satisfactory score). Students who pass the test overall, with 7 correct answers out of 10, but who do not have a satisfactory subscore, will be made aware of this fact and offered self-study resources. Calculus 2: Limits (3 questions, 2 correct is a satisfactory score) and integrals and derivatives (7 questions, 5 correct is a satisfactory score). Students who pass the test overall, with 7 correct answers out of 10, but who do not have a satisfactory subscore, will be made aware of this fact and offered self-study resources. FINDINGS: Spring 2012 on first attempt of the in-class Calculus 1 Gateway Exam: There were 214 registered students in the course. Of these students, 151 took the in-class test of which 94 (62%) passed. There were 47 out of 49 students that took the electronic version of the Gateway Exam and passed. There was 1 student that did not pass the test due to the 2/3 & 5/7 rule. See attached report for more details. Calculus 2: There were 125 registered students in the course. There were 46 (41.82%) out of 110 students that passed the in-class version. There were 63 (82.3%) students out of 76 who passed the electronic version. INTERPRETATION: Our well designed Gateway Exam series is working well for us and helping student learning.

Evaluation:

Findings Satisfactory

Related Documents:

[Calculus 1 Report](#)

11/07/2011 - PROCEDURE: Study the number of attempts and eventual pass rates in the Gateway calculus 1 and 2 Exams. From Fall 2011, we report subscores as follows: Calculus 1: Limits (3 questions, 2 correct is a satisfactory score) and derivatives (7 questions, 5 correct is a satisfactory score). Students who pass the test overall, with 7 correct answers out of 10, but who do not have a satisfactory subscore, will be made aware of this fact and offered self-study resources. Calculus 2: Limits (3 questions, 2 correct is a satisfactory score) and integrals and derivatives (7 questions, 5 correct is a satisfactory score). Students who pass the test overall, with 7 correct answers out of 10, but who do not have a satisfactory subscore, will be made aware of this fact and offered self-study resources. FINDINGS: Fall 2011 on first attempt of the in-class Calculus 1 Gateway Exam: There were 291 registered students in the course. Of these students, 249 took the test of which 148 (59.4%) passed. Among those that passed: 35 students missed one problem on limits; 43 students missed one problem on derivatives; 31 students missed two problems on derivatives. The average score on the in-class

None planned

Obtain more information

Findings and Interpretation

Findings and Interpretation	Improvement Plan	Action on Plan	Response
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score of 7 but did not pass the test due to the fact that they violated the above-mentioned rule. NOTE: (ADDED: 01/12/12) See related document (Electronic Calculus 1 Gateway results) for final gateway results for the semester. Calculus 2: There were 70 registered students in the course. Of these students, 29 (41.43%) passed the in-class version. Among those that passed: 15 students missed one problem on limits; 5 students missed one problem on derivatives or integrals; 7 students missed two problems on derivatives or integrals. The average score on the in-class exam was 65.9%. NOTE: Students have until the end of the semester to pass the Gateway Exams in Calculus I and II. NOTE: (ADDED 1/17/12) There were 25 (35.7%) students who passed the electronic version. Number of attempts on the electronic version (among those students that passed): 1 attempt: 10 students, 2 attempts: 6 students, 3 attempts: 3 students, 4 attempts: 3 students, 5 attempts: 1 student, 6 or more attempts: 2 students. The median number of attempts was 2. INTERPRETATION: Our well designed Gateway Exam series is working well for us and helping student learning.

Evaluation:

Findings Satisfactory

Related Documents:

[Calc1_gateway_11.pdf](#)

[Calc2_gateway_11.pdf](#)

[Electronic CalcI Gateway Fall2011.docx](#)

<p>12/03/2010 - PROCEDURE: Study the number of attempts and eventual pass rates in the Gateway calculus 1 and 2 Exams. Note added on 6/10/2011: From Fall 2011, we will report subscores as follows:</p> <p>Calculus 1: Limits (3 questions, 2 correct is a satisfactory score) and derivatives (7 questions, 5 correct is a satisfactory score). Students who pass the test overall, with 7 correct answers out of 10, but who do not have a satisfactory subscore, will be made aware of this fact and offered self-study resources.</p> <p>Calculus 2: Limits (3 questions, 2 correct is a satisfactory score) and integrals and derivatives (7 questions, 5 correct is a satisfactory score). Students who pass the test overall, with 7 correct answers out of 10, but who do not have a satisfactory subscore, will be made aware of this fact and offered self-study resources.</p> <p>FINDINGS for Fall 2010: Calculus 1: 118, 59, 22, 9, 3, 6, 0, and 0 students needed 1, 2, 3, 4, 5, 6, 7, 8 attempts to pass respectively. 27 students did not pass. Calculus 2: 61, 28, 28, 13, 5, 1, 3, and 1 students needed 1, 2, 3, 4, 5, 6, 7, and 8 attempts to pass the exam. 29 students did not pass. INTERPRETATION: Our well designed gateway test series is working well for us and helping student learning</p> <p>Evaluation: Findings Satisfactory</p> <p>Related Documents: Section1-2-Irubic.docx</p>	<p>06/10/2011 - From Fall 2011, Two subscores will be reported on the gateway tests for both Calculus</p> <p>12/15/2009 - PROCEDURE: Same as that described in 2008. No additional data will be reported until Fall 2010 since this way of learning</p>	<p>02/13/2013 - This plan has been implemented and the number of students requiring assistance is</p>	<p>Obtain more information</p>
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1 and Calculus 2. Students who pass overall but do documented in each year's findings. not have two satisfactory subscores will be offered help.

12/15/2009 - We will continue to analyze gateway

Sustain existing

Findings and Interpretation

Findings and Interpretation	Improvement Plan	Action on Plan	Response
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about success will be evaluated on a biennial cycle. We will continue to analyze gateway test data and ask faculty to report "passing rate" as being synonymous with "success rate", i.e. grades of C- or better.

FINDINGS: No new findings

INTERPRETATION: No new interpretations

Evaluation:

Findings Satisfactory

test data and ask faculty to report "passing rate" as being synonymous with "success rate", i.e. grades of C- or better.

10/21/2008 - PROCEDURE: Gateway exam results are below. Passing rate analysis not reported here due to lack of data. A process has been set up to harvest passing rate information in a statistically sound manner (i.e., making sure everyone is reporting the same information the same way, as in one instructor reporting W's as failures while another doesn't).

The gateway exams in MATH 1910 and MATH 1920 are good indicators of MATH 1910 instruction and learning. The MATH 1910 gateway exam covers material from the first half of MATH 1910, and the MATH 1920 gateway exam covers material from the last half of MATH 1910 and the first third of MATH 1920. Both tests are 30 minute, 10 question multiple choice assessments (5 choices per question). No calculators or technology tools are permitted, and questions are short and skill-focused. Students can take the exams repeatedly until making at least a 7 out of 10 (twice per week in the math lab with different versions for each attempt).

FINDINGS: Comprehensive gateway exam data are collected each semester and reported to the calculus coordinator, Dr. Jeff Knisley. Data for the academic years 2006/2007 and 2007/2008 were analyzed for this report. However, the results are consistent with similar analyses over the past several years.

All but a few students eventually pass the gateway, and those who do not pass typically are not passing with respect to the rest of the class. Students who do pass the course but not the gateway are typically given an "incomplete" and required to pass the gateway in the next semester. All math majors in MATH 1910 and MATH 1920 passed the gateway exam in Fall 2007 and Spring 2008.

Results are summarized in the document "Gateway Exam Results." The majority of students passed within two attempts of the exam, and in all cases the average number of attempts is below 3. No student has ever required even 50% of the possible offerings in passing the exam, and those who do not pass the exam on average take the exam fewer than 4 times. The average score on the first attempt of the exam ranges from a low of 5.29 to a high of 7.31.

We also found that the students tended to require more attempts and had a lower average on the first attempt of the MATH 1920 gateway exam than on the MATH 1910 gateway exam. However, it must be noted that the populations of the courses differ significantly in size and diversity of majors, since many majors require the MATH 1910 course.

INTERPRETATION: Our interpretation of these findings is that the gateway exam is not an undue burden on the students, yet it does insure

10/21/2008 - PROPOSAL: Utilize a standard protocol and recording instrument to obtain data on passing rates during the 2007/2008 academic year.

RATIONALE: Without a uniform method for reporting passing rates -- such as how to consider FN versus F versus W, whether D is passing, and so on -- the results will be flawed regardless of the analysis applied.

Obtain more information

Findings and Interpretation

Findings and Interpretation	Improvement Plan	Action on Plan	Response
<p>that students who pass MATH 1910 and MATH 1920 have acquired the most important quantitative skills from MATH 1910. Since all math majors are required to complete MATH 1910 and MATH 1920 before taking upper level math courses, we can assume that math majors do acquire quantitative skills before moving into higher level courses. This allows upper level courses to assume such skills exist when our math majors reach those courses.</p> <p>Evaluation: Findings Satisfactory</p> <p>Related Documents: Gateway Exam Results.docx</p>			

(AA/CAS) - Mathematics and Statistics: 1.2.2 MATH (BS)

Majors will acquire logical skills related to set theory, induction and proof by contradiction.

Definition Type: PIE

Start Date: 08/13/2008

Definition Status: Active

Assessment Method

Assessment Method	Criterion	Cycle	Active
Analyzing data concerning performance on a gateway examination administered in Mathematical Reasoning, MATH 3000. Test areas may include set theory; induction; and proof by contradiction, logic, direct proof, and counterexample. Satisfactory findings are determined by a 70% average success rate in each testing area.			Yes
Analyzing data concerning performance on a gateway examination administered in Mathematical Reasoning, MATH 2800. Test items may include set theory; induction; and proof by contradiction, logic, direct proof, and counterexample.		Biennial	No

Findings and Interpretation

Findings and Interpretation	Improvement Plan	Action on Plan	Response
<p>09/25/2013 - The gateway test in MATH 3000 was given Spring 2013. The questions test students on the skills that are taught in all such classes at all schools. Topics that fall in this category are set theory; induction; proof by contradiction, logic, direct proof, and counter example.</p> <p>FINDINGS: Sixteen students took the exam. Summary Statistics for each category. Set Theory - Problem 1 (20 possible points): Mean = 17, StDev = 5; Proof by Induction - Problem 5 (20 possible points): Mean = 15, StDev = 5; Proof by Contradiction - Problem 4 (20 possible points): Mean = 14, StDev = 7; Logic - Problem 2 (20 possible points): Mean = 19, StDev = 3; Direct Proof - Problem 3 (20 possible points): Mean = 15, StDev = 7. INTERPRETATION: Overall, the students did quite well on the five areas of the exam. The weakest area occurred in proof by contradiction, where only 56% of students scored above a C. The other areas had at least 75% of the students make a C or better (70%).</p>			None planned

Findings and Interpretation

Findings and Interpretation	Improvement Plan	Action on Plan	Response
<p>Evaluation: Findings Satisfactory</p> <p>Related Documents: MATH 3000 Spring 2013</p> <p>01/08/2013 - PROCEDURE: The gateway test in MATH 2800 was given Fall 2012. The questions test students on the skills that are taught in all such classes at all schools. Topics that fall in this category are set theory; induction; proof by contradiction, logic, direct proof, and counter example. FINDINGS: Eighteen students took the exam. Here are the means and standard deviations for each category. Set Theory - Problem 1 (20 possible points): Mean = 18, StDev = 5; Proof by Induction - Problem 5 (20 possible points): Mean = 17, StDev = 5; Proof by Contradiction - Problem 4 (20 possible points): Mean = 17, StDev = 5; Logic - Problem 2 (20 possible points): Mean = 18, StDev = 5; Direct Proof - Problem 3 (20 possible points): Mean = 19, StDev = 4. INTERPRETATION: Overall, the students did quite well on the five areas of the exam. The weakest area occurred in proof by induction, where only 83% of students scored above a C which is still above the 70% success rate goal set by the department.</p> <p>Evaluation: Findings Satisfactory</p> <p>Related Documents: Math 2800 Fall 2012 Report.docx</p>			None planned
<p>06/06/2012 - PROCEDURE: The gateway test in MATH 2800 was given Fall 2011. The questions test students on the skills that are taught in all such classes at all schools. Topics that fall in this category are set theory; induction; proof by contradiction, logic, direct proof, and counter example. FINDINGS: Twenty students took the exam. Here are the means and standard deviations for each category. Set Theory (24 possible points): Mean = 18, StDev = 5. Induction (12 possible points): Mean = 9, StDev = 3. Proof by Contradiction (12 possible points): Mean = 11, StDev = 3. Logic (30 possible points): Mean = 29, StDev = 3. Direct Proof (12 possible points): Mean = 11, StDev = 2. INTERPRETATION: Overall, the students did quite well on the five areas of the exam. The weakest area occurred in set theory which averaged 75% (18 out of 24).</p> <p>Evaluation: Findings Satisfactory</p> <p>Related Documents: Final Exam 2011 Data Final Exam Fall 2011</p>			Sustain existing improvement plan
<p>08/29/2011 - PROCEDURE: The gateway test in MATH 2800 was developed in Summer 2010, and students in summer 2011 took the test. Questions test students on the skills that are taught in all such classes at all schools. Topics that fall in this category are set theory; induction; proof by contradiction, logic, direct proof, and counter example. FINDINGS: Five students took the exam. Here are the means and standard deviations for each category. Set Theory (25 possible points): Mean = 23, StDev = 2.35. Induction (15 possible points): Mean = 15, StDev = 0. Proof by Contradiction (15 possible points): Mean = 15, StDev = 0. Logic (31 possible points): Mean = 30.6, StDev = .894.</p>	<p>06/10/2011 - Added on 6/10/2011: From Summer 2011, we will administer a gateway test that includes subscores. In addition, we will devise a method by which students who pass overall, but who receive one or more failing subscores are offered suggestions for self-improvement.</p>	<p>06/28/2012 - The gateway test in MATH 2800 was developed in Summer 2010.</p>	Sustain existing improvement plan

Findings and Interpretation

Findings and Interpretation	Improvement Plan	Action on Plan	Response
<p>Direct Proof (15 possible points): Mean = 15, StDev = 0. Counter example (3 possible points); Mean = 3, StDev = 0. INTERPRETATION: Overall, the students did quite well on the six areas of competencies. The weakest area occurred in set theory which averaged 92% (23 out of 25).</p> <p>Evaluation: Findings Satisfactory</p> <p>Related Documents: FinalExam_Report.pdf</p>			
<p>12/15/2009 - PROCEDURE: The gateway test in MATH 2800 will be developed by the Summer of 2010, and students in Fall 2010 will take the test until they score above a baseline score of 70%. Questions will test students on the skills that are taught in all such classes at all schools. Topics that fall in this category are set theory; induction; proof by contradiction, etc.</p> <p>FINDINGS: None INTERPRETATION: None</p> <p>Evaluation: Findings Inconclusive</p>	<p>12/15/2009 - Same as that reported in October 2008</p>		<p>Obtain more information</p>
<p>10/21/2008 - PROCEDURE: Analysis of a gateway exam developed for the Math 2800, Mathematical Reasoning, course. By gateway exam, we mean an assessment which can be attempted until scoring at least a pre-determined baseline score.</p> <p>FINDINGS: Gateway exams require an entire semester before data is available. This is the first semester of implementation, so no results are available.</p> <p>INTERPRETATION: none.</p> <p>Evaluation: Findings Inconclusive</p>	<p>10/21/2008 - PROPOSAL: Collect data on gateway exam information in Math 2800, Mathematical Reasoning, during the 2008/2009 academic year.</p> <p>RATIONALE: No gateway exam existed in MATH 2800 until PIE. It will take a full year before we have data to assess.</p>		<p>Obtain more information</p>

(AA/CAS) - Mathematics and Statistics: 1.2.3 MATH (BS)

Majors acquire computational skills by the end of their undergraduate career.

Definition Type: PIE

Start Date: 08/13/2008

Definition Status: Active

Assessment Method			
Assessment Method	Criterion	Cycle	Active
Analyzing data concerning performance on a computational assignments, projects, or exams assigned in Numerical Analysis and Numerical Linear Algebra. The method of evaluation will be developed and assessed by the course instructors.			Yes

Findings and Interpretation

Findings and Interpretation

Findings and Interpretation	Improvement Plan	Action on Plan	Response
<p>09/11/2012 - PROCEDURE: Assignments and exams were studied in Numerical Linear Algebra during the Spring 2012 semester. FINDINGS: See attached document for results. INTERPRETATION: In looking at this data, I would say the biggest weaknesses and strengths were</p> <p>Weaknesses:</p> <ol style="list-style-type: none"> 1. Proofs. There were a few assignments that resulted more in proving concepts related to the algorithms, and each of these assignments had the lowest grades. 2. Background knowledge from their elementary linear algebra course - it was greatly forgotten by the time they took Numerical Linear Algebra. This was a huge stumbling block. 3. Fear of using the computational software. <p>Strengths:</p> <ol style="list-style-type: none"> 1. When given a scheme for an algorithm, such as the steps to find the LU decomposition, steps to solve a system using gaussian elimination with partial pivoting, steps for finding the singular value decomposition, etc. , they performed really well. 2. When given a particular numerical algorithm, they could implement it over and over if it was systematic with only minor changes needed. <p>Evaluation: Findings Satisfactory</p> <p>Related Documents: Numerical Linear Alg</p>	<p>09/11/2012 - 1. My biggest suggestion would be for students to take this class the semester after taking Linear Algebra. Any later, they have forgotten so much that it is hard to cover new topics (numerical algorithms) while trying to catch them up on old topics (how to find the inverse of a 2x2 matrix for example). I think changing the time between MATH 2010 and MATH 4267 would make the most significant impact.</p> <p>2. Hands-on group activities worked best in driving home the algorithms. I did many more of these activities towards the middle and end of the semester, and I saw a huge jump in performance. They need repetition and practice. By doing activities in class, they can ask each other and me questions, so they perform better on homework.</p>		Propose new improvement plan

<p>10/27/2011 - PROCEDURE: Numerical Analysis fall 2011: So far data was collected on two assignments given early in the course of the semester; each required numerical programming using a mathematical software Matlab. Homework 1: Topics: Matlab basics involving for loops, while loops, and if statements, functions calls, script files, and concepts such as machine epsilon. Grade distribution: 90-100: 3/13, 80-90: 2/13, 70-80: 5/13, 60-70: 1/13, < 60: 1/13, Not submitted: 1/13. Homework 2: Topics: Root finding methods Grade distribution: 90-100: 5/13, 80-90: 6/13, 70-80: 0/13, 60-70: 0/13, < 60: 0/13, Not submitted: 2/13 NOTE: More data will be added as it comes in. (ADDED: 1/12/12 See Final Results Document) INTERPRETATION: In general, the majority of the weaknesses were in actually learning the software language enough to be able to implement the numerical procedures within the software. The structure of the Numerical Analysis course was designed around two central themes: 1) the algorithms themselves and 2) the implementation of the algorithm in an actual computing language. Both are important, and there is no use in knowing a numerical algorithm if you cannot numerically implement it on an actual problem. For the first part, the algorithms themselves, the students need to be able to discuss the pros and cons of a method, what the method is, and be able to implement by hand on paper the first few steps of a method. In the second part, the students need to write and use built-in code correctly to apply the methods to a problem. One major weakness was in their lack of ability to program (for loops, if loops, syntax, etc.) and to debug a code.</p> <p>Evaluation: Findings Satisfactory</p>	<p>01/23/2012 - To help students with this weakness, 01/23/2012 - Attention to certain areas has been brought to the faculty members attention and efforts are being made to focus extra attention to these areas.</p> <p>several in-class labs on each topic are presented along with the syntax in groups in class. The instructor personally helps each person during these in-class demonstrations which increases their proficiency and performance. The last topic covered, numerical solutions to ordinary differential equations, is always difficult as well. They must learn how to take an actual problem and write it in a way that the software can understand to find and output the numerical solution. This involves some techniques from ordinary differential equations which are reviewed (as it is not a prerequisite for this class) as well as the ability to correctly input the system into the computer. Finally, most students get the broad concept, but may not grasp the tedious details of an algorithm. During the in-class labs, we will focus on these details that they sometimes overlook.</p>		Obtain more information
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Findings and Interpretation

Findings and Interpretation	Improvement Plan	Action on Plan	Response
<p>Related Documents: Math4257 Oct 27 11.docx Math4257 Final Results</p>			
<p>12/03/2010 - PROCEDURE: Numerical Analysis fall 2010: Data was collected for six assignments given throughout the course of the semester; each required numerical programming using a mathematical software Matlab. NOTE ADDED ON 6/10/2011: From Fall 2011, the instructor will write a narrative report for each student in the class, indicating areas of weakness and identifying strengths. In this fashion, students will receive feedback about their strong and weak areas, even though they might pass overall.</p> <p>FINDINGS: Reporting for just two of the assignments, there was a 100% pass rate, with the grades ranging from 62-93 and 68-100. There were also several in-class numerical labs throughout the semester which were completed during class as a method to gauge understanding of the numerical concepts.</p> <p>INTERPRETATION: This seems quite satisfactory.</p> <p>Evaluation: Findings Satisfactory</p>	<p>06/10/2011 - From Fall 2011, the instructor will write a narrative report for each student in the class, indicating areas of weakness and identifying strengths. In this fashion, students will receive feedback about their strong and weak areas, even though they might pass overall.</p>	<p>02/13/2012 - Results for each area studied in Numerical Analysis are reported and attached to the findings reported each year.</p>	<p>Obtain more information</p>
<p>12/15/2009 - PROCEDURE: The same procedure will be followed as outlined in 2008, using a midterm assignment. However, this class will likely be taught now (as in fall 2009) by a new tenure track faculty member, so that the nature of the assignment might change. No further reporting is scheduled until Fall 2010.</p> <p>FINDINGS: No new findings</p> <p>INTERPRETATION: No new interpretation.</p> <p>Evaluation: Findings Satisfactory</p>	<p>12/15/2009 - The next round of data will be reported in Fall 2010; we will use the same plan as before</p>		<p>Obtain more information</p>
<p>10/21/2008 - PROCEDURE: A numerical analysis midterm project was designed and assigned. It was required that the result be turned in as a Maple worksheet, where Maple is a primary computational tool for mathematicians.</p> <p>FINDINGS: The numerical analysis course is a course populated primarily by senior year math majors. Grades were based on a standard scale of A:90-100, B:80-90, C:70-80, D:60-70, and below 70 as failing. All students passed with a grade range of 80-100.</p> <p>INTERPRETATION: Because of the computational nature of the project and the computational skills required by Maple, we interpret these findings to be partial evidence that our math majors do acquire computational skills before they graduate. Since every math major is required to complete either Numerical Analysis (offered every Fall) or Numerical Linear Algebra (offered every Spring), there will not be enough evidence to conclude definitively that all math majors obtain computational skills until after a similar analysis of the Numerical Linear Algebra course has also been completed.</p> <p>Evaluation: Findings Satisfactory</p> <p>Related Documents: NA_midterm.pdf</p>	<p>12/15/2009 - No further data needs to be reported until Fall 2010</p> <p>10/21/2008 - PROPOSAL: Use Numerical Linear Algebra, offered Spring 2009, midterm project as a tool to generate data in parallel to the Fall 2008 Numerical Analysis assessment effort.</p> <p>RATIONALE: Either Numerical Analysis or Numerical Linear Algebra can be used by math majors to fulfill the requirement for a computational course.</p>		<p>Obtain more information</p>

Findings and Interpretation

Findings and Interpretation	Improvement Plan	Action on Plan	Response
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Educational - The Department of Mathematics seeks to prepare graduate students for professional careers by additional training beyond the bachelor's degree level through an intensive program of advanced study including a research experience.

(AA/CAS) - Mathematics and Statistics: 1.3.3 MATH (MS)

Graduate students are able to conduct scholarly research and produce written work suitable for peer-reviewed publications and/or presentations.

Definition Type: PIE

Start Date: 08/13/2008

Definition Status: Active

Assessment Method

Assessment Method	Criterion	Cycle	Active
Analyzing data on the number of students completing a thesis each year. Data will also be gathered on the number of students completing original research. Data will be analyzed by the Graduate Coordinator.		Biennial	Yes

Findings and Interpretation

Findings and Interpretation	Improvement Plan	Action on Plan	Response
08/10/2012 - PROCEDURE: We will analyze data on the number of students completing a thesis each year. Data will also be gathered on the number of students completing original research. Data will be analyzed by the Graduate Coordinator. FINDINGS: There were 5 students who completed a thesis in the 2011-2012 academic year. Three completed their thesis by the end of their fourth semester. The other two completed this summer after the fourth semester. INTERPRETATION: All 5 students did original research and demonstrated knowledge of the research process. Evaluation: Findings Satisfactory			Obtain more information
09/06/2011 - PROCEDURE: We will analyze data on the number of students completing original research. Data will be analyzed by the Graduate Coordinator. FINDINGS: 8 students completed theses and graduated. 1 student started/continued thesis but did not graduate. All 9 students did original research. Evaluation: Findings Satisfactory	01/27/2012 - Data will be gathered on the quality of their research. If possible, we will attempt to assess placement in full-time degree-related positions within two years of graduation.	02/13/2013 - Findings reported in 2012 reflect the department's efforts to track the time it takes for students to complete their thesis.	Obtain more information
12/03/2010 - PROCEDURE: We will analyze data on the number of students completing a thesis each year. Data will also be gathered on the number of students completing original research. Data will be analyzed by the Graduate Coordinator. FINDINGS: 10 students completed thesis and graduated. 5 students started/continued thesis but did not graduate. All 15 students did			Obtain more information

Findings and Interpretation

Findings and Interpretation	Improvement Plan	Action on Plan	Response
original research.			
Evaluation: Findings Satisfactory			
12/15/2009 - PROCEDURE: The next round of data will be reported in Fall 2010 using numbers of students completing theses, and those among them who conduct original research. FINDINGS: The next round will be reported in 2010. INTERPRETATION: None Evaluation: Findings Satisfactory			None planned
10/21/2008 - PROCEDURE: All masters degree students are required to complete a thesis. FINDINGS: In the academic years 2006/2007 and 2007/2008, a total of 18 students completed a master's thesis. Each thesis was the result of students completing original research, and 15 of the students produced research suitable for publication (though not all submitted their results as a publication). INTERPRETATION: Our interpretation of these findings is that such graduate student production of research is conclusive evidence that graduate students do learn how to do research. Evaluation: Findings Satisfactory			None planned

(AA/CAS) - Mathematics and Statistics: 1.3.1 MATH (MS)

Graduate students in mathematics demonstrate knowledge of the foundational topics of Calculus and Linear Algebra in a timely fashion early in their graduate careers.

Definition Type: PIE

Start Date: 08/13/2008

End Date: 11/15/2012

Definition Status: Inactive

Assessment Method

Assessment Method	Criterion	Cycle	Active
Analyzing data on attempts required to pass, and performance on, the two comprehensive examinations. Data will be analyzed by the Graduate Coordinator.	Every graduate student in mathematics must pass a comprehensive exam in the foundational topics of Calculus and Linear Algebra in a timely fashion early in their graduate career. Knowledge of these topics are essential for graduate students in mathematics to be successful.	Biennial	No

Findings and Interpretation

Findings and Interpretation

Findings and Interpretation	Improvement Plan	Action on Plan	Response
<p>08/10/2012 - PROCEDURE: We will present scores on comprehensive examinations taken by graduate students. FINDINGS: There were 10 first year students who took the calculus comprehensive an aggregate total of 24 times, thus averaging 2.4 attempts per student. All 10 students passed the Calculus comprehensive exam in 2011 - 2012 academic year. There were 10 first year students who took the linear algebra comprehensive exam an aggregate total of 17 times, thus averaging 1.7 attempts per student. Of the 10 students, 9 passed the Linear Algebra comprehensive in the 2011 - 2012 academic year. The remaining student passed the linear algebra requirement in the summer of 2012.</p> <p>Evaluation: Findings Satisfactory</p>			Obtain more information
<p>09/06/2011 - PROCEDURE: We will present scores on comprehensive examinations taken by graduate students. However, we are discussing replacing the Linear Algebra comprehensive by a Statistics comprehensive, so as to better use the services of our graduate students in MATH 1530. Future PIE reports may reflect this fact but this year we have data on the Calculus and Linear Algebra exams: FINDINGS: In this reporting period 5 of 6 students who took the comprehensive exams passed them. (ADDED: 1/19/12) The student that failed the comprehensive exam on the first try passed on the second try.</p> <p>Evaluation: Findings Satisfactory</p>			Obtain more information
<p>12/03/2010 - PROCEDURE: We will present scores on comprehensive examinations taken by graduate students. However, we are discussing replacing the Linear Algebra comprehensive by a Statistics comprehensive, so as to better use the services of our graduate students in MATH 1530. Future PIE reports may reflect this fact but this year we have data on the Calculus and Linear Algebra exams: FINDINGS: In this reporting period 4 of 7 students who took the comprehensive exams passed them. INTERPRETATION: Historically many first time attemptees pass the exams on their second try, and all those who failed the exam this year were attempting the exams for the first time!</p> <p>Evaluation: Findings Satisfactory</p>			Obtain more information
<p>12/15/2009 - PROCEDURE: The next round of data will be reported in fall 2010 using scores on comprehensive examinations taken by graduate students. However, we have voted to replace the Linear Algebra comprehensive by a Statistics comprehensive, so as to better use the services of our graduate students in MATH 1530. FINDINGS: No new findings to report INTERPRETATION: No new interpretation.</p> <p>Evaluation: Findings Satisfactory</p>			None planned
<p>10/21/2008 - PROCEDURE: Comprehensive exams in the foundational topics of Calculus and Linear Algebra are conducted several times each year. The scores for those exams are the data source for this assessment.</p>			None planned

Findings and Interpretation

Findings and Interpretation	Improvement Plan	Action on Plan	Response
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FINDINGS: The comprehensive exams in Calculus and Linear Algebra were completed approximately 100 times during the 2006/2007 and 2007/2008 academic years. Each exam requires several hours for completion and is an exhaustive assessment of the foundational techniques and concepts in an undergraduate mathematics major.

There is a 60% passing rate for the exam, thus indicating that most students require multiple attempts to pass each exam. The data also show, however, that the comprehensive exams do not prevent students from timely completion of their master's degree. Comprehensive study materials thus serve both to prepare students for the exams and to promote the development of a complete foundation of fundamental mathematics.

INTERPRETATION: Our interpretation of these findings is that the comprehensive exams do require a great deal of effort from faculty and students alike, but students do eventually pass. Thus, the comprehensive exams do not limit our program or frustrate the career objectives of our students, but they do represent and are recognized by students and faculty alike as a required standard.

Evaluation:
Findings Satisfactory

(AA/CAS) - Mathematics and Statistics: 1.3.2 MATH (MS)

Graduate students acquire specialized skills in an important area of mathematics.

Definition Type: PIE

Start Date: 09/01/2009

Definition Status: Inactive

Assessment Method

Assessment Method	Criterion	Cycle	Active
Analyzing data on the success in completing a two-course sequence in an area of mathematics. Data will also be gathered on the types of sequences completed. Data will be analyzed by the Graduate Coordinator.		Biennial	No

Findings and Interpretation

Findings and Interpretation	Improvement Plan	Action on Plan	Response
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12/03/2010 - Archived None planned

Evaluation:
Findings Inconclusive

12/15/2009 - PROCEDURE: The next round of data will be gathered in Fall 2010 using the same process as outlined in 2008, i.e. success rates in a two course sequence. None planned

FINDINGS: None to report for this PIE cycle.
INTERPRETATION: No new interpretation

Findings and Interpretation**Findings and Interpretation****Improvement Plan****Action on Plan****Response****Evaluation:**

Findings Satisfactory

10/21/2008 - PROCEDURE: All graduate students are required to complete a two-course sequence that focuses on a particular area of mathematics that is still an area of active mathematical research.

None planned

FINDINGS: A total of 23 students completed a 2 course sequence during the 2006/2007 and 2007/2008 academic years.

The two-courses sequences completed during this time were

Graph Theory: MATH 5340 - 5350

Real Analysis: MATH 5210 - 5220

Applied Math: MATH 5610 - 5620

Modern Algebra: MATH 5410 - 5420

Statistical Methods: MATH 5710 - 5720

Numerical Methods: MATH 5257 - 5267

The Graph Theory sequence was the most popular during this time period.

INTERPRETATION: The 2-course sequences were put in place to insure that each graduate student obtained advanced skills and abilities in at least one important area of mathematics. That is, our 2 course sequences are designed to equip students with skills and concepts unique to an important subfield of mathematics. Thus, our interpretation of these findings is that graduate students are acquiring specialized skills in an important area of mathematics.

Evaluation:

Findings Satisfactory

Research/Creative - The research purpose of the Department of Mathematics is to advance mathematical knowledge and pedagogy.

Appendix B2: IE Reports 2015-16 Undergraduate Programs

3.3.1.1 Education Programs and Student Learning Outcomes
 College of Arts and Sciences
 Department of Mathematics and Statistics
 Mathematics, BS, Computational Applied Mathematics Concentration

The mission of the Department of Mathematics and Statistics is to promote the goals of the University by offering high quality educational programs in Pure and Applied mathematics, Statistics, and Mathematics Education, and have a capstone experience that serves as the culmination of the mathematics education. Specifically, undergraduates will work on research problems under the direction of mathematics faculty members.

Outcomes	Assessment	Results and Analysis	Improvement Plan(s)	Effectiveness of Improvement(s)
SLO #1: Students ask questions that facilitate the solution of mathematical modeling problems and the pursuit of opportunities (2014-15).	<p><u>Measure 1A</u>: Grading rubric for MATH 4010: Asks appropriate questions to expand their knowledge. (2014-15).</p> <p><u>Criteria 1A</u>: 80% of students will perform above the level 2 (Satisfactory) benchmark (2014-15).</p> <p><u>Schedule 1A</u>: MATH 4010, a required course in this concentration, is offered each fall and spring. Data will be collected each semester, beginning in fall 2015. The undergraduate coordinator will compile data in May each year, beginning in 2016. Faculty will review data and develop improvement plans (as needed) during spring faculty meeting, starting in 2016 (2014-15).</p>	<p><u>Measure 1A</u>: 100% of Computational Applied Mathematics concentration students (2 of 2) performed above the level 2 benchmark; criteria met (2015-16).</p>	<p><u>Measure 1A</u>: TBD (2015-16).</p>	<p>TBD (2016-17).</p>

	<p><u>Measure 1B</u>: Grading rubric for MATH 4010: Asks questions that show a mastery of mathematical modeling. (2014-15).</p> <p><u>Criteria 1B</u>: 80% of students will perform above the level 2 (Satisfactory) benchmark (2014-15).</p> <p><u>Schedule 1B</u>: MATH 4010, a required course in this concentration, is offered each fall and spring. Data will be collected each semester, beginning in fall 2015. The undergraduate coordinator will compile data in May each year, beginning in 2016. Faculty will review data and develop improvement plans (as needed) during spring faculty meeting, starting in 2016 (2014-15).</p>	<p><u>Measure 1B</u>: 100% of Computational Applied Mathematics concentration students (2 of 2) performed above the level 2 benchmark; criteria met (2015-16).</p>	<p><u>Measure 1B</u>: TBD (2015-16).</p>	<p>TBD (2016-17).</p>
<p>SLO #2: Students apply critical thinking skills in analyzing mathematical/statistical concepts. (2014-15)</p>	<p><u>Measure 1A</u>: Grading rubric for MATH 4010: Analysis of mathematical concepts is logical (2014-15).</p> <p><u>Criteria 1A</u>: 80% of students will perform above the level 2 (Satisfactory) benchmark (2014-15).</p> <p><u>Schedule 1A</u>: MATH 4010, a required course in this concentration, is offered each fall and spring. Data will be collected each semester, beginning in fall 2015. The undergraduate coordinator will compile data in May each year, beginning in 2016. Faculty will review data and develop improvement plans (as needed) during spring faculty meeting, starting in 2016 (2014-15).</p>	<p><u>Measure 2A</u>: 100% of Computational Applied Mathematics concentration students (2 of 2) performed above the level 2 benchmark; criteria met (2015-16).</p>	<p><u>Measure 2A</u>: TBD (2015-16).</p>	<p>TBD (2016-17)</p>

	<p><u>Measure 1B</u>: Grading rubric for MATH 4010: Analysis of mathematical concepts is internally consistent (2014-15).</p> <p><u>Criteria 1B</u>: 80% of students will perform above the level 2 (Satisfactory) benchmark (2014-15).</p> <p><u>Schedule 1B</u>: MATH 4010, a required course in this concentration, is offered each fall and spring. Data will be collected each semester, beginning in fall 2015. The undergraduate coordinator will compile data in May each year, beginning in 2016. Faculty will review data and develop improvement plans (as needed) during spring faculty meeting, starting in 2016 (2014-15).</p>	<p><u>Measure 2B</u>: 100% of Computational Applied Mathematics concentration students (2 of 2) performed above the level 2 benchmark; criteria met (2015-16).</p>	<p><u>Measure 1B</u>: TBD (2015-16).</p>	<p>TBD (2016-17)</p>
<p>SLO #3: Students model real world situations using mathematics and solve these systems employing analytical and numerical techniques. (2014-15)</p>	<p><u>Measure 1A</u>: Grading rubric for MATH 4010: Write clear and concise solutions to computational problems (2014-15).</p> <p><u>Criteria 1A</u>: 80% of students will perform above the level 2 (Satisfactory) benchmark (2014-15).</p> <p><u>Schedule 1A</u>: MATH 4010, a required course in this concentration, is offered each fall and spring. Data will be collected each semester, beginning in fall 2015. The undergraduate coordinator will compile data in May each year, beginning in 2016. Faculty will review data and develop improvement plans (as needed) during spring faculty meeting, starting in 2016 (2014-15).</p>	<p><u>Measure 3A</u>: 100% of Computational Applied Mathematics concentration students (2 of 2) performed above the level 2 benchmark; criteria met (2015-16).</p>	<p><u>Measure 3A</u>: TBD (2015-16).</p>	<p>TBD (2016-17)</p>

	<p>Measure 1B: Grading rubric for MATH 4010: Implement numerical approaches using computational software (2014-15).</p> <p>Criteria 1B: 80% of students will perform above the level 2 (Satisfactory) benchmark (2014-15).</p> <p>Schedule 1B: MATH 4010, a required course in this concentration, is offered each fall and spring. Data will be collected each semester, beginning in fall 2015. The undergraduate coordinator will compile data in May each year, beginning in 2016. Faculty will review data and develop improvement plans (as needed) during spring faculty meeting, starting in 2016 (2014-15).</p>	<p>Measure 3B: 100% of Computational Applied Mathematics concentration students (2 of 2) performed above the level 2 benchmark; criteria met (2015-16).</p>	<p>Measure 3B: TBD (2015-16).</p>	<p>TBD (2016-17)</p>
<p>EPO #1: Graduates will be able to apply mathematical knowledge to a career related to mathematics or in post-baccalaureate studies (2014-15).</p>	<p>Measure: Alumni survey items which ask students to indicate whether current position is within the field of study. (2014-15)</p>	<p>0% of alumni responded to the survey. 100% of alumni responding (2 of 2), reported employment in the field. Criteria met (2015-16).</p>	<p>Beginning 2016-17, send alumni survey reminders via social media sites in an attempt to increase response rates (2015-16).</p>	<p>Insufficient time to determine effectiveness of improvement (2015-16).</p>
	<p>Criteria: 80% of alumni responding will report employment within the field of study.</p>			<p><u>Effectiveness of Improvement</u> = (2016-17).</p>
	<p>Schedule: Alumni surveys are sent to graduates electronically one year following graduation. Data will be collected each spring, beginning in 2016, by the program advisor (2014-15).</p>			<p>(2017-18).</p>

3.3.1.1 Education Programs and Student Learning Outcomes
 College of Arts and Sciences
 Department of Mathematics and Statistics
 Mathematics, BS, Mathematical Sciences Concentration

The mission of the Department of Mathematics and Statistics is to promote the goals of the University by offering high quality educational programs in Pure and Applied mathematics, Statistics, and Mathematics Education, and have a capstone experience that serves as the culmination of the mathematics education. Specifically, undergraduates will work on research problems under the direction of mathematics faculty members.

Outcomes	Assessment	Results and Analysis	Improvement Plan(s)	Effectiveness of Improvement(s)
<p>SLO #1: Students ask questions that facilitate the solution of mathematical modeling problems and the pursuit of opportunities (2014-15).</p>	<p><u>Measure 1A</u>: Grading rubric for MATH 4010: Asks appropriate questions to expand their knowledge. (2014-15).</p> <p><u>Criteria 1A</u>: 80% of students will perform above the level 2 (Satisfactory) benchmark (2014-15).</p> <p><u>Schedule 1A</u>: MATH 4010, a required course in this concentration, is offered each fall and spring. Data will be collected each semester, beginning in fall 2015. The undergraduate coordinator will compile data in May each year, beginning in 2016. Faculty will review data and develop improvement plans (as needed) during spring faculty meeting, starting in 2016 (2014-15).</p>	<p><u>Measure 1A</u>: 35.7% of Mathematical Sciences concentration students (3 of 8) performed above the level 2 benchmark. Criteria not met (2015-16).</p>	<p><u>Measure 1A</u>: TBD (2015-16).</p>	<p>TBD (2016-17).</p>

	<p><u>Measure 1B:</u> Grading rubric for MATH 4010: Asks questions that show a mastery of mathematical modeling. (2014-15).</p> <p><u>Criteria 1B:</u> 80% of students will perform above the level 2 (Satisfactory) benchmark (2014-15).</p> <p><u>Schedule 1B:</u> MATH 4010, a required course in this concentration, is offered each fall and spring. Data will be collected each semester, beginning in fall 2015. The undergraduate coordinator will compile data in May each year, beginning in 2016. Faculty will review data and develop improvement plans (as needed) during spring faculty meeting, starting in 2016 (2014-15).</p>	<p><u>Measure 1B:</u> 35.7% of Mathematical Sciences concentration students (3 of 8) performed above the level 2 benchmark. Criteria not met (2015-16).</p>	<p><u>Measure 1B:</u> TBD (2015-16).</p>	<p>TBD (2016-17).</p>
<p>SLO #2: Students apply critical thinking skills in analyzing mathematical/statistical concepts. (2014-15)</p>	<p><u>Measure 2A:</u> Grading rubric for MATH 4010: Analysis of mathematical concepts is logical (2014-15).</p> <p><u>Criteria 2A:</u> 80% of students will perform above the level 2 (Satisfactory) benchmark (2014-15).</p> <p><u>Schedule 2A:</u> MATH 4010, a required course in this concentration, is offered each fall and spring. Data will be collected each semester, beginning in fall 2015. The undergraduate coordinator will compile data in May each year, beginning in 2016. Faculty will review data and develop improvement plans (as needed) during spring faculty meeting, starting in 2016 (2014-15).</p>	<p><u>Measure 2A:</u> 50% of Mathematical Sciences concentration students (4 of 8) performed above the level 2 benchmark. Criteria not met (2015-16).</p>	<p><u>Measure 2A:</u> TBD (2015-16).</p>	<p>TBD (2016-17)</p>

	<p><u>Measure 2B</u>: Grading rubric for MATH 4010: Analysis of mathematical concepts is internally consistent (2014-15).</p> <p><u>Criteria 2B</u>: 80% of students will perform above the level 2 (Satisfactory) benchmark (2014-15).</p> <p><u>Schedule 2B</u>: MATH 4010, a required course in this concentration, is offered each fall and spring. Data will be collected each semester, beginning in fall 2015. The undergraduate coordinator will compile data in May each year, beginning in 2016. Faculty will review data and develop improvement plans (as needed) during spring faculty meeting, starting in 2016 (2014-15).</p>	<p><u>Measure 2B</u>: 50% of Mathematical Sciences concentration students (4 of 8) performed above the level 2 benchmark. Criteria not met (2015-16).</p>	<p><u>Measure 1B</u>: TBD (2015-16).</p>	<p>TBD (2016-17)</p>
<p>SLO #3: Students demonstrate proficiency in mathematical communication. (2014-15)</p>	<p><u>Measure 3A</u>: Grading rubric for MATH 4010: Mathematical proofs are organized and sound. (2014-15).</p> <p><u>Criteria 3A</u>: 80% of students will perform above the level 2 (Satisfactory) benchmark (2014-15).</p> <p><u>Schedule 3A</u>: MATH 4010, a required course in this concentration, is offered each fall and spring. Data will be collected each semester, beginning in fall 2015. The undergraduate coordinator will compile data in May each year, beginning in 2016. Faculty will review data and develop improvement plans (as needed) during spring faculty meeting, starting in 2016 (2014-15).</p>	<p><u>Measure 3A</u>: 50% of Mathematical Sciences concentration students (4 of 8) performed above the level 2 benchmark. Criteria not met (2015-16).</p>	<p><u>Measure 3A</u>: TBD (2015-16).</p>	<p>TBD (2016-17)</p>

	<p>Measure 3B: Grading rubric for MATH 4010: Written and oral presentations are professional. (2014-15).</p> <p>Criteria 3B: 80% of students will perform above the level 2 (Satisfactory) benchmark (2014-15).</p> <p>Schedule 3B: MATH 4010, a required course in this concentration, is offered each fall and spring. Data will be collected each semester, beginning in fall 2015. The undergraduate coordinator will compile data in May each year, beginning in 2016. Faculty will review data and develop improvement plans (as needed) during spring faculty meeting, starting in 2016.</p>	<p>Measure 3B: 50% of Mathematical Sciences concentration students (4 of 8) performed above the level 2 benchmark. Criteria not met (2015-16).</p>	<p>Measure 3B: TBD (2015-16).</p>	<p>TBD (2016-17)</p>
<p>EPO #1: Graduates will be able to apply mathematical knowledge to a career related to mathematics or in post-baccalaureate studies (2014-15).</p>	<p>Measure: Alumni survey items which ask students to indicate whether current position is within the field of study. (2014-15)</p>	<p>0% of alumni responded to the survey. Y% of alumni responding (n of N), reported employment in the field. Criteria not met (2015-16).</p>	<p>Beginning 2016-17, send alumni survey reminders via social media sites in an attempt to increase response rates (2015-16).</p>	<p>Insufficient time to determine effectiveness of improvement (2015-16).</p>
	<p>Criteria: 80% of alumni responding will report employment within the field of study. (2014-15)</p>			<p><u>Effectiveness of Improvement</u> = (2016-17).</p>
	<p>Schedule: Alumni surveys are sent to graduates electronically one year following graduation. Data will be collected each spring, beginning in 2016, by the program advisor (2014-15).</p>			<p>(2017-18).</p>

3.3.1.1 Education Programs and Student Learning Outcomes
 College of Arts and Sciences
 Department of Mathematics and Statistics
 Mathematics, BS, Mathematics Education Concentration

The mission of the Department of Mathematics and Statistics is to promote the goals of the University by offering high quality educational programs in Pure and Applied mathematics, Statistics, and Mathematics Education, and have a capstone experience that serves as the culmination of the mathematics education. Specifically, undergraduates will work on research problems under the direction of mathematics faculty members.

Outcomes	Assessment	Results and Analysis	Improvement Plan(s)	Effectiveness of Improvement(s)
<p>SLO #1: Students ask questions that facilitate the solution of mathematical modeling problems and the pursuit of opportunities (2014-15).</p>	<p><u>Measure 1A</u>: Grading rubric for MATH 4010: Asks appropriate questions to expand their knowledge. (2014-15).</p> <p><u>Criteria 1A</u>: 80% of students will perform above the level 2 (Satisfactory) benchmark (2014-15).</p> <p><u>Schedule 1A</u>: MATH 4010, a required course in this concentration, is offered each fall and spring. Data will be collected each semester, beginning in fall 2015. The undergraduate coordinator will compile data in May each year, beginning in 2016. Faculty will review data and develop improvement plans (as needed) during spring faculty meeting, starting in 2016 (2014-15).</p>	<p><u>Measure 1A</u>: 25% of Mathematics Education concentration students (1 of 4) performed above the level 2 benchmark. Criteria not met (2015-16).</p>	<p><u>Measure 1A</u>: TBD (2015-16).</p>	<p>TBD (2016-17).</p>

	<p><u>Measure 1B</u>: Grading rubric for MATH 4010: Asks questions that show a mastery of mathematical modeling. (2014-15).</p> <p><u>Criteria 1B</u>: 80% of students will perform above the level 2 (Satisfactory) benchmark (2014-15).</p> <p><u>Schedule 1B</u>: MATH 4010, a required course in this concentration, is offered each fall and spring. Data will be collected each semester, beginning in fall 2015. The undergraduate coordinator will compile data in May each year, beginning in 2016. Faculty will review data and develop improvement plans (as needed) during spring faculty meeting, starting in 2016 (2014-15).</p>	<p><u>Measure 1B</u>: 25% of Mathematics Education concentration students (1 of 4) performed above the level 2 benchmark. Criteria not met (2015-16).</p>	<p><u>Measure 1B</u>: TBD (2015-16).</p>	<p>TBD (2016-17).</p>
<p>SLO #2: Students apply critical thinking skills in analyzing mathematical/statistical concepts. (2014-15)</p>	<p><u>Measure 1A</u>: Grading rubric for MATH 4010: Analysis of mathematical concepts is logical (2014-15).</p> <p><u>Criteria 1A</u>: 80% of students will perform above the level 2 (Satisfactory) benchmark (2014-15).</p> <p><u>Schedule 1A</u>: MATH 4010, a required course in this concentration, is offered each fall and spring. Data will be collected each semester, beginning in fall 2015. The undergraduate coordinator will compile data in May each year, beginning in 2016. Faculty will review data and develop improvement plans (as needed) during spring faculty meeting, starting in 2016 (2014-15).</p>	<p><u>Measure 2A</u>: 25% of Mathematics Education concentration students (1 of 4) performed above the level 2 benchmark. Criteria not met (2015-16).</p>	<p><u>Measure 2A</u>: TBD (2015-16).</p>	<p>TBD (2016-17)</p>

	<p><u>Measure 1B</u>: Grading rubric for MATH 4010: Analysis of mathematical concepts is internally consistent (2014-15).</p> <p><u>Criteria 1B</u>: 80% of students will perform above the level 2 (Satisfactory) benchmark (2014-15).</p> <p><u>Schedule 1B</u>: MATH 4010, a required course in this concentration, is offered each fall and spring. Data will be collected each semester, beginning in fall 2015. The undergraduate coordinator will compile data in May each year, beginning in 2016. Faculty will review data and develop improvement plans (as needed) during spring faculty meeting, starting in 2016 (2014-15).</p>	<p><u>Measure 2B</u>: 25% of Mathematics Education concentration students (1 of 4) performed above the level 2 benchmark. Criteria not met (2015-16).</p>	<p><u>Measure 1B</u>: TBD (2015-16).</p>	<p>TBD (2016-17)</p>
<p>SLO #3: Students use print and electronic materials to produce resources related to mathematics teaching or evaluate and synthesize existing mathematics education research on a chosen topic (2014-15)</p>	<p><u>Measure 1A</u>: Grading rubric for MATH 4010: Effectively incorporates appropriate sources. (2014-15).</p> <p><u>Criteria 1A</u>: 80% of students will perform above the level 2 (Satisfactory) benchmark (2014-15).</p> <p><u>Schedule 1A</u>: MATH 4010, a required course in this concentration, is offered each fall and spring. Data will be collected each semester, beginning in fall 2015. The undergraduate coordinator will compile data in May each year, beginning in 2016. Faculty will review data and develop improvement plans (as needed) during spring faculty meeting, starting in 2016 (2014-15).</p>	<p><u>Measure 3A</u>: 0% of Mathematics Education concentration students (0 of 4) performed above the level 2 benchmark. Criteria not met (2015-16).</p>	<p><u>Measure 3A</u>: TBD (2015-16).</p>	<p>TBD (2016-17)</p>

	<p>Measure 1B: Grading rubric for MATH 4010: Provides details that are necessary, relevant, and appropriate (2014-15).</p> <p>Criteria 1B: 80% of students will perform above the level 2 (Satisfactory) benchmark (2014-15).</p> <p>Schedule 1B: MATH 4010, a required course in this concentration, is offered each fall and spring. Data will be collected each semester, beginning in fall 2015. The undergraduate coordinator will compile data in May each year, beginning in 2016. Faculty will review data and develop improvement plans (as needed) during spring faculty meeting, starting in 2016.</p>	<p>Measure 3B: 25% of Mathematics Education concentration students (1 of 4) performed above the level 2 benchmark. Criteria not met (2015-16).</p>	<p>Measure 3B: TBD (2015-16).</p>	<p>TBD (2016-17)</p>
<p>EPO #1: Graduates will be able to apply mathematical knowledge to a career related to mathematics or in post-baccalaureate studies (2014-15).</p>	<p>Measure: Alumni survey items which ask students to indicate whether current position is within the field of study. (2014-15)</p>	<p>0% of alumni responded to the survey. Y% of alumni responding (n of N), reported employment in the field. Criteria not met (2015-16).</p>	<p>Beginning 2016-17, send alumni survey reminders via social media sites in an attempt to increase response rates (2015-16).</p>	<p>Insufficient time to determine effectiveness of improvement (2015-16).</p>
	<p>Criteria: 80% of alumni responding will report employment within the field of study. (2014-15)</p>			<p><u>Effectiveness of Improvement</u> = (2016-17).</p>
	<p>Schedule: Alumni surveys are sent to graduates electronically one year following graduation. Data will be collected each spring, beginning in 2016, by the program advisor (2014-15).</p>			<p>(2017-18).</p>

3.3.1.1 Education Programs and Student Learning Outcomes
 College of Arts and Sciences
 Department of Mathematics and Statistics
 Mathematics, BS, Statistics Concentration

The mission of the Department of Mathematics and Statistics is to promote the goals of the University by offering high quality educational programs in Pure and Applied mathematics, Statistics, and Mathematics Education, and have a capstone experience that serves as the culmination of the mathematics education. Specifically, undergraduates will work on research problems under the direction of mathematics faculty members.

Outcomes	Assessment	Results and Analysis	Improvement Plan(s)	Effectiveness of Improvement(s)
<p>SLO #1: Students ask questions that facilitate the solution of mathematical modeling problems and the pursuit of opportunities (2014-15).</p>	<p><u>Measure 1A</u>: Grading rubric for MATH 4010: Asks appropriate questions to expand their knowledge. (2014-15).</p> <p><u>Criteria 1A</u>: 80% of students will perform above the level 2 (Satisfactory) benchmark (2014-15).</p> <p><u>Schedule 1A</u>: MATH 4010, a required course in this concentration, is offered each fall and spring. Data will be collected each semester, beginning in fall 2015. The undergraduate coordinator will compile data in May each year, beginning in 2016. Faculty will review data and develop improvement plans (as needed) during spring faculty meeting, starting in 2016 (2014-15).</p>	<p><u>Measure 1A</u>: 60% of Statistics concentration students (3 of 5) performed above the level 2 benchmark. Criteria not met (2015-16).</p>	<p><u>Measure 1A</u>: TBD (2015-16).</p>	<p>TBD (2016-17).</p>

	<p><u>Measure 1B</u>: Grading rubric for MATH 4010: Asks questions that show a mastery of mathematical modeling. (2014-15).</p> <p><u>Criteria 1B</u>: 80% of students will perform above the level 2 (Satisfactory) benchmark (2014-15).</p> <p><u>Schedule 1B</u>: MATH 4010, a required course in this concentration, is offered each fall and spring. Data will be collected each semester, beginning in fall 2015. The undergraduate coordinator will compile data in May each year, beginning in 2016. Faculty will review data and develop improvement plans (as needed) during spring faculty meeting, starting in 2016 (2014-15).</p>	<p><u>Measure 1B</u>: 20% of Statistics concentration students (1 of 5) performed above the level 2 benchmark. Criteria not met (2015-16).</p>	<p><u>Measure 1B</u>: TBD (2015-16).</p>	<p>TBD (2016-17).</p>
<p>SLO #2: Students apply critical thinking skills in analyzing mathematical/statistical concepts. (2014-15)</p>	<p><u>Measure 1A</u>: Grading rubric for MATH 4010: Analysis of mathematical concepts is logical (2014-15).</p> <p><u>Criteria 1A</u>: 80% of students will perform above the level 2 (Satisfactory) benchmark (2014-15).</p> <p><u>Schedule 1A</u>: MATH 4010, a required course in this concentration, is offered each fall and spring. Data will be collected each semester, beginning in fall 2015. The undergraduate coordinator will compile data in May each year, beginning in 2016. Faculty will review data and develop improvement plans (as needed) during spring faculty meeting, starting in 2016 (2014-15).</p>	<p><u>Measure 2A</u>: 40% of Statistics concentration students (2 of 5) performed above the level 2 benchmark. Criteria not met (2015-16).</p>	<p><u>Measure 2A</u>: TBD (2015-16).</p>	<p>TBD (2016-17)</p>

	<p><u>Measure 1B</u>: Grading rubric for MATH 4010: Analysis of mathematical concepts is internally consistent (2014-15).</p> <p><u>Criteria 1B</u>: 80% of students will perform above the level 2 (Satisfactory) benchmark (2014-15).</p> <p><u>Schedule 1B</u>: MATH 4010, a required course in this concentration, is offered each fall and spring. Data will be collected each semester, beginning in fall 2015. The undergraduate coordinator will compile data in May each year, beginning in 2016. Faculty will review data and develop improvement plans (as needed) during spring faculty meeting, starting in 2016 (2014-15).</p>	<p><u>Measure 2B</u>: 40% of Statistics concentration students (2 of 5) performed above the level 2 benchmark. Criteria not met (2015-16).</p>	<p><u>Measure 1B</u>: TBD (2015-16).</p>	<p>TBD (2016-17)</p>
<p>SLO #3: Students demonstrate a working knowledge of the core concepts in probability and/or statistics. (2014-15)</p>	<p><u>Measure 1A</u>: Grading rubric for MATH 4010: Use basic mathematical skills needed for probability and statistics (2014-15).</p> <p><u>Criteria 1A</u>: 80% of students will perform above the level 2 (Satisfactory) benchmark (2014-15).</p> <p><u>Schedule 1A</u>: MATH 4010, a required course in this concentration, is offered each fall and spring. Data will be collected each semester, beginning in fall 2015. The undergraduate coordinator will compile data in May each year, beginning in 2016. Faculty will review data and develop improvement plans (as needed) during spring faculty meeting, starting in 2016 (2014-15).</p>	<p><u>Measure 3A</u>: 20% of Statistics concentration students (1 of 5) performed above the level 2 benchmark. Criteria not met (2015-16).</p>	<p><u>Measure 3A</u>: TBD (2015-16).</p>	<p>TBD (2016-17)</p>

	<p>Measure 1B: Grading rubric for MATH 4010: Draw on a strong foundation in probability/statistics reasoning and inferential methods (2014-15).</p> <p>Criteria 1B: 80% of students will perform above the level 2 (Satisfactory) benchmark (2014-15).</p> <p>Schedule 1B: MATH 4010, a required course in this concentration, is offered each fall and spring. Data will be collected each semester, beginning in fall 2015. The undergraduate coordinator will compile data in May each year, beginning in 2016. Faculty will review data and develop improvement plans (as needed) during spring faculty meeting, starting in 2016 (2014-15).</p>	<p>Measure 3B: 20% of Statistics concentration students (1 of 5) performed above the level 2 benchmark. Criteria not met (2015-16).</p>	<p>Measure 3B: TBD (2015-16).</p>	<p>TBD (2016-17)</p>
<p>EPO #1: Graduates will be able to apply mathematical knowledge to a career related to mathematics or in post-baccalaureate studies (2014-15).</p>	<p>Measure: Alumni survey items which ask students to indicate whether current position is within the field of study. (2014-15)</p>	<p>0% of alumni responded to the survey. 40% of alumni responding (2 of 5), reported employment in the field. Criteria not met (2015-16).</p>	<p>Beginning 2016-17, send alumni survey reminders via social media sites in an attempt to increase response rates (2015-16).</p>	<p>Insufficient time to determine effectiveness of improvement (2015-16).</p>
	<p>Criteria: 80% of alumni responding will report employment within the field of study. (2014-15)</p>			<p><u>Effectiveness of Improvement</u> = (2016-17).</p>
	<p>Schedule: Alumni surveys are sent to graduates electronically one year following graduation. Data will be collected each spring, beginning in 2016, by the program advisor (2014-15).</p>			<p>(2017-18).</p>

Rubric used to measure common undergraduate student learning outcomes

MATH 4010

INtopFORM Category	Exceeds Expectation	Meets Expectations	Does not meet Expectation
Questioning			
Asks appropriate questions to expand their knowledge (SLO #1A)			
Explains the motivation behind areas of investigation			
Asks questions that show a mastery of mathematical modeling (SLO #1B)			
Seeking			
Identifies appropriate sources			
Shows an understanding of which sources are relevant			
Does not ignore or neglect major sources			
Evaluating			
Analysis of mathematical concepts is logical (SLO #2A)			
Analysis of mathematical concepts is internally consistent (SLO #2B)			
Analysis of mathematical concepts is well-developed			
Identifies types of arguments used in sources			
Draws plausible conclusions from sources			
Communicating			
Writer stays on topic			
There are effective transitions between ideas			
Written and oral presentations conform to professional standards.			
Using			
Effectively incorporates appropriate sources			
Understands the main ideas in an area			
Covers the main issues relevant to a topic			
Provides details that are necessary, relevant, and appropriate			

Fairly and accurately reflects views in sources			
Recognizing			
Clearly identifies sources			
Uses an acceptable style for citing sources			

IEP Rubric

Rubric used to measure undergraduate student learning outcomes specific to the four concentrations (Mathematical Sciences, Mathematics Education, Computational Applied Mathematics, Statistics)

Mathematical Sciences

Math Communication	Exceeds Expectation	Meets Expectation	Does not meet Expectation
Mathematical proofs are well organized and logically sound.			
Written and oral presentations conform to professional standards.			

Mathematics Education

Using Resources	Exceeds Expectation	Meets Expectation	Does not meet Expectation
Effectively incorporates appropriate sources.			
Provides details that are necessary, relevant, and appropriate.			

Computational Applied Mathematics

Modeling	Exceeds Expectation	Meets Expectation	Does not meet Expectation
Write clear and concise solutions to computational problems.			
Implement numerical approaches using computational software.			

Statistics

Core concepts in probability and statistics	Exceeds Expectation	Meets Expectation	Does not meet Expectation
Use basic mathematical skills needed for probability and statistics			
Draw on a strong foundation in probability/statistical reasoning and inferential methods			

Appendix B3: IE Reports 2015-16 Graduate Programs

3.3.1.1 Education Programs and Student Learning Outcomes

College of Arts and Sciences

Department of Mathematics and Statistics

Mathematical Sciences, MS, no concentrations

The mission of the Department of Mathematics and Statistics is to promote the goals of East Tennessee State University **by offering high quality educational programs in Pure and Applied Mathematics, Statistics, and Mathematics Education**, conducting original research in Discrete Mathematics, Mathematical Modeling and Computation, and Statistics, and providing service to the university and the community. Specifically, graduate students should be able to conduct scholarly research and produce written work suitable for peer-reviewed publications.

Outcomes	Assessment	Results and Analysis	Improvement Plan(s)	Effectiveness of Improvement(s)
SLO #1: Students assemble information from various sources when conducting mathematical/statistical research (2014-15).	<p><u>Measure 1A</u>: Grading rubric for thesis is MATH 5960: <i>Identifies and cites appropriate secondary sources</i> (2014-15).</p> <p><u>Criteria 1A</u>: 80% of students will perform at or above the level 3 (Meets Expectations) benchmark (2014-15).</p> <p><u>Schedule 1A</u>: MATH 5960, a required course in the graduate curriculum, is offered each fall and spring. Data will be collected each semester, beginning in fall 2015. The graduate coordinator will compile data in May of each year, beginning in 2016. Faculty will review data and develop improvement plans (as needed) during the June faculty meeting, starting in 2016 (2014-15).</p>	100% of students (n = 10) performed at or above the level 3 benchmark. Criteria met (2015-16). Mean = 4.26	TBD (2015-16).	TBD (2016-17).

	<p><u>Measure 1B</u>: Grading rubric for thesis is MATH 5960: <i>Effectively incorporates secondary sources</i> (2014-15).</p> <p><u>Criteria 1B</u>: 80% of students will perform at or above the level 3 (Meets Expectations) benchmark (2014-15).</p> <p><u>Schedule 1B</u>: MATH 5960, a required course in the graduate curriculum, is offered each fall and spring. Data will be collected each semester, beginning in fall 2015. The graduate coordinator will compile data in May of each year, beginning in 2016. Faculty will review data and develop improvement plans (as needed) during the June faculty meeting, starting in 2016 (2014-15).</p>	<p>100% of students (n = 10) performed at or above the level 3 benchmark. Criteria met (2015-16). Mean = 4.26</p>	<p>TBD (2015-16).</p>	<p>TBD (2016-17).</p>
<p>SLO #2: Students write in a way that successfully communicates mathematical/statistical content (2014-15).</p>	<p><u>Measure 2A</u>: Grading rubric for thesis is MATH 5960: <i>Demonstrates ability to communicate complex ideas clearly, succinctly, and coherently</i> (2014-15).</p> <p><u>Criteria 2A</u>: 80% of students will perform at or above the level 3 (Meets Expectations) benchmark (2014-15).</p> <p><u>Schedule 2A</u>: MATH 5960, a required course in the graduate curriculum, is offered each fall and spring. Data will be collected each semester, beginning in fall 2015. The graduate coordinator will compile data in May of each year, beginning in 2016. Faculty will review data and develop improvement plans (as needed) during the June faculty meeting, starting in 2016 (2014-15).</p>	<p>100% of students (n = 10) performed at or above the level 3 benchmark. Criteria met (2015-16). Mean = 4.26</p>	<p>TBD (2015-16).</p>	<p>TBD (2016-17).</p>

	<p><u>Measure 2B:</u> Grading rubric for thesis is MATH 5960: <i>The text has a clear thesis</i> (2014-15).</p> <p><u>Criteria 2B:</u> 80% of students will perform at or above the level 3 (Meets Expectations) benchmark (2014-15).</p> <p><u>Schedule 2B:</u> MATH 5960, a required course in the graduate curriculum, is offered each fall and spring. Data will be collected each semester, beginning in fall 2015. The graduate coordinator will compile data in May of each year, beginning in 2016. Faculty will review data and develop improvement plans (as needed) during the June faculty meeting, starting in 2016 (2014-15).</p>	<p>Measure 2B: 100% of students (n = 10) performed at or above the level 3 benchmark. Criteria met (2015-16). Mean = 4.32</p>	<p>TBD (2015-16).</p>	<p>TBD (2016-17).</p>
	<p><u>Measure 2C:</u> Grading rubric for thesis is MATH 5960: <i>Adequately covers the main issues relevant to the topic</i> (2014-15).</p> <p><u>Criteria 2C:</u> 80% of students will perform at or above the level 3 (Meets Expectations) benchmark (2014-15).</p> <p><u>Schedule 2C:</u> MATH 5960, a required course in the graduate curriculum, is offered each fall and spring. Data will be collected each semester, beginning in fall 2015. The graduate coordinator will compile data in May of each year, beginning in 2016. Faculty will review data and develop improvement plans (as needed) during the June faculty meeting, starting in 2016 (2014-15).</p>	<p>Measure 2C: 100% of students (n = 10) performed at or above the level 3 benchmark. Criteria met (2015-16). Mean = 4.26</p>	<p>TBD (2015-16).</p>	<p>TBD (2016-17).</p>

<p>SLO #3: Students evaluate mathematical/statistical information and criticisms effectively (2014-15).</p>	<p><u>Measure 3A:</u> Grading rubric for thesis is MATH 5960: <i>The student draws plausible conclusions from the reasoning presented in the text</i> (2014-15).</p> <p><u>Criteria 3A:</u> 80% of students will perform at or above the level 3 (Meets Expectations) benchmark (2014-15).</p> <p><u>Schedule 3A:</u> MATH 5960, a required course in the graduate curriculum, is offered each fall and spring. Data will be collected each semester, beginning in fall 2015. The graduate coordinator will compile data in May of each year, beginning in 2016. Faculty will review data and develop improvement plans (as needed) during the June faculty meeting, starting in 2016 (2014-15).</p>	<p>Measure 3A: 100% of students (n = 10) performed at or above the level 3 benchmark. Criteria met (2015-16). Mean = 4.26</p>	<p>TBD (2015-16).</p>	<p>TBD (2016-17).</p>
	<p><u>Measure 3B:</u> Grading rubric for thesis is MATH 5960: <i>The line of argument anticipates and adequately responds to relevant objections</i> (2014-15).</p> <p><u>Criteria 3B:</u> 80% of students will perform at or above the level 3 (Meets Expectations) benchmark (2014-15).</p> <p><u>Schedule 3B:</u> MATH 5960, a required course in the graduate curriculum, is offered each fall and spring. Data will be collected each semester, beginning in fall 2015. The graduate coordinator will compile data in May of each year, beginning in 2016. Faculty will review data and develop improvement plans (as needed) during the June faculty meeting, starting in 2016 (2014-15).</p>	<p>Measure 3B: 100% of students (n = 10) performed at or above the level 3 benchmark. Criteria met (2015-16). Mean = 4.21</p>	<p>TBD (2015-16).</p>	<p>TBD (2016-17).</p>

<p>EPO: Graduates will be able to apply mathematical knowledge to a Ph.D. school, teaching position, or industry job (2014-15).</p>	<p><u>Measure:</u> Graduate coordinator will ask students to indicate their next position after completing the program. (2014-15).</p> <p><u>Criteria:</u> 80% of alumni responding will report next position in Ph.D. school, teaching position, or industry job 2014-15).</p> <p><u>Schedule:</u> Data will be collected each spring by the graduate coordinator (2014-15).</p>	<p>80% of students (n = 10) in Ph.D. school, teaching position, or industry job. Criteria met/not met (2015-16).</p>	<p>TBD (2015-16).</p>	<p>TBD (2016-17).</p>
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3.3.1.1 Education Programs and Student Learning Outcomes
 College of Arts and Sciences
 Department of Mathematics and Statistics
 Mathematical Sciences, MS, (Precollegiate Mathematics Concentration)

The mission of the Department of Mathematics and Statistics is to promote the goals of East Tennessee State University **by offering high quality educational programs in Pure and Applied Mathematics, Statistics, and Mathematics Education**, conducting original research in Discrete Mathematics, Mathematical Modeling and Computation, and Statistics, and providing service to the university and the community. Specifically, graduate students should be able to conduct scholarly research and produce written work suitable for peer-reviewed publications.

Outcomes	Assessment	Results and Analysis	Improvement Plan(s)	Effectiveness of Improvement(s)
SLO #1: Students assemble information from various sources when conducting mathematical/statistical research (2014-15).	<p><u>Measure 1A</u>: Grading rubric for thesis is MATH 5960: <i>Identifies and cites appropriate secondary sources</i> (2014-15).</p> <p><u>Criteria 1A</u>: 80% of students will perform at or above the level 3 (Meets Expectations) benchmark (2014-15).</p> <p><u>Schedule 1A</u>: MATH 5960, a required course in the graduate curriculum, is offered each fall and spring. Data will be collected each semester, beginning in fall 2015. The graduate coordinator will compile data in May of each year, beginning in 2016. Faculty will review data and develop improvement plans (as needed) during the June faculty meeting, starting in 2016 (2014-15).</p>	?% of students (n = 0) performed at or above the level 3 benchmark. Criteria met/not met (2015-16).	TBD (2015-16).	TBD (2016-17).
	<p><u>Measure 1B</u>: Grading rubric for thesis is MATH 5960: <i>Effectively incorporates secondary sources</i> (2014-15).</p> <p><u>Criteria 1B</u>: 80% of students will perform at or above the level 3 (Meets Expectations) benchmark (2014-15).</p>	?% of students (n = 0) performed at or above the level 3 benchmark. Criteria met/not met (2015-16).	TBD (2015-16).	TBD (2016-17).

	<p><u>Schedule 1B</u>: MATH 5960, a required course in the graduate curriculum, is offered each fall and spring. Data will be collected each semester, beginning in fall 2015. The graduate coordinator will compile data in May of each year, beginning in 2016. Faculty will review data and develop improvement plans (as needed) during the June faculty meeting, starting in 2016 (2014-15).</p>			
<p>SLO #2: Students write in a way that successfully communicates mathematical/statistical content (2014-15).</p>	<p><u>Measure 2A</u>: Grading rubric for thesis is MATH 5960: <i>Demonstrates ability to communicate complex ideas clearly, succinctly, and coherently</i> (2014-15).</p> <p><u>Criteria 2A</u>: 80% of students will perform at or above the level 3 (Meets Expectations) benchmark (2014-15).</p> <p><u>Schedule 2A</u>: MATH 5960, a required course in the graduate curriculum, is offered each fall and spring. Data will be collected each semester, beginning in fall 2015. The graduate coordinator will compile data in May of each year, beginning in 2016. Faculty will review data and develop improvement plans (as needed) during the June faculty meeting, starting in 2016 (2014-15).</p>	<p>?% of students (n = 0) performed at or above the level 3 benchmark. Criteria met/not met (2015-16).</p>	TBD (2015-16).	TBD (2016-17).
	<p><u>Measure 2B</u>: Grading rubric for thesis is MATH 5960: <i>The text has a clear thesis</i> (2014-15).</p> <p><u>Criteria 2B</u>: 80% of students will perform at or above the level 3 (Meets Expectations) benchmark (2014-15).</p> <p><u>Schedule 2B</u>: MATH 5960, a required course in the graduate curriculum, is offered each</p>	<p>Measure 2B: ?% of students (n = 0) performed at or above the level 3 benchmark. Criteria met/not met (2015-16).</p>	TBD (2015-16).	TBD (2016-17).

	<p>fall and spring. Data will be collected each semester, beginning in fall 2015. The graduate coordinator will compile data in May of each year, beginning in 2016. Faculty will review data and develop improvement plans (as needed) during the June faculty meeting, starting in 2016 (2014-15).</p>			
	<p><u>Measure 2C</u>: Grading rubric for thesis is MATH 5960: <i>Adequately covers the main issues relevant to the topic</i> (2014-15).</p> <p><u>Criteria 2C</u>: 80% of students will perform at or above the level 3 (Meets Expectations) benchmark (2014-15).</p> <p><u>Schedule 2C</u>: MATH 5960, a required course in the graduate curriculum, is offered each fall and spring. Data will be collected each semester, beginning in fall 2015. The graduate coordinator will compile data in May of each year, beginning in 2016. Faculty will review data and develop improvement plans (as needed) during the June faculty meeting, starting in 2016 (2014-15).</p>	<p>Measure 2C: ?% of students (n = 0) performed at or above the level 3 benchmark. Criteria met/not met (2015-16).</p>	<p>TBD (2015-16).</p>	<p>TBD (2016-17).</p>
<p>SLO #3: Students speak in a way that successfully communicates mathematical/statistical content (2014-15).</p>	<p><u>Measure 3A</u>: Grading rubric for thesis is MATH 5960: <i>Demonstrates ability to communicate complex ideas clearly, succinctly and coherently</i> (2014-15).</p> <p><u>Criteria 3A</u>: 80% of students will perform at or above the level 3 (Meets Expectations) benchmark (2014-15).</p> <p><u>Schedule 3A</u>: MATH 5960, a required course in the graduate curriculum, is offered each fall and spring. Data will be collected each semester, beginning in fall 2015. The</p>	<p>Measure 3A: ?% of students (n = 0) performed at or above the level 3 benchmark. Criteria met/not met (2015-16).</p>	<p>TBD (2015-16).</p>	<p>TBD (2016-17).</p>

	graduate coordinator will compile data in May of each year, beginning in 2016. Faculty will review data and develop improvement plans (as needed) during the June faculty meeting, starting in 2016 (2014-15).			
	<p>Measure 3B: Grading rubric for thesis is MATH 5960: <i>Demonstrates flexibility and creativity in responding to questions by not merely repeating what was said during presentation</i> (2014-15).</p> <p><u>Criteria 3B</u>: 80% of students will perform at or above the level 3 (Meets Expectations) benchmark (2014-15).</p> <p><u>Schedule 3B</u>: MATH 5960, a required course in the graduate curriculum, is offered each fall and spring. Data will be collected each semester, beginning in fall 2015. The graduate coordinator will compile data in May of each year, beginning in 2016. Faculty will review data and develop improvement plans (as needed) during the June faculty meeting, starting in 2016 (2014-15).</p>	Measure 3B: ?% of students (n = 0) performed at or above the level 3 benchmark. Criteria met/not met (2015-16).	TBD (2015-16).	TBD (2016-17).
EPO: Graduates will be able to apply mathematical knowledge to their teaching position. Graduates of the secondary program will have enough mathematics hours to be highly qualified as teachers of mathematics	<p><u>Measure</u>: Graduate coordinator will ask students to indicate the level of mathematics will be teaching after completing the program. (2014-15).</p> <p><u>Criteria</u>: 80% of alumni responding will report a higher level of mathematics taught in their teaching position (2014-15).</p>	? % of students (n = 0) in teaching position. Criteria met/not met (2015-16).	TBD (2015-16).	TBD (2016-17).

<p>under No Child Left Behind; graduates of the elementary program who have at least 3 undergraduate hours of mathematics prior to this degree will also be highly qualified as teachers of mathematics under No Child Left Behind. (2014-15).</p>	<p><u>Schedule</u>: Data will be collected each spring by the graduate coordinator (2014-15).</p>			
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Department of Mathematics & Statistics Rubric for Papers and Oral Presentations

Key

5 = Well exceeds expectations, 4 = Somewhat exceeds expectations, 3 = Meets expectations,
2 = Somewhat below expectations, 1 = Does not meet expectations

Mathematical/Statistical Research					
Identifies and cites appropriate primary sources	5	4	3	2	1
Effectively incorporates appropriate primary sources	5	4	3	2	1
<i>Identifies and cites appropriate secondary sources SLO #1</i>	5	4	3	2	1
<i>Effectively incorporates appropriate secondary sources SLO #1</i>	5	4	3	2	1
Mathematical/Statistical Writing					
Writing Skills					
The text is well organized	5	4	3	2	1
The writer stays on topic	5	4	3	2	1
The text is clear	5	4	3	2	1
There are effective transitions between ideas	5	4	3	2	1
The tone is appropriate for the purpose and the intended audience	5	4	3	2	1
The writing conforms to standards of Edited Standard Written English	5	4	3	2	1
Mathematical/Statistical Content					
Develops major points that support the central thesis	5	4	3	2	1
<i>Demonstrates ability to communicate complex ideas clearly, succinctly and coherently SLO #2</i>	5	4	3	2	1
<i>The text has a clear thesis SLO #2</i>	5	4	3	2	1
The text has an identifiable thesis	5	4	3	2	1
The text has a substantial thesis	5	4	3	2	1
Demonstrates an understanding of major ideas relevant to the topic	5	4	3	2	1
<i>Adequately covers the main issues relevant to the topic SLO #2</i>	5	4	3	2	1
Details are necessary, relevant and appropriate	5	4	3	2	1
The text accurately and fairly represents the views expressed in primary and secondary sources	5	4	3	2	1
Reasoning Ability					
The analysis is logical	5	4	3	2	1
The analysis is internally consistent	5	4	3	2	1
The analysis is well-developed	5	4	3	2	1
<i>The student draws plausible conclusions from the reasoning presented in the text SLO #3</i>	5	4	3	2	1
<i>The line of argument anticipates and adequately responds to relevant objections SLO #3</i>	5	4	3	2	1
Revision and Improvement					
Student improves written work in response to comments	5	4	3	2	1

Oral Skills					
Language employed is appropriate to content and audience	5	4	3	2	1
Oral expression is fluent and grammatically correct	5	4	3	2	1
The speaker orders major points that support the purpose of the presentation in a reasonable manner	5	4	3	2	1
The speaker stays on topic	5	4	3	2	1
Demonstrates ability to communicate complex ideas clearly, succinctly and coherently	5	4	3	2	1
Demonstrates an understanding of questions and an ability to give relevant responses	5	4	3	2	1
Demonstrates flexibility and creativity in responding to questions by not merely repeating what was said during presentation	5	4	3	2	1

Comments:

Overall Evaluation: Pass: _____

Fail: _____

Appendix B4: IE Reports 2015-16 Graduate Certificate Program

3.3.1.1 Education Programs and Student Learning Outcomes
 College of Arts and Sciences
 Department of Mathematics and Statistics
 Mathematical Modeling in Biosciences, Graduate Certificate

The mission of the Department of Mathematics and Statistics is to promote the goals of East Tennessee State University **by offering high quality educational programs in Pure and Applied Mathematics, Statistics, and Mathematics Education**, conducting original research in Discrete Mathematics, Mathematical Modeling and Computation, and Statistics, and providing service to the university and the community.

Outcomes	Assessment	Results and Analysis	Improvement Plan(s)	Effectiveness of Improvement(s)
SLO #1: Students will be able to effectively apply their knowledge of graph-theoretic principles and demonstrate their ability to create a graph-theoretic model for a given data set. (2014-15).	<p><u>Measure 1A</u>: Problem 2 on rubric for MATH 5870: Modeling real world problems (2014-15).</p> <p><u>Criteria 1A</u>: 80% of students will perform at or above the level 3 (Meets Expectations) benchmark (2014-15).</p> <p><u>Schedule 1A</u>: MATH 5870, is a required course for the graduate certificate, is offered online each spring. Data will be collected after the completion of the course, beginning in fall 2016. The graduate certificate coordinator will compile data in fall of each year, beginning in 2016. Graduate certificate faculty will review data and develop improvement plans (as needed), starting in 2016.</p>	100% of students (n = 2) performed at or above the level 3 benchmark. Criteria was met (2015-16).	TBD (2015-16).	TBD (2016-17).
	<p><u>Measure 1B</u>: Problem 3 on rubric for MATH 5870: Interpret the resulting graph measures and transfer back to the data set (2014-15).</p> <p><u>Criteria 1B</u>: 80% of students will perform at or above the level 3 (Meets Expectations) benchmark (2014-15).</p> <p><u>Schedule 1B</u>: MATH 5870, is a required course for the graduate certificate, is offered online during summer. Data will be collected after the completion of the course,</p>	100% of students (n = 2) performed at or above the level 3 benchmark. Criteria met (2015-16).	TBD (2015-16).	TBD (2016-17).

	beginning in fall 2016. The graduate certificate coordinator will compile data in fall of each year, beginning in 2016. Graduate certificate faculty will review data and develop improvement plans (as needed), starting in 2016.			
EPO: Graduates will be able to apply their knowledge to meet the challenge of computational bioscience and bioinformatics education with five online courses that will serve as a bridge to graduate school, employment in research and development in biotechnology, a new career, or increase their professional development (2014-15).	<p><u>Measure</u>: Graduate certificate coordinator will ask students to indicate their future plans (2014-15).</p> <p><u>Criteria</u>: 80% of alumni responding will report (2014-15).</p> <p><u>Schedule</u>: Data will be collected each spring by the certificate coordinator (2014-15).</p>	?% of students (n = 2) in position. Criteria not met (2015-16) Students haven't finished program.	TBD (2015-16).	TBD (2016-17).

Part II – Questions based on the Applications of Graphs 10 problems @ 10 points each = 100 points.

1. Graphs can be used to represent molecules where the vertices are atoms and the edges are connecting bonds. We represented a molecule known as a saturated hydrocarbon. In this setting, a carbon atom must always be of degree 4 and a hydrogen atom of degree one. Draw a graph representing a saturated hydrocarbon with 5 carbon atoms. Recall the formula for a saturated hydrocarbon will tell us how many hydrogen atoms we must have if the molecule has 5 carbon atoms. The resulting graph is a simple graph, that is there are no multiple edges.
2. On page 18 of your text is a graph of a benzene molecule, also consisting of carbon and hydrogen atoms. Again, each carbon is of degree 4 and each hydrogen vertex is of degree 1. However, with the benzene molecule, we use multiple edges to represent a double bond. The one in the text has 6 carbon atoms. Can you draw a benzene molecule with 5 carbon atoms. If so, draw one and if not explain why not.
3. Returning to RNA structure represented as graphs, go to the webpage www.biomath.nyu.edu and go to the tree database where all trees of order 7 are depicted.
 - a) Write down the degree sequence for each tree and find the sum of the degrees.
 - b) What theory of graphs would have told you what to expect the sum of the degrees to be?
 - c) There are methods for counting the number of ways to partition an integer into parts, in particular the number of ways to partition the integer 12 into 7 parts (so that the sum is 12). Could we use these counting methods to determine the number of distinct RNA molecules with 7 vertices?
4. Go to the dual graphs of order 3 and consider the 11 topologies there. Find the degree sequence of each of the 11.
5. Clearly the degree sequence cannot be used to distinguish the graphs so let's add another measure. Create a spreadsheet with the topologies in the first column and the degree sequence of each in the next 3 columns. The distance between any two vertices is the length of the shortest path and the diameter of a graph is the maximum distance considering all pairs of vertices. Find the diameter of each of the 11 topologies.
6. Still, each topology does not have its own unique set of measures, so we will find another measure to add to the set. Find the number of loops of each graph. Just to be a little more informative, find the vertex-connectivity of each graph.
7. Using the spreadsheet from problem 4, create a dendrogram for the 11 topologies.
8. Construct a 3 connected graph using Tutte's construction.
9. Construct a graph on 9 vertices that is 6 connected using Harary's construction.
10. Construct a graph on 9 vertices that is 6 connected using Harary's construction.

Appendix C: INtopFORM (QEP)

INtopFORM Rubric

MATH 4010

Student Name _____

INtopFORM Category	Exceeds Expectation	Meets Expectations	Does not meet Expectation
Questioning			
Asks appropriate questions to expand their knowledge (SLO #1A)			
Explains the motivation behind areas of investigation			
Asks questions that show a mastery of mathematical modeling (SLO #1B)			
Seeking			
Identifies appropriate sources			
Shows an understanding of which sources are relevant			
Does not ignore or neglect major sources			
Evaluating			
Analysis of mathematical concepts is logical (SLO #2A)			
Analysis of mathematical concepts is internally consistent (SLO #2B)			
Analysis of mathematical concepts is well-developed			
Identifies types of arguments used in sources			
Draws plausible conclusions from sources			
Communicating			
Writer stays on topic			
There are effective transitions between ideas			
Written and oral presentations conform to professional standards.			
Using			
Effectively incorporates appropriate sources			
Understands the main ideas in an area			
Covers the main issues relevant to a topic			
Provides details that are necessary, relevant, and appropriate			
Fairly and accurately reflects views in sources			
Recognizing			
Clearly identifies sources			
Uses an acceptable style for citing sources			



Major: Mathematics	Concentration: All
Academic Year: 2014-15	Name of Contact Person: Corlis Robe, Rick Norwood
Contact e-mail: robe@etsu.edu ; norwoodr@etsu.edu	Contact Phone: 9-5579; 9-6972

Course in which assessment occurs: MATH 4010: Undergraduate Research
 Student work evaluated: Final Research Paper
 Assessment instruments: Approved INtopFORM Rubric
 Evaluator(s): Math Faculty
 Population or sample evaluated: Population
 Baseline term, year: 2013-14, Year 2

Summary of data and targets throughout participation

Students Attaining Each INtopFORM Outcome
 2013-14 (N = 9); 2014-15 (N=9)

INtopFORM Learning Outcome	Students Attaining Rubric Rating							
	Excellent (30% Target)				Satisfactory or Better (90% Target)			
	2013-14		2014-15		2013-14		2014-15	
	n	%	n	%	n	%	n	%
Questioning	4	44%	3	33%	9	100%	9	100%
Seeking	2	22%	3	33%	9	100%	9	100%
Evaluating	6	67%	1	11%	9	100%	9	100%
Using	6	67%	3	33%	9	100%	9	100%
Communicating	5	56%	3	33%	9	100%	9	100%
Recognizing	4	44%	2	22%	9	100%	9	100%

Students Rated at least Satisfactory on All INtopFORM Outcomes (N=9)

Students scoring at least acceptable on all INtopFORM outcomes	n	%	Target Met
2013-14	9	100%	Yes
2014-15	9	100%	Yes

CCTST Score Results (N=21)

CCTST Score	Related ITF OUTCOME	Strong (30% Target)				Moderate (90% Target)			
		2013-14		2014-15		2013-14		2014-15	
		n	%	n	%	n	%	n	%
Total Score		10	50%	17	74%	16	80%	20	87%
Analysis	EVALUATING	11	55%	13	57%	16	80%	21	90%
Evaluation	EVALUATING	3	15%	2	9%	17	85%	17	74%
Inference	USING	5	25%	13	57%	19	95%	22	96%



CCTST Total Scores						
	N	Mean	SD	Median	Q1	Q3
ETSU	1568	17.22	4.88	14	17	21
College of Arts & Sciences	569	17.84	5.08	14	17	22
Mathematics Majors	21	21.9	5.07	20	23	25
CCTST Analysis Scores (map to EVALUATING outcome)						
	N	Mean	SD	Median	Q1	Q3
ETSU	1568	3.81	1.44	3	4	5
College of Arts & Sciences	569	3.9	1.45	3	4	5
Mathematics Majors	21	4.81	1.44	3	6	6
CCTST Evaluation Scores (map to EVALUATING outcome)						
	N	Mean	SD	Median	Q1	Q3
ETSU	1568	4.33	1.96	3	4	6
College of Arts & Sciences	569	4.68	2.02	3	5	6
Mathematics Majors	21	5.29	2.17	4	5	7
CCTST Inference Scores (map to USING outcome)						
	N	Mean	SD	Median	Q1	Q3
ETSU	1568	9.07	2.62	7	9	11
College of Arts & Sciences	569	9.27	2.73	7	9	11
Mathematics Majors	21	11.81	2.5	11	12	14

Mean CCTST Scores		
	2013-14	2014-15
Total	19.1	21.9
Analysis (EVALUATING)	4.5	4.81
Evaluation (EVALUATING)	5.0	5.29
Inference (USING)	9.6	11.81

Interpretation of CCTST Total Score:			
<ul style="list-style-type: none"> • 8-12 (Weak); • 13-18 (Moderate); • 19-23 (Strong); • ≥24 (Superior). <p>The 2014 national mean for the CCTST was 17.1 for 4-year college and university level test takers.</p>			
Critical Thinking Area	Score Interpretation		
	Weak	Moderate	Strong
Analysis	0-2	3-4	5 or more
Inference	0-5	6-11	12 or more
Evaluation	0-3	4-7	8 or more

Data interpretation

Based on the performance criteria set by the university, the program of study should consider making improvements in the following areas:

- Evaluating
- Recognizing

[The program may add further data interpretations here]

Action on previous improvement plans and comments on their success

In AY 2013-14 the department of Mathematics planned the following program improvements to enhance learning of selected INtopFORM outcomes.

Department of Mathematics Planned Improvements to Support INtopFORM Outcomes

INtopFORM Outcome	Improvement		
	Course	Strategy	Date
Seeking	Math 2090 Mathematical Computing	Data has always been a primary motivation for scientific questions, and over 98% of the all the data that has ever existed has been generated in the last three years. Coding is essential to working with all that data, so it is no surprise that coding and computing are shaping the questions scientists and mathematicians are now asking. Moreover, computing is more than utilitarian number crunching, but rather as the rap musician will.i.am asserts, coding is the unleashing of creativity and is as important in today's world as is the ability to read and write. We plan to expand on what we are already doing in this area.	2015
Seeking	Math 3040 History of Mathematics	One major weakness in many of our students is difficulty in telling good sources from bad. In the papers assigned in History of Mathematics, students are required to cite sources. We plan to stress methods of evaluating those sources, especially sources on the internet.	2015

During a meeting with the directors of the QEP and Assessment, the department of PROGRAM decided to implement the following improvements:

INtopFORM Outcome	Improvement		
	Course	Strategy	Date
TBD	TBD	TBD	TBD
TBD	TBD	TBD	TBD
TBD	TBD	TBD	TBD
TBD	TBD	TBD	TBD

Evaluating effectiveness of improvements

Topic	Finding																											
Learning outcome:	SEEKING																											
Data supporting need for improvement:	<table border="1"> <thead> <tr> <th colspan="7">Rubric Results 2013-14</th> </tr> <tr> <th rowspan="2">ITF LO</th> <th colspan="3">Excellent (30% Target)</th> <th colspan="3">Satisfactory or Better (90% Target)</th> </tr> <tr> <th>n</th> <th>%</th> <th>Target Met?</th> <th>n</th> <th>%</th> <th>Target Met</th> </tr> </thead> <tbody> <tr> <td>Seeking</td> <td>2</td> <td>22%</td> <td>No</td> <td>9</td> <td>100%</td> <td>Yes</td> </tr> </tbody> </table>	Rubric Results 2013-14							ITF LO	Excellent (30% Target)			Satisfactory or Better (90% Target)			n	%	Target Met?	n	%	Target Met	Seeking	2	22%	No	9	100%	Yes
Rubric Results 2013-14																												
ITF LO	Excellent (30% Target)			Satisfactory or Better (90% Target)																								
	n	%	Target Met?	n	%	Target Met																						
Seeking	2	22%	No	9	100%	Yes																						
Course where improvement occurs:	MATH 2090: Mathematical Computing																											
Improvement strategy:	Data has always been a primary motivation for scientific questions, and over 98% of the all the data that has ever existed has been generated in the last three years. Coding is essential to working with all that data, so it is no surprise that coding and computing are shaping the questions scientists and mathematicians are now asking. Moreover, computing is more than utilitarian number crunching, but rather as the rap musician will.i.am asserts, coding is the unleashing of creativity and is as important in today's world as is the ability to read and write. We plan to expand on what we are already doing in this area.																											
Planned implementation date:	2015																											
Actual implementation date:																												
Post Improvement Data:	<table border="1"> <thead> <tr> <th colspan="7">Rubric Results 2014-15</th> </tr> <tr> <th rowspan="2">ITF LO</th> <th colspan="3">Excellent (30% Target)</th> <th colspan="3">Satisfactory or Better (90% Target)</th> </tr> <tr> <th>n</th> <th>%</th> <th>Target Met?</th> <th>n</th> <th>%</th> <th>Target Met</th> </tr> </thead> <tbody> <tr> <td>Seeking</td> <td>3</td> <td>33%</td> <td>Yes</td> <td>9</td> <td>100%</td> <td>Yes</td> </tr> </tbody> </table>	Rubric Results 2014-15							ITF LO	Excellent (30% Target)			Satisfactory or Better (90% Target)			n	%	Target Met?	n	%	Target Met	Seeking	3	33%	Yes	9	100%	Yes
Rubric Results 2014-15																												
ITF LO	Excellent (30% Target)			Satisfactory or Better (90% Target)																								
	n	%	Target Met?	n	%	Target Met																						
Seeking	3	33%	Yes	9	100%	Yes																						
Improvement Effectiveness (3-highly effective, 2-effective, 1-ineffective):																												
Further action planned:																												



Topic	Finding																																	
Learning outcome:	SEEKING																																	
Data supporting need for improvement:	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="7" style="text-align: left;">Rubric Results 2013-14</th> </tr> <tr> <th></th> <th colspan="3" style="text-align: center;">Excellent (30% Target)</th> <th colspan="3" style="text-align: center;">Satisfactory or Better (90% Target)</th> </tr> <tr> <th>ITF LO</th> <th>n</th> <th>%</th> <th>Target Met?</th> <th>n</th> <th>%</th> <th>Target Met</th> </tr> </thead> <tbody> <tr> <td>Seeking</td> <td style="text-align: center;">2</td> <td style="text-align: center;">22%</td> <td style="text-align: center;">No</td> <td style="text-align: center;">9</td> <td style="text-align: center;">100%</td> <td style="text-align: center;">Yes</td> </tr> </tbody> </table>						Rubric Results 2013-14								Excellent (30% Target)			Satisfactory or Better (90% Target)			ITF LO	n	%	Target Met?	n	%	Target Met	Seeking	2	22%	No	9	100%	Yes
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ITF LO	n	%	Target Met?	n	%	Target Met																												
Seeking	2	22%	No	9	100%	Yes																												
Course where improvement occurs:	MATH 3040: History of Mathematics																																	
Improvement strategy:	One major weakness in many of our students is difficulty in telling good sources from bad. In the papers assigned in History of Mathematics, students are required to cite sources. We plan to stress methods of evaluating those sources, especially sources on the internet.																																	
Planned implementation date:	2015																																	
Actual implementation date:																																		
Post Improvement Data:	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="7" style="text-align: left;">Rubric Results 2014-15</th> </tr> <tr> <th></th> <th colspan="3" style="text-align: center;">Excellent (30% Target)</th> <th colspan="3" style="text-align: center;">Satisfactory or Better (90% Target)</th> </tr> <tr> <th>ITF LO</th> <th>n</th> <th>%</th> <th>Target Met?</th> <th>n</th> <th>%</th> <th>Target Met</th> </tr> </thead> <tbody> <tr> <td>Seeking</td> <td style="text-align: center;">3</td> <td style="text-align: center;">33%</td> <td style="text-align: center;">Yes</td> <td style="text-align: center;">9</td> <td style="text-align: center;">100%</td> <td style="text-align: center;">Yes</td> </tr> </tbody> </table>						Rubric Results 2014-15								Excellent (30% Target)			Satisfactory or Better (90% Target)			ITF LO	n	%	Target Met?	n	%	Target Met	Seeking	3	33%	Yes	9	100%	Yes
Rubric Results 2014-15																																		
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ITF LO	n	%	Target Met?	n	%	Target Met																												
Seeking	3	33%	Yes	9	100%	Yes																												
Improvement Effectiveness (3-highly effective, 2-effective, 1-ineffective):																																		
Further action planned:																																		

Appendix: Raw rubric data throughout participation

Mathematics INtopFORM Evaluation Rubric



INtopFORM Outcome/Program Specific Criteria	Excellent		Satisfactory		Unsatisfactory		Mean Score	
	YR1	YR2	YR1	YR2	YR1	YR2	YR1	YR2
Questioning								
Asks appropriate questions to expand their knowledge	6 67%	4 44%	3 33%	5 56%	0 0%	0 0%	2.7	2.4
Explains the motivation behind areas of investigation	5 56%	2 22%	4 44%	7 78%	0 0%	0 0%	2.6	2.2
Asks questions that show a mastery of mathematical modeling	4 44%	1 11%	5 56%	8 89%	0 0%	0 0%	2.4	2.1
Overall	4 44%	3 33%	5 56%	6 67%	0 0%	0 0%	2.4	2.3
Seeking								
Identifies and cites appropriate sources	1 11%	2 22%	8 89%	7 78%	0 0%	0 0%	2.1	2.2
Does not ignore or neglect major sources	2 22%	2 22%	7 78%	7 78%	0 0%	0 0%	2.2	2.2
Shows an understanding of which sources are relevant	2 22%	2 22%	7 78%	7 78%	0 0%	0 0%	2.2	2.2
Overall	2 22%	3 33%	7 78%	6 67%	0 0%	0 0%	2.2	2.2
Evaluating								
Analysis is logical	5 56%	2 22%	4 44%	7 78%	0 0%	0 0%	2.6	2.2
Analysis is internally consistent	6 67%	1 11%	3 33%	8 89%	0 0%	0 0%	2.7	2.1
Analysis is well-developed	6 67%	1 11%	3 33%	8 89%	0 0%	0 0%	2.7	2.1
Identifies types of arguments used in sources	4 44%	2 22%	5 56%	7 78%	0 0%	0 0%	2.4	2.2
Draws plausible conclusions from sources	4 44%	1 11%	5 56%	8 89%	0 0%	0 0%	2.4	2.1
Overall	6 67%	1 11%	3 33%	8 89%	0 0%	0 0%	2.7	2.2
Using								
Effectively incorporates appropriate sources	2 22%	2 22%	7 78%	7 78%	0 0%	0 0%	2.2	2.2
Understands the main ideas in an area	6 67%	3 33%	3 33%	6 67%	0 0%	0 0%	2.7	2.3
Covers the main issues relevant to a topic	6 67%	3 33%	3 33%	6 67%	0 0%	0 0%	2.7	2.3
Provides details that are necessary, relevant, and appropriate	6 67%	2 22%	3 33%	7 78%	0 0%	0 0%	2.7	2.2
Mathematics INtopFORM Evaluation Rubric								
	Excellent		Satisfactory		Unsatisfactory		Mean Score	
Using	YR 1	YR 2	YR 1	YR 2	YR 1	YR 2	YR 1	YR 2



Fairly and accurately reflects views in sources	2 22%	2 22%	7 78%	7 78%	0 0%	0 0%	2.2	2.2
Overall	6 67%	3 33%	3 33%	6 67%	0 0%	0 0%	2.7	2.3
Communicating								
Writer stays on topic	5 56%	3 33%	4 44%	6 67%	0 0%	0 0%	2.6	2.3
There are effective transitions between ideas	6 67%	2 22%	3 33%	6 67%	0 0%	1 11%	2.7	2.1
The writing conforms to the standards of Technical Writing in the Mathematical Sciences	6 67%	3 33%	3 33%	6 67%	0 0%	0 0%	2.7	2.3
Overall	5 56%	3 33%	4 44%	6 67%	0 0%	0 0%	2.6	2.3
Recognizing								
Clearly identifies sources	2 22%	2 22%	6 67%	7 78%	0 0%	0 0%	2.3	2.2
Uses an acceptable style for citing sources	4 44%	2 22%	5 56%	5 56%	0 0%	2 22%	2.4	2.0
Overall	4 44%	2 22%	5 56%	7 78%	0 0%	0 0%	2.4	2.1

APPENDIX D: CCTST Results

		2011-12					
Thinking Skills Test		N	Mean	Std Dev	Q1	Median	Q3
Analysis	National	2677	4.4	1.4	4	5	5
	Math/Stat	8	4.8	1.4	3.5	5	6
Deduction	National	2677	7.3	2.9	5	7	9
	Math/Stat	8	10	2.8	8	11	12
Evaluation	National	2677	4.5	2.1	3	4	6
	Math/Stat	8	6.1	2.7	3.5	6.5	7.5
Induction	National	2677	9.5	2.8	8	10	11
	Math/Stat	8	11.1	3.2	10	10.5	12.5
Inference	National	2677	7.8	2.7	6	8	10
	Math/Stat	8	10.3	2.8	8.5	11.5	12
Total Score	National	2677	16.8	5.1	13	16	20
	Math/Stat	8	21.1	5.6	18.5	21	25
		2012-13					
Thinking Skills Test		N	Mean	Std Dev	Q1	Median	Q3
Analysis	National	1718	3.7	1.4	3	4	5
	Math/Stat	21	4.6	1.5	4	5	5
Deduction	National	1718	7.2	2.8	5	7	9
	Math/Stat	21	9.7	3	7	10	12
Evaluation	National	1718	4.1	1.9	3	4	5
	Math/Stat	21	5	2.3	3	5	7
Induction	National	1718	9.3	2.5	7	9	11
	Math/Stat	21	10.5	3	8	11	12
Inference	National	1718	8.7	2.6	7	9	10
	Math/Stat	21	10.6	3	8	10	13
Total Score	National	1718	16.5	4.7	13	16	20
	Math/Stat	21	20.2	5.6	17	21	25
		2013-14					
Thinking Skills Test		N	Mean	Std Dev	Q1	Median	Q3
Analysis	ETSU	2016	3.8	1.4	3	4	5
	Math/Stat	19	4.63	1.64	3.5	5	6
Deduction	ETSU	2016	7.6	3	5	7	10
	Math/Stat	19	9.74	3.23	7.5	9	13
Evaluation	ETSU	2016	4.2	1.9	3	4	5
	Math/Stat	19	5.26	1.85	4	5	6
Induction	ETSU	2016	9.4	2.6	8	9	11
	Math/Stat	19	10.21	2.2	8.5	10	11.5
Inference	ETSU	2016	9	2.7	7	9	11
	Math/Stat	19	10.05	2.63	9	10	11.5
Total Score	ETSU	2016	17	4.9	14	17	20
	Math/Stat	19	19.95	5.08	16.5	19	24.5
		2014-15					
Thinking Skills Test		N	Mean	Std Dev	Q1	Median	Q3
Analysis	ETSU	1575	3.81	1.44	3	4	5
	Math/Stat	23	4.65	1.5	3	5	6
Deduction	ETSU	1568	7.8	2.99	5	8	10
	Math/Stat	23	10.17	3.55	8	11	13
Evaluation	ETSU	1575	4.33	1.96	3	4	6
	Math/Stat	23	5.13	2.26	3	5	7
Induction	ETSU	1575	9.4	2.58	8	9	11
	Math/Stat	23	10.83	2.66	10	11	13
Inference	ETSU	1575	9.05	2.64	7	9	11
	Math/Stat	23	11.22	3.15	9	12	14
Total Score	ETSU	1575	17.2	4.89	14	17	21
	Math/Stat	23	21	5.78	17	22	25
		2015-16					
Thinking Skills Test		N	Mean	Std Dev	Q1	Median	Q3
Analysis	ETSU	1713	3.84	1.47	3	4	5
	Math/Stat	23	5.09	1.04	4	5	6
Deduction	ETSU	1713	7.7	3.09	5	7	10
	Math/Stat	23	11.74	2.05	10	12	13
Evaluation	ETSU	1713	4.23	1.9	3	4	6
	Math/Stat	23	6	1.83	5	6	7
Induction	ETSU	1713	9.5	2.5	8	9	11
	Math/Stat	23	11.65	1.97	10	12	13
Inference	ETSU	1713	9.14	2.64	7	9	11
	Math/Stat	23	12.3	1.96	11	12	14
Total Score	ETSU	1713	17.21	4.89	14	17	21
	Math/Stat	23	23.39	3.65	21	25	26

APPENDIX E: Table of Course Offerings

2013-14 Academic Year

FALL 2013				SPRING 2014			
Course	Name	Cr Hr	# Sec	Course	Name	Cr Hr	# Sec
MATH-1410	Numb Conc/Alge	3	2	MATH-1410	Numb Conc/Alge	3	1
MATH-1420	Logic/Problems/Geo	3	1	MATH-1420	Logic/Problems/Geo	3	1
MATH-1530	Prob/Stats-Noncalc	3	29	MATH-1530	Prob/Stats-Noncalc	3	26
MATH-1530 LS	Prob/Stats-Noncalc	3	17	MATH-1530 LS	Prob/Stats-Noncalc	3	12
MATH-1710	Precalc I	3	1	MATH-1710	Precalc I	3	1
MATH-1720	Precalc II	3	5	MATH-1720	Precalc II	3	4
MATH-1840	Anly Geo/Dif Calc	3	1	MATH-1840	Anly Geo/Dif Calc	3	1
MATH-1850	Integral Calc Tech	3	1	MATH-1850	Integral Calc Tech	3	1
MATH-1910	Calculus I	4	12	MATH-1910	Calculus I	4	8
MATH-1920	Calculus II	4	3	MATH-1920	Calculus II	4	4
MATH-2010	Linear Algebra	3	2	MATH-2010	Linear Algebra	3	1
MATH-2050	Prob/Stats-Calc Based	3	1	MATH-2050	Prob/Stats-Calc Based	3	1
				MATH-2090	Math Computing	3	2
MATH-2110	Calculus III	4	1	MATH-2110	Calculus III	4	1
MATH-2120	Diff Equations	3	1	MATH-2120	Diff Equations	3	1
MATH-3000	Math Reasoning	3	1	MATH-3000	Math Reasoning	3	1
MATH-3040	History of Math	3	1				
				MATH- 3050	Stat Modeling	3	1
MATH-3150	Math Modeling	3	1				
MATH-3340	App Combin & Prob Slv	3	1				
MATH-4010	Undergrad Research	3	1	MATH-4010	Undergrad Research	3	1
				MATH-4018	Honors Thesis	3	2
				MATH-4027	Intro Applied Math	3	1
MATH-4047/5047	Math Statistic I	3	1				
MATH-4127/5127	Intro To Mod Alg	3	1	MATH-4057/5057	Math Statistic II	3	1
MATH-4217/5217	Analysis I	3	1	MATH-4137/5137	Intro To Mod Alg II	3	1
				MATH-4157/5157	Intro To Mod Geo	3	1
MATH-4257/5257	Numerical Analys I	3	1				
				MATH-4227/5227	Analysis II	3	1
MATH-4287/5287	Applic of Stat	3	1				
MATH-4307/5307	Sampl/Surv Tech	3	1	MATH-4267/5267	Numerical Lin Alg	3	1
MATH-4337/5337	Complx Vars	3	1				
MATH-4417/5417	Res I: Teach Sec Math	3	1	MATH-4347/5347	Intro Graph Theory	3	1
MATH-4900	Indpnt Study	1	1				
MATH-5019	Supervised Teach	1	1	MATH-5019	Supervised Teach	1	1
				MATH-5210	Real Analysis I	3	1
MATH-5340	Graph Theory I	3	1				
MATH-5410	Modern Alg I	3	1				
				MATH-5420	Modern Alg II	3	1
				MATH-5450	Graph Theory II	3	1
MATH-5510	Complex Analys I	3	1				
				MATH-5520	Complex Analys II	3	1
MATH-5810	Operatn Resear I	3	1				
				MATH-5820	Operatn Resear II	3	1
MATH-5830	Predictive Analyt	3	1				
MATH-5900	Indpnt Study	1	1	MATH-5900	Indpnt Study	3	2
MATH-5960	Thesis	3	2	MATH-5960	Thesis	3	8
MATH-5990	Read & Research	3	1				
				STAT-2090	Stat Computing	2	1
				STAT-5730	Multivar Stat	3	1

Cr Hr: Number of credit hours per course.

Sec: Number of sections offered per course. Note that some of the courses also have an honors section.

Note that 4xx7/5xx7 are cross-listed courses and have both undergraduate and graduate students enrolled.

2014-15 Academic Year

FALL 2014				SPRING 2015			
Course	Name	Cr Hr	# Sec	Course	Name	Cr Hr	# Sec
MATH-1410	Numb Conc/Alge	3	2	MATH-1410	Numb Conc/Alge	3	1
MATH-1420	Logic/Problems/Geo	3	1	MATH-1420	Logic/Problems/Geo	3	1
MATH-1530	Prob/Stats-Noncalc	3	28	MATH-1530	Prob/Stats-Noncalc	3	26
MATH-1530 LS	Prob/Stats-Noncalc	3	17	MATH-1530 LS	Prob/Stats-Noncalc	3	12
MATH-1710	Precalc I	3	1	MATH-1710	Precalc I	3	1
MATH-1720	Precalc II	3	5	MATH-1720	Precalc II	3	4
MATH-1840	Anly Geo/Dif Calc	3	1	MATH-1840	Anly Geo/Dif Calc	3	1
MATH-1850	Integral Calc Tech	3	1	MATH-1850	Integral Calc Tech	3	1
MATH-1910	Calculus I	4	11	MATH-1910	Calculus I	4	7
MATH-1920	Calculus II	4	2	MATH-1920	Calculus II	4	4
MATH-2010	Linear Algebra	3	1	MATH-2010	Linear Algebra	3	1
MATH-2050	Prob/Stats-Calc Based	3	1	MATH-2050	Prob/Stats-Calc Based	3	1
				MATH-2090	Math Computing	3	1
MATH-2110	Calculus III	4	1	MATH-2110	Calculus III	4	1
MATH-2120	Diff Equations	3	1	MATH-2120	Diff Equations	3	1
				MATH-2390	Intro Res Quant Biology	3	1
MATH-3000	Math Reasoning	3	1	MATH-3000	Math Reasoning	3	1
				MATH-3040	History of Math	3	1
MATH-3150	Math Modeling	3	1				
				MATH-3250	Intro Stoch Modeling	3	2
MATH-3340	App Combin & Prob Slv	3	1				
MATH-4010	Undergrad Research	3	7	MATH-4010	Undergrad Research	3	7
MATH-4018	Honors Thesis	3	3	MATH-4018	Honors Thesis	3	2
				MATH-4027/5027	Intro Applied Math	3	1
MATH-4127/5127	Intro To Mod Alg	3	1				
				MATH-4137/5137	Intro To Mod Alg II	3	1
				MATH-4157/5157	Intro To Mod Geo	3	1
MATH-4217/5217	Analysis I	3	1				
				MATH-4227/5227	Analysis II	3	1
MATH-4257/5257	Numerical Anlys I	3	1				
				MATH-4267/5267	Numerical Lin Alg	3	1
				MATH-4337/5337	Complex Vars	3	1
				MATH-4347/5347	Intro Graph Theory	3	1
MATH-4357	Intro To Topology	3	1				
MATH-4417/5417	Res I: Teach Sec Math	3	1				
MATH-4900	Indpt Study	3	3	MATH-4900	Indpt Study	3	2
MATH-5019	Supervised Teach	1	1	MATH-5019	Supervised Teach	1	1
MATH-5210	Real Analysis I	3	1				
				MATH-5220	Real Analysis II	3	1
MATH-5340	Graph Theory I	3	1				
				MATH-5410	Modern Alg I	3	1
				MATH-5450	Graph Theory II	3	1
MATH-5510	Complex Anlys I	3	1				
				MATH-5520	Complex Anlys II	3	1
MATH-5610	Applied Math I	3	1				
				MATH-5620	Applied Math II	3	1
MATH-5810	Operatn Resear I	3	1				
MATH-5840	Comp Net & Systems	3	1				
				MATH-5870	Graph-theoretic Model	3	1
MATH-5890	Stochas Modeling	3	1				
MATH-5900	Indpt Study	3	4	MATH-5900	Indpt Study	3	1
MATH-5960	Thesis	3	2	MATH-5960	Thesis	3	8
STAT-2090	Stat Computing	2	1	STAT-2090	Stat Computing	2	1
				STAT-3050	Stat Modeling	3	1
STAT-4047/5047	Math Statistic I	3	1				
				STAT-4057/5057	Math Statistic II	3	1
STAT-4287/5287	Applic of Stat	3	1				
				STAT-4307/5307	Sampl/Surv Tech	3	1
STAT-4327/5327	Time Series	3	1				
STAT-5710	Stat Methods I	3	1				
				STAT-5720	Stat Methods II	3	1

Note change of rubric from MATH to STAT.

2015-16 Academic Year

FALL 2015				SPRING 2016			
Course	Name	Cr Hr	# Sec	Course	Name	Cr Hr	# Sec
MATH-1410	Numb Conc/Alge	3	2	MATH-1410	Numb Conc/Alge	3	1
MATH-1420	Logic/Problems/Geo	3	1	MATH-1420	Logic/Problems/Geo	3	1
MATH-1530	Prob/Stats-Noncalc	3	27	MATH-1530	Prob/Stats-Noncalc	3	23
MATH-1530 LS	Prob/Stats-Noncalc	3	15	MATH-1530 LS	Prob/Stats-Noncalc	3	11
MATH-1710	Precalc I	3	2	MATH-1710	Precalc I	3	2
MATH-1720	Precalc II	3	4	MATH-1720	Precalc II	3	2
MATH-1840	Anly Geo/Dif Calc	3	1	MATH-1840	Anly Geo/Dif Calc	3	1
MATH-1850	Integral Calc Tech	3	1	MATH-1850	Integral Calc Tech	3	1
MATH-1910	Calculus I	4	10	MATH-1910	Calculus I	4	6
MATH-1920	Calculus II	4	2	MATH-1920	Calculus II	4	3
MATH-2010	Linear Algebra	3	2	MATH-2010	Linear Algebra	3	2
MATH-2050	Prob/Stats-Calc Based	3	1	MATH-2050	Prob/Stats-Calc Based	3	1
				MATH-2090	Math Computing	3	1
MATH-2110	Calculus III	4	1	MATH-2110	Calculus III	4	1
MATH-2120	Diff Equations	3	1	MATH-2120	Diff Equations	3	1
				MATH-2390	Intro Res Quant Biology	3	1
MATH-3000	Math Reasoning	3	1	MATH-3000	Math Reasoning	3	1
				MATH-3040	History of Math	3	1
MATH-3150	Math Modeling	3	1				
				MATH-3250	Intro Stoch Modeling	3	1
MATH-3340	App Combin & Prob Slv	3	1				
MATH-4010	Undergrad Research	3	6	MATH-4010	Undergrad Research	3	9
MATH-4018	Honors Thesis	3	1				
				MATH-4027/5027	Intro Applied Math	3	1
MATH-4127/5127	Intro To Mod Alg	3	1				
				MATH-4137/5137	Intro To Mod Alg II	3	1
				MATH-4157/5157	Intro To Mod Geo	3	1
MATH-4217/5217	Analysis I	3	1				
				MATH-4227/5227	Analysis II	3	1
MATH-4257/5257	Numerical Analys I	3	1				
				MATH-4267/5267	Numerical Lin Alg	3	1
MATH-4337/5337	Complx Vars	3	1				
				MATH-4347/5347	Intro Graph Theory	3	1
MATH-4357	Intro To Topology	3	1				
MATH-4417/5417	Res I: Teach Sec Math	3	1				
MATH-4900	Indpt Study	3	1	MATH-4900	Indpt Study	3	2
MATH-4957/5957	Spec Topics in Math	1	1	MATH-4957/5957	Spec Topics in Math	3	2
MATH-5019	Supervised Teach	1	1	MATH-5019	Supervised Teach	1	1
				MATH-5210	Real Analysis I	3	1
MATH-5340	Graph Theory I	3	1				
MATH-5410	Modern Alg I	3	1				
				MATH-5450	Graph Theory II	3	1
MATH-5510	Complex Analys I	3	1				
MATH-5810	Operatn Resear I	3	1				
				MATH-5820	Operatn Resear II	3	1
MATH-5840	Comp Net & Systems	3	1				
				MATH-5870	Graph-theoretic Model	3	1
				MATH-5880	Infect Disease Math Model	3	1
MATH-5890	Stochas Modeling	3	1				
MATH-5900	Indpt Study	3	4	MATH-5900	Indpt Study	3	1
MATH-5960	Thesis	3	4	MATH-5960	Thesis	3	5
MATH-5990	Read & Research	3	1	MATH-5990	Read & Research	1	1
				STAT-2090	Stat Computing	2	1
				STAT-3050	Stat Modeling	3	1
STAT-4047/5047	Math Statistic I	3	1				
				STAT-4057/5057	Math Statistic II	3	1
STAT-4287/5287	Applic of Stat	3	1				
				STAT-4307/5307	Sampl/Surv Tech	3	1
STAT-4327/5327	Time Series	3	1				
				STAT-5730	MultivarStat	3	1

2016-17 Academic Year

FALL 2016				SPRING 2017			
Course	Name	Cr Hr	# Sec	Course	Name	Cr Hr	# Sec
MATH-1410	Numb Conc/Alge	3	2	MATH-1410	Numb Conc/Alge	3	1
MATH-1420	Logic/Problems/Geo	3	1	MATH-1420	Logic/Problems/Geo	3	1
MATH-1530	Prob/Stats-Noncalc	3	24	MATH-1530	Prob/Stats-Noncalc	3	23
MATH-1530 LS	Prob/Stats-Noncalc	3	14	MATH-1530 LS	Prob/Stats-Noncalc	3	11
MATH-1710	Precalc I	3	5	MATH-1710	Precalc I	3	2
MATH-1720	Precalc II	3	3	MATH-1720	Precalc II	3	2
MATH-1840	Anly Geo/Dif Calc	3	1				
				MATH-1850	Integral Calc Tech	3	1
MATH-1910	Calculus I	4	9	MATH-1910	Calculus I	4	6
MATH-1920	Calculus II	4	2	MATH-1920	Calculus II	4	3
MATH-2010	Linear Algebra	3	2	MATH-2010	Linear Algebra	3	2
MATH-2050	Prob/Stats-Calc Based	3	1	MATH-2050	Prob/Stats-Calc Based	3	1
				MATH-2090	Math Computing	3	1
MATH-2110	Calculus III	4	1	MATH-2110	Calculus III	4	1
MATH-2120	Diff Equations	3	1	MATH-2120	Diff Equations	3	1
				MATH-2390	Intro Res Quant Biology	3	1
MATH-3000	Math Reasoning	3	1	MATH-3000	Math Reasoning	3	1
				MATH-3040	History of Math	3	1
MATH-3150	Math Modeling	3	1				
				MATH-3250	Intro Stoch Modeling	3	1
MATH-3340	App Combin & Prob Slv	3	1				
MATH-4010	Undergrad Research	3	6	MATH-4010	Undergrad Research	3	9
MATH-4018	Honors Thesis	3	1				
				MATH-4027/5027	Intro Applied Math	3	1
MATH-4127/5127	Intro To Mod Alg	3	1				
				MATH-4137/5137	Intro To Mod Alg II	3	1
				MATH-4157/5157	Intro To Mod Geo	3	1
MATH-4217/5217	Analysis I	3	1				
				MATH-4227/5227	Analysis II	3	1
MATH-4257/5257	Numerical Anlys I	3	1				
				MATH-4267/5267	Numerical Lin Alg	3	1
				MATH-4347/5347	Intro Graph Theory	3	1
MATH-4357	Intro To Topology	3	1				
MATH-4417/5417	Res I: Teach Sec Math	3	1				
MATH-4900	Indpt Study	3	1	MATH-4900	Indpt Study	3	2
MATH-5019	Supervised Teach	1	1	MATH-5019	Supervised Teach	1	1
MATH-5210	Real Analysis I	3	1				
				MATH-5220	Real Analysis II	3	1
MATH-5340	Graph Theory I	3	1				
				MATH-5410	Modern Alg I	3	1
				MATH-5450	Graph Theory II	3	1
MATH-5610	Applied Math I	3	1				
MATH-5830	Predictive Analytics	3	1				
MATH-5840	Comp Net & Systems	3	1				
				MATH-5870	Graph-theoretic Model	3	1
				MATH-5880	Infect Disease Math Model	3	1
MATH-5900	Indpt Study	3	2	MATH-5900	Indpt Study	3	1
MATH-5960	Thesis	3	2	MATH-5960	Thesis	3	5
MATH-5990	Read & Research	3	3	MATH-5990	Read & Research	1	1
				STAT-2090	Stat Computing	2	1
				STAT-3050	Stat Modeling	3	1
STAT-4047/5047	Math Statistic I	3	1				
				STAT-4057/5057	Math Statistic II	3	1
STAT-4287/5287	Applic of Stat	3	1				
				STAT-4307/5307	Sampl/Surv Tech	3	1
MATH-4957/5957	Stat Machine Learning	3	1				
STAT-5710	Stat Methods I	3	1	STAT-5720	Stat Methods II	3	1

Appendix F: Diversity of Majors

Undergraduate Mathematics Majors

Term	Out-of-State	Non-Resident Alien	Minority	Male	Female	Total	Term	Out-of-State	Non-Resident Alien	Minority	Male	Female	Total	Term	Out-of-State	Non-Resident Alien	Minority	Male	Female	Total
Summer 2011	2	0	3	15	17	32	Fall 2011	10	1	12	66	49	115	Spring 2012	10	1	13	60	50	110
Summer 2012	1	0	1	12	14	26	Fall 2012	12	0	13	62	50	112	Spring 2013	11	1	11	58	43	101
Summer 2013	4	0	2	9	14	23	Fall 2013	13	3	10	64	51	115	Spring 2014	10	3	11	59	46	105
Summer 2014	2	0	2	14	12	26	Fall 2014	12	4	13	62	66	128	Spring 2015	8	4	9	53	54	107
Summer 2015	2	0	4	10	19	29	Fall 2015	7	4	10	49	69	118	Spring 2016	8	4	11	46	60	106

Source: TBR Enrollment Files

Office of Institutional Research - Oct. 2016

Graduate Mathematics Majors

Term	Out-of-State	Non-Resident Alien	Minority	Male	Female	Total	Term	Out-of-State	Non-Resident Alien	Minority	Male	Female	Total	Term	Out-of-State	Non-Resident Alien	Minority	Male	Female	Total
Summer 2011	3	0	0	6	2	8	Fall 2011	8	3	1	10	5	15	Spring 2012	9	2	2	10	5	15
Summer 2012	6	2	4	10	4	14	Fall 2012	8	7	4	15	7	22	Spring 2013	8	9	4	16	9	25
Summer 2013	2	4	2	6	5	11	Fall 2013	3	9	1	16	8	24	Spring 2014	3	10	2	17	10	27
Summer 2014	1	3	1	7	2	9	Fall 2014	5	11	2	22	5	27	Spring 2015	6	12	3	22	5	27
Summer 2015	1	5	2	11	1	12	Fall 2015	8	13	5	23	6	29	Spring 2016	7	16	4	26	5	31

Source: TBR Enrollment Files

Office of Institutional Research - Oct. 2016

Appendix G: Library Holdings and Service Report

EAST TENNESSEE STATE UNIVERSITY
SHERROD LIBRARY

INTERDEPARTMENTAL COMMUNICATION

TO: Leigh Lewis, Assistant Director of Assessment

FROM: Alison Lampley, Resource Sharing and Acquisitions Librarian

SUBJECT: Program Review: Mathematics (UG and GR)

DATE: 10/7/16

Books and eBooks

Summary of Collection and Acquisitions

Year	Number of Books and eBooks Ordered	Amount of Purchases
2015-2016	31	\$1,504.13
2014-2015	8	No data
2013-2014	162	\$4,891.23
2012-2013	No data	No data
2011-2012	105	\$6,491.68

A subject search of “mathematics” in the Sherrod Library catalog yields 2,139 books and 5,016 eBooks.

Recommendation and selection of new library material has been mainly the responsibility of the faculty in a particular program. Each department assigns a library coordinator who oversees, assists, and implements book recommendations for library purchase. Selection resources are available at the Sherrod Library’s acquisitions website (<http://libguides.etsu.edu/acquisitions>).

Recommending library materials is easier than ever before with a new ILLiad form called “Suggest a Purchase.” Faculty can simply log into their ILLiad accounts, click the form “Suggest a Purchase,” then submit and track their request from their ILLiad account. We highly encourage all faculty, staff, and students to request materials to help enhance our print collection.

Information Commons

In the area of mathematics, the information commons collection includes approximately 17 books in print. Please note that many of the print materials in the old Reference Collection were moved to the general circulating collection in 2014. All books in print and electronic format are accessible through the library’s online catalog. Bibliographic and other pertinent databases are linked from the library webpage, using the link under *Research > Databases* (see Database list below). Library users may either browse the list of databases or browse by topic. Most of the databases of interest to students and faculty in the ETSU program are found under the following topic: Mathematics.

Sherrod Library's online catalog and our databases are available 24/7 through the Sherrod Library webpage: <http://sherrod.etsu.edu>. The information desk is staffed while the library is open. Students can ask for help at the information desk or they can make an appointment with a reference librarian for longer help sessions (<http://sherrod.etsu.edu/reference-appointment>). The library also maintains a toll-free telephone number. E-mail and chat reference services are available for users at remote locations. In addition, the Sherrod Library Information Commons contains both PC and Mac computer workstations and an OIT service desk. Students can borrow laptops for use in the library and receive help with computer issues at the OIT service desk.

Interlibrary Loan

Summary of Interlibrary Loan Use

Year	Undergraduate	Graduate
2015-2016	0	0
2014-2015	10	12
2013-2014	9	11
2012-2013	11	2
2011-2012	20	1

The Mathematics Department makes little use of the access we have to the collections of other libraries through Interlibrary Loan (ILL). The small number of undergraduate/graduate requests over the past five years suggests that Sherrod Library is supporting the programs well.

Sherrod Library does not charge a per-request fee and through extensive reciprocal agreements and consortial arrangements, obtains approximately 91% of all material for free. If there is a fee for a request, the library subsidizes library and copyright fees to support the work of faculty members, graduate students, and undergraduates.

Library Instruction

ETSU faculty members often request library instruction sessions that complement classroom instruction and introduce the library's resources to their students. Librarians coordinate group library sessions for students outside of class, schedule individual reference-by-appointment to work one-on-one with students, and also provide faculty with library information that they can embed within their Desire2Learn courses. Faculty and students may find additional information about library services by browsing the Sherrod Library website, <http://sherrod.etsu.edu>.

Since 2011 we have taught zero (0) library instruction sessions for the mathematics department.

Audio/Video

The bulk of our videos can be found in our online streaming databases. Films on Demand Digital Educational Video and Kanopy Streaming are the two streaming services for films.

A subject search of "math*" in the library catalog yields a result of 378 streaming video and streaming media items.

Government Documents and Law

Through its extensive collections of print and online resources, the Documents/Law/Maps Department more than adequately

supports ETSU's programs in Mathematics. Sherrod Library has been a selective U.S. depository since 1942 and a Tennessee state depository since 1978. In its role as a depository library, the department receives government publications from a wide range of state and federal agencies, including the Smithsonian Institution, the Library of Congress, and the National Endowment for the Humanities, which publish information supporting the research of students taking classes in the program.

Since the early 1990's the federal government, primarily through the Government Printing Office, has been working to reduce the number of physical items distributed and to provide electronic access to government information. Many recent documents appear electronically on the Internet as well as in print. Access to these documents is available through OneSearch, the library's online catalogs. The Government Printing Office's database, FDsys.gov, along with other search engines such as Google Books, provides electronic access beyond the scope of the library's holdings.

Individual assistance is provided by trained staff and student workers during most hours the library is open. Group instruction is also available for individual classes upon request. Assisting library users with the changing formats and holdings of government and legal resources is a primary goal of the department.

Electronic Databases

1. ACM Digital Library
2. Applied Science and Technology Full-Text
3. arXiv
4. Electrical Engineering and Computer Sciences Technical Reports
5. ENGnetBASE
6. EULER - Your Portal to Mathematics Publications
7. Illustrata Natural Sciences
8. IOPScience Extra
9. MathSciNet
10. OmniFile Full Text Mega
11. Oxford Reference Online
12. Project Muse
13. Science Database
14. ScienceDirect
15. Science Journals
16. Ulrichsweb
17. University of Michigan Historical Mathematics Collection
18. Web of Science
19. Wiley Online Library

Journals

The library provides access to 501 eJournal titles and 134 print journal titles.

Appendix H: Faculty Preparation

Tenure/Tenure-Track Faculty 2016

Name	Degr	Specialization	Status	Rank	Graduate Stat
Beeler, Robert	PhI	Discrete Mathematics	Tenured	Associate	Yes
Cintron-Arias, Ariel	PhI	Applied Mathematics	Tenured	Associate	Yes
Davidson, Robert	EdI	Develop Math	Tenured	Professor	No
Gardner, Robert	PhI	Combinatorics/Complex	Tenured	Professor	Yes
Hardin, Sherri	EdI	Develop Math	Tenured	Assistant	No
Haynes, Teresa	PhI	Graph Theory	Tenured	Professor	Yes
Hendrickson, JeanMa	PhI	Statistics	Tenure-Track	Assistant	Yes
Joyner, Michele	PhI	Computational Mathemati	Tenured	Associate	No
Keaton, Rodney	PhI	Number Theory	Tenure-Track	Assistant	Yes
Knisley, Debra	PhI	Computational Biology	Tenured	Professor	Yes
Knisley, Jeff	PhI	Computational Mathemati	Tenured	Professor	Yes
Lewis, Nicole	PhI	Statistics	Tenure-Track	Assistant	Yes
Marks, Michael	MS	Mathematics	Tenured	Instructor	No
McGill, Jamie	MS	Develop Math	Tenured	Assistant	No
Norwood, Frederick	PhI	Knot Thy/Topology	Tenured	Professor	Yes
Poole, George	PhI	Matrix Thy, K-12 Math E	Tenured	Professor	Yes
Price, Robert	PhI	Statistics	Tenured	Professor	Yes
Smith, DC	MAI	Develop Math	Tenured	Instructor	No
Stephens, Daryl	PhI	Mathematics Education	Tenured	Associate	Yes

Lecturers 2016

Hicks, John Hosler, De	MSMSI	Statistics/Statist	Lecturer	Lecturer Le	No
Robe, Corlis		Mathematic			No

Part-Time Adjunct 2016

Allen, Jacob	MS	Mathematics	Part-Time	No
Brown, Floyd	MEd	Mathematics	Part-Time	No
Buck, Travis	MS	Mathematics	Part-Time	No
Fuller, Randetta	MS	Mathematics	Part-Time	No
Garrett, Michael	MS	Technology	Part-Time	No

Full-Time Faculty for the period 2009-2016

Godbole, Anant	PhD	Probability	Director CEMSE 201	Professor
Helfgott, Michel	EdD	Mathematics Education	Retired 2016	Associate
Liu, Yali	PhD	Statistics	Resigned 2015	Associate
Nigussie, Yared	PhD	Graph Theory	Denied tenure 2012	Assistant
Seier, Edith	PhD	Statistics	Retired 2016	Professor

Appendix I: Faculty Diversity

	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
#Faculty	22	24	23	24	23	22	22
# Females	8	10	10	10	10	9	9
#Males	14	14	13	14	13	13	13
#Minorities	6	6	6	6	5	4	2

Appendix J: Faculty Activities Report and Evaluation

EAST TENNESSEE STATE UNIVERSITY FACULTY ACTIVITIES REPORT – ASSISTANT AND ASSOCIATE PROFESSORS

Faculty Member _____ Department _____
School/College Arts and Sciences Report Period August 15, 2015 to August 14, 2016

This Faculty Activities should describe your activities from August 15, 2015 to August 14, 2016 only. It identifies the variety and distribution of professional activities that you have pursued and upon which your performance should be evaluated. This document provides a foundation for reporting your achievements in your future promotion and/or tenure dossier. **Please submit this report electronically to your department chair no later than September 30, 2016.**

Please attach copies of the following:

1. **Your most recent workload document.**
2. **Peer reviews of your teaching conducted during the reporting period.**
3. **A current CV.**

DIRECTIONS:

For the purpose of this document, the faculty role is divided into the three major categories of teaching, research, and service; a fourth category “Other Activities” is provided for activities that do not fit logically into the three major categories. Please respond to each of these categories by listing specific activities you have undertaken.

A. TEACHING ACTIVITIES

Please complete the table below for Fall 2015 and Spring 2016. Include any summer 2016 teaching that was part of your regular position (12-month appointment). DO NOT include summer teaching for which you received additional compensation.

Semester	Course No.	Course Title	Credit hours	Enrollment

Total SCH taught during 2015-16 (course credit hours x enrollment for each course): _____

In addition, you may wish to comment briefly on the following teaching-related activities: development of new courses, instructional methods, or student evaluation methods; contracts or grants related to teaching and instruction; continuing education courses; or thesis/dissertation supervision.

B. RESEARCH OR CREATIVE ACTIVITIES

For the reporting period, please provide a list of publications, performances, exhibits or presentations, grants awarded, grant proposals submitted, and any other completed research, scholarly or creative activities, and a brief statement of their significance.

For ongoing projects, please provide a brief but informative description of their status, with anticipated completion dates.

Publications (include full citation, or status if in preparation, in review; indicate undergraduate and/or graduate co-authors)

Peer-reviewed journal articles:

Books/Book chapters:

Other:

Exhibits, performances or presentations (with dates and venues; indicate undergraduate and/or graduate co-authors)

Grants (include title, funding agency or sponsor, dates and dollar amount requested and/or awarded; indicate undergraduate and/or graduate PI, co-PI or participants):

Pre-proposals

submitted: Full

proposals submitted:

Grants awarded:

Ongoing research, scholarship or creative work

C. SERVICE ACTIVITIES

Please describe the service activities in which you have participated, and your role, during the reporting period in relation to service to the community, your profession, or the university (including department and college level activities).

Advising (describe activities and number of students advised)

Participation in peer review (publications and grant proposals - include numbers, book publisher or journal title, and funding agency or sponsor)

On-campus service (please list- department, college, university)

Off-campus service (please list)

D. OTHER ACTIVITIES

F. ACTIVITIES SUMMARY

Please estimate (to the nearest 5 or 10%) the proportion of your time that you actually devoted to teaching, research, and service activities during the report period.

TEACHING _____%; RESEARCH _____%; SERVICE _____%;

ADMINISTRATION _____% (for those with administrative responsibilities)

CHAIR'S EVALUATION:

Department Chair Date

I agree/disagree (circle one) with this evaluation. _____
Faculty Member Date

If you disagree with the above evaluation, please explain the points of disagreement on a separate page.

DEAN'S EVALUATION:

Dean Date

EAST TENNESSEE STATE UNIVERSITY
 FACULTY ACTIVITIES REPORT – FULL PROFESSOR

Faculty Member _____ Department _____
 School/College Arts and Sciences Report Period August 15, 2015 to August 14, 2016

This abbreviated Faculty Activities Report is for full professors only and should describe your completed activities from August 15, 2015 to August 14, 2016 only. Please submit this report electronically to your department chair no later than September 30, 2016. No attachments are necessary.

DIRECTIONS:

For the purpose of this document, the faculty role is divided into the three major categories of teaching, research, and service; a fourth category “Other Activities” is provided for activities that do not fit logically into the three major categories. Please respond to each of these categories by listing specific activities you have undertaken.

A. TEACHING ACTIVITIES

Please complete the table below for Fall 2015 and Spring 2016. Include any summer 2016 teaching that was part of your regular position (12-month appointment). DO NOT include summer teaching for which you received additional compensation.

Semester	Course No.	Course Title	Credit hours	Enrollment

Total SCH taught during 2015-16 (course credit hours x enrollment for each course): _____

B. RESEARCH OR CREATIVE ACTIVITIES

For the reporting period, please provide a list of publications, performances, exhibits or presentations, grants awarded, grant proposals submitted, and any other completed research, scholarly or creative activities, and a brief statement of their significance.

Publications (include full citation, or status if in preparation, in review; indicate undergraduate and/or graduate co-authors)

Peer-reviewed journal articles:

Books/Book chapters:

Other:

Exhibits, performances or presentations (with dates and venues; indicate undergraduate and/or graduate co-authors)

Grants (include title, funding agency or sponsor, dates and dollar amount requested and/or awarded; indicate undergraduate and/or graduate PI, co-PI or participants):

Pre-proposals submitted:

Full proposals submitted:

Grants awarded:

C. SERVICE ACTIVITIES

Please describe the service activities in which you have participated, and your role, during the reporting period in relation to service to the community, your profession, or the university (including department and college level activities).

Advising (describe activities and number of students advised)

Participation in peer review (publications and grant proposals - include numbers, book publisher or journal title, and funding agency or sponsor)

On-campus service (please list- department, college, university)

Off-campus service (please list)

D. OTHER ACTIVITIES

F. ACTIVITIES SUMMARY

Please estimate (to the nearest 5 or 10%) the proportion of your time that you actually devoted to teaching, research, and service activities during the report period.

TEACHING _____%; RESEARCH _____%; SERVICE _____%;

ADMINISTRATION _____% (for those with administrative responsibilities)

CHAIR'S EVALUATION:

Department Chair Date

I agree/disagree (circle one) with this evaluation. _____
Faculty Member Date

If you disagree with the above evaluation, please explain the points of disagreement on a separate page.

DEAN'S REVIEW: Initials _____

Date _____

Appendix K: Faculty Activities Summary

Name	Year	Publications				Grant Dollars	Peer Review of			Service	
		Peer Reviewed	Other	Books	Book Chapters		Publications	Grants	Presentations	On-Campus	Off-Campus
Beeler, Robert	2010-11	3	1			9970	2		1	5	
	2011-12	4	2				1		2	4	
	2012-13	2					2		1	4	2
	2013-14	2					1		1	6	1
	2014-15	1		1			2		2	8	
	2015-16	3					2		1	7	2
Cintron-Arias, Ariel	2010-11					38,726 622,498 ^{PI} ; 39,965 13,000 125,000 ^{CoPI}	2	1		3	1
	2011-12		1				4			3	1
	2012-13	2			1						
	2013-14										
	2014-15										
	2015-16	1						3		1	3
Davidson, Robert	2010-11										
	2011-12										
	2012-13										
	2013-14										
	2014-15										
	2015-16										
Gardner, Robert	2010-11	1					2		3		
	2011-12	1					1		4		
	2012-13	1					2		1		
	2013-14	2		1			8		1		
	2014-15	1					3		2		
	2015-16	1	1				5		5		
Godbole, Anant	2010-11	4				622,498 ^{CoPI}	7	1.5	7		
	2011-12	2					7	1.5	2		
	2012-13	3					7	1.5	6		
	2013-14	5					7	1.5	3		
	2014-15	5					7	1.5	6		
	2015-16	10					7	1.5	5		
Hardin, Sherri	2010-11										
	2011-12										
	2012-13										
	2013-14										
	2014-15										
	2015-16										
Haynes, Teresa	2010-11	9					12		6	5	6
	2011-12	10			1	12,000	13	1	6	3	9
	2012-13	7					10		9	3	5
	2013-14	11					12	1	6	3	6
	2014-15	11					14	1	3	2	5
	2015-16	9			2		14		8	2	5
Helfgott, Michel	2010-11										
	2011-12										
	2012-13										
	2013-14										
	2014-15										
	2015-16										
Joyner, Michele	2010-11								2	3	1
	2011-12	1				229,000 ^{CoPI}	1		3	4	3
	2012-13	3							3	4	2
	2013-14	1							1	3	
	2014-15	2				5,000	1		2	6	
	2015-16	3				3,000			2	4	1
Knisley, Debra	2010-11	5							3	2	
	2011-12	1				11,000	2		4		5
	2012-13	2	1				2	3		1	3
	2013-14	1	2				1	1			5
	2014-15		1							1	1
	2015-16	1				125,000 ^{CoPI}			1	2	1
Knisley, Jeff	2010-11	3									3
	2011-12	2								1	2
	2012-13	4						1	1	1	3
	2013-14	2				622,498 ^{CoPI}				2	4
	2014-15	1						1		1	3
	2015-16						1	1		2	2

Name	Year	Publications			Grant	Peer Review of		Service		
		Peer Reviewed	Other	Books	Book Chapters	Dollars	Publications	Grants	Presentation	On-Campus
Lewis, Nicole	2013-14								5	
	2014-15	1						2	12	
	2015-16	1					1		9	
Liu, Yali	2010-11	3							1	3
	2011-12	2							12	
	2012-13	2					1		5	
	2013-14	3					2		4	
Marks, Michael	2010-11									1
	2011-12									
	2012-13									
	2013-14									
	2014-15									
	2015-16									
McGill, Jamie	2010-11									
	2011-12									
	2012-13									
	2013-14									
	2014-15									
	2015-16									
Nigussie, Yared	2010-11	5								
Norwood, Rick	2010-11	1							2	
	2011-12	1					1		2	
	2012-13						2		5	
	2013-14	1					3		6	2
	2014-15						1		4	
	2015-16						2		6	
Poole, George	2010-11							3		3
	2011-12		1							
	2012-13							1		4
	2013-14								1	2
	2014-15						1			
	2015-16						1			6
Price, Robert	2010-11	1								
	2011-12		1							
	2012-13	1								
	2013-14	2								
	2014-15	1								
	2015-16									
Seier, Edith	2010-11									
	2011-12	2			1	229,000 ^{CoPI}	2	1	25	
	2012-13	1						4	24	
	2013-14	2				622,498 ^{CoPI}	4	3	18	
	2014-15	2					2		4	1
	2015-16	1							20	
Smith, DC	2010-11									
	2011-12									
	2012-13									
	2013-14									
	2014-15									
	2015-16									
Stephens, Daryl	2010-11	3						1	3	4
	2011-12	2							2	2
	2012-13							4	5	3
	2013-14							5	3	3
	2014-15							5	3	4
	2015-16							1	4	3

Appendix L: Enrollment, Graduation Rates, and Class Size Report

Lower Level Courses

	1000 Level				2000 Level				3000 Level			
Year	Courses	Sections	Headcount	Average Class Size	Courses	Sections	Headcount	Average Class Size	Courses	Sections	Headcount	Average Class Size
2011-2012	9	156	4443	28.48	7	22	383	17.41	4	4	38	9.50
2012-2013	11	214	5072	23.70	7	22	357	16.23	5	5	79	15.80
2013-2014	11	171	4266	24.95	5	22	297	13.50	5	7	121	17.29
2014-2015	12	164	4177	25.47	6	18	345	19.17	5	10	121	12.10
2015-2016	13	159	3817	24.01	5	24	290	12.08	6	9	108	12.00

Upper Level Courses

	4000 Level				5000 Level				6000 Level			
Year	Courses	Sections	Headcount	Average Class Size	Courses	Sections	Headcount	Average Class Size	Courses	Sections	Headcount	Average Class Size
2011-2012	21	36	208	5.78	26	44	190	4.32	0	0	0	0
2012-2013	18	35	248	7.09	29	53	237	4.47	0	0	0	0
2013-2014	18	27	181	6.70	29	48	253	5.27	0	0	0	0
2014-2015	15	36	207	5.75	25	44	197	4.48	1	1	32	32
2015-2016	15	35	209	5.97	30	49	282	5.76	1	1	24	24

Undergraduate Retention Data

	Retained/Graduated			Retained/Graduated			Retained/Graduated			Retained/Graduated			Retained/Graduated		
	Fall 2011		Fall 2012	Fall 2012		Fall 2013	Fall 2013		Fall 2014	Fall 2014		Fall 2015	Fall 2015		Fall 2016
Level	N	N	%	N	N	%	N	N	%	N	N	%	N	N	%
ALL	115	91	79.13%	112	94	83.93%	115	97	84.35%	128	110	85.94%	118	94	79.66%
FR	21	15	71.43%	10	5	50.00%	16	13	81.25%	17	14	82.35%	23	17	73.91%
SO	22	18	81.82%	24	19	79.17%	19	15	78.95%	24	17	70.83%	20	14	70.00%
JR	31	28	90.32%	28	25	89.29%	31	28	90.32%	31	28	90.32%	23	19	82.61%
SR	41	30	73.17%	50	45	90.00%	49	41	83.67%	56	51	91.07%	52	44	84.62%

Credit Hours per Faculty

		Full Time	Part Time/Adjunct		Approximate
Year	Credit Hours	Faculty	Fall	Spring	Hours Per Faculty
2011-12	19,788	24	13	10	557
2012-13	14,831	23	8	7	486
2013-14	14,876	24	5	4	522
2014-15	15,054	23	5	5	538
2015-16	13,802	22	6	4	511

Note: Developmental Mathematics (0800 Level) existed in 2011-12.

Undergraduate Mathematics Majors

Term	Headcount	FTE	Term	Headcount	FTE	Term	Headcount	FTE	Total Degrees
Summer 2011	32	14.87	Fall 2011	115	108.40	Spring 2012	110	101.07	9
Summer 2012	26	10.33	Fall 2012	112	107.27	Spring 2013	101	93.53	23
Summer 2013	23	8.67	Fall 2013	115	104.00	Spring 2014	105	98.80	16
Summer 2014	26	10.73	Fall 2014	128	118.27	Spring 2015	107	101.87	32
Summer 2015	29	11.73	Fall 2015	118	112.53	Spring 2016	106	96.33	29

Undergraduate Mathematics and Statistics Minor

Term	Mathematics Headcount	Statistics Headcount	Term	Mathematics Headcount	Statistics Headcount	Term	Mathematics Headcount	Statistics Headcount
Summer 2011	4	0	Fall 2011	24	0	Spring 2012	26	0
Summer 2012	10	0	Fall 2012	24	1	Spring 2013	31	3
Summer 2013	4	0	Fall 2013	19	0	Spring 2014	18	2
Summer 2014	4	2	Fall 2014	17	2	Spring 2015	21	1
Summer 2015	11	1	Fall 2015	34	3	Spring 2016	32	3

Graduate Mathematics Majors

Term	Headcount	FTE	Term	Headcount	FTE	Term	Headcount	FTE	Total Degrees	Graduate Faculty
Summer 2011	8	2.50	Fall 2011	15	11.75	Spring 2012	15	11.50	7	16
Summer 2012	14	4.00	Fall 2012	22	17.17	Spring 2013	25	18.50	10	15
Summer 2013	11	4.25	Fall 2013	24	20.42	Spring 2014	27	21.25	11	16
Summer 2014	9	3.25	Fall 2014	27	22.92	Spring 2015	27	23.00	9	15
Summer 2015	12	4.08	Fall 2015	29	24.92	Spring 2016	31	25.08	10	14



EAST TENNESSEE STATE
UNIVERSITY

ETSU MATH & STAT NEWS

Department of Mathematics and Statistics
East Tennessee State University
(<http://www.etsu.edu/cas/math/>)



Message from the Chair

Greetings to all our friends and alumni from your Department of Mathematics and Statistics! We are very pleased to announce that changes have occurred this past year with both the undergraduate program and the graduate program. We now have replaced our tracks with concentrations, and have added an online graduate certificate. We think that these changes will benefit our students.

This is my fourth year as Chair of a very vibrant department that consists of 21 full-time tenured or tenure-track faculty, three full-time lecturers, and several adjunct faculty. The faculty has an excellent research record, which is

demonstrated by strong publication numbers and the ability to attract external funding. We have published, or have had accepted for publication, approximately 45 papers in peer-reviewed journals, eight other scholarly papers, three books, and two book chapters. Additionally, excellence in the classroom in the training of our undergraduate and graduate students is the norm rather than the exception. I am very proud of our faculty's dedication to teaching, research, and service.

The department's student population, both undergraduate and graduate, continues to grow, with a number of students exhibiting excellent, professional-level publication and/or presentation skills. This past year there were seven articles with graduate students as coauthors, and 16 articles with undergraduate students as coauthors. In addition, two graduate students gave presentations of their research at a conference and 10 undergraduate students presented their work.

We renovated the main office, faculty offices, and the graduate student offices a few years back. Please do stop by when you are in the neighborhood, or send me an e-mail, pricejr@etsu.edu, to arrange a visit or give a talk. I think you will love what you see. Contributions to the Department of Mathematics and Statistics Gift Fund are always welcome. These funds are used to support students and department expenses.

Go Bucs!
 – Robert M. Price, Jr.

Faculty and Staff News



Nicole Lewis joined the department last August as an assistant professor. She earned her Ph.D. in Statistics from the University of South Carolina in May 2013. Her research area is primarily in proteomics and she is continuing to work on identifying proteins through a Bayesian stochastic search. Her other areas of interest include infectious diseases, biomedical applications, statistical education, and statistical computing. This past summer she was the lead instructor in statistics for the Tennessee Governors School on Scientific Models and Data Analysis.



Anant Godbole received this year's faculty award in research. 2013-14 was a great research year for Anant. In collaboration with his REU students and colleagues, he published or had papers accepted in places like *Integers*, *Graphs and Combinatorics*, *Annals of Combinatorics*, *Electronic Journal of Combinatorics*, and *Utilitas Mathematica*. He also organized the 12th International Conference on Permutation Patterns, see www.etsu.edu/cas/math/pp2014 and served on the editorial boards of three journals. In August 2014, he began his new job as Director of the Center of Excellence in Mathematics and Science Education.



Ariel Cintron-Arias received this year's faculty award in service. During 2013-14, Ariel was the principal investigator of a project funded by the Tennessee Board of Regents with a budget of \$40,000. Seven undergraduate students participated in this initiative while engaging in research projects under the supervision of ETSU faculty members. Additionally, this grant funded visits by speakers from the University of Tennessee, North Carolina State University, and Oak Ridge Associated Universities. In every visit students had invaluable interactions with the speakers, who gave them feedback on their research projects, while also advising them in how and where to apply for summer research programs nationwide. Five of the participants successfully landed offers from competitive sum-

mer research programs where they competed with hundreds of other students from across the United States.



Michael Marks received this year's faculty award in teaching. ETSU's Office of eLearning has made the digital recordings from Mike's MATH 1530 lectures available to the general public through iTunes. Mike's philosophy is to teach critical thinking skills above and beyond an algorithm for solving a particular problem. Teaching undergraduate students to become critical thinkers is a difficult task, but Mike has found that the most effective method is through overt modeling of a four-step problem-solving strategy: understand the problem, devise a plan for solving the problem, carry out the plan, and look back at the problem, checking the answer to ensure that it makes sense. One student said, "I have unfortunately taken this class several times years ago. It has been some time since I have been in school but Mr. Marks makes all the difference in the world in this class. He seems to really want his students to do a good job in the class and most of all understand what's going on. I'm definitely doing better this time than before. I believe the main reason for that is because Mr. Marks makes the course more understandable and interesting."



John Hicks received this year's outstanding non-regular faculty member award. John graduated with his master's degree in mathematics from ETSU and joined the department last August as a lecturer. His teaching philosophy is to give students every chance to succeed, but it is up to them to take it. He is a full-time lecturer teaching five sections of Math 1530 each semester, while also being a full-time student at the University of Tennessee where he is pursuing his doctoral degree in mathematics. One student stated, "I took the winter session and it was the best thing I've ever decided to do! I am terrible at math but the statsportal we were required to download was helpful and his notes on D2L, as well. I emailed and annoyed him with questions but each time he was nice and helpful! I would recommend his class to the fullest, especially if you're not good at math!"



Robert Davidson was recognized by SGA President Doretha Benn at the Faculty Convocation on August 22, 2014. She stated he made her academic career easier by having such a positive influence on the introductory probability and statistics course. Ms. Benn added that he put a

lot of effort into the class by conducting study sessions in the evenings and working to help the students understand the material. Ms. Benn ended the recognition stating that he cared about his students and made a difference in her experience at ETSU.

Congratulations: Dr. Michele Joyner was granted tenure and promotion to associate professor. Dr. Jeff Knisely was promoted to full professor. The July 2014 issue of *Utilitas Mathematica* was dedicated to Dr. Teresa Haynes. We want to congratulate these hard-working faculty members!

Students

Undergraduate Program

Our undergraduate program in mathematics continues to attract and graduate great students. The undergraduate committee also continues to update the curriculum and procedures for the degree. Starting in August 2014, four concentrations have been added to the program. Students can now choose between mathematical education, mathematical sciences, computational applied mathematics, and statistics for a concentration. In addition, the department offers a minor in mathematics and a minor in statistics. We currently have 138 majors and 16 minors in the department. Projects for the coming year include continuing the work on how we assess our undergraduate program and on producing new pamphlets about the program and new concentrations to help in recruiting and advising.

Four students from the Department of Mathematics and Statistics have been accepted to participate in summer research programs funded through the National Science Foundation. These are competitive programs in which students compete with sometimes hundreds of other students from across the United States. Kristen Bales, a junior double major in mathematics and computer science, accepted an offer from

Rochester Institute of Technology's Research Experience for Undergraduates where her research project will use extremal graph theory to research functional connectivity of the human brain in athletes. Zach Helbert is a senior mathematics major who was admitted in a summer undergraduate research program hosted by Indiana University. His project relates to dynamical sys-

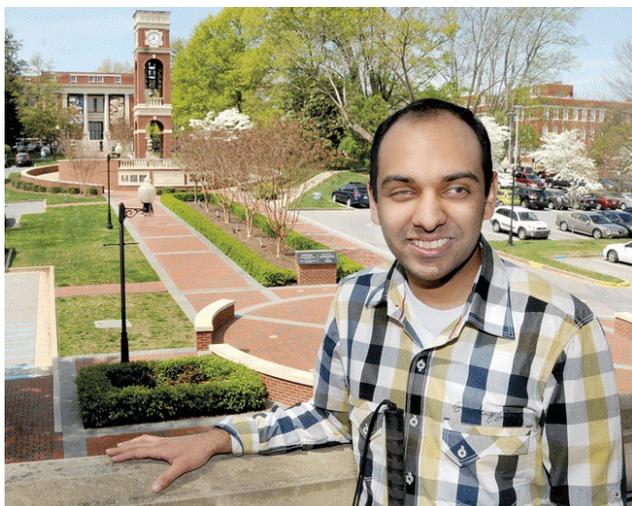
tems with an emphasis in chaotic signals with reduced noise. Jennifer Houser, a junior mathematics major, will be exploring fast-spiking interneurons in schizophrenia in the context of network dynamic models at the Mathematical Biosciences Institute of Ohio State University. Alex Quijano, a junior dual major in mathematics and computer science, accepted an offer from the Maryland

Robotic Center of the University of Maryland to join its Research Experience for Undergraduates program. His project will involve robots of size between 1mm and 100mm, with the potential to enhance capabilities in manufacturing, medicine, reconnaissance, search and rescue, etc. All four of these students are part of the Access & Diversity grant funded by TBR.



Students and Faculty at NiMBioS Conference
Front Row: Cecilia Dorado, Yesenia Cruz, Kristen Bales, Alex Quijano, Dr. Ariel Cintron-Arias;
Back Row: Dr. Michele Joyner, Jennifer Houser, Ty Frazier, Zach Helbert

2013 - 2014 Undergraduate Awards



Devanshu Agrawal excelled in the mathematics program here at ETSU. He won the outstanding student award voted on by the faculty, undergraduate mathematics award, and the Honors-in-Discipline award. He was recognized on the ETSU homepage and in the *Johnson City Press*, see www.etsu.edu/news/2014/04_apr/profileagrawalde-vanshu.aspx and www.johnsoncitypress.com/article/117143/blind-etsu-graduate-sees-world-through-use-of-math. Devanshu is now a graduate student at ETSU where he will be working on his master's degree in statistics.

2013 - 2014 Scholarship Recipients

Rex Denwil Depew: Kaylen N. Christian

Wilson-Hartsell: Caitlin E. Bradley and Jenna B. Estep

Jeffrey Lynn Hightower: Kaeli B. Gardner and Christian L. Watson

Faber-Neal: Caleb J. Ignace

Otis A. Peeler: Leanna R. Murdock, Alex J. A. Quijano, and Cassidy P. Shaffer

Edward L. Stanley: Ellen R. Byers, Hannah R. Dyer, Denise J. Harness, Christian J. Harris, and Sarah E. Luttrell

Charles F. Wilkey: Adam L. Chase, Allison D. Foster, Russell T. Harper, Zach T. Helbert, John H. Lagergren, James S. Wagner, and Rebekah D. White

Graduate Program

Our graduate students continue to contribute to our department's research success. The graduate committee continues to update the curriculum and procedures for the degree. In the spring, Dr. Nicole Lewis taught an experimental course in STAT 5730 - Applied Multivariate Statistical Analysis. Since the course was successful, efforts will be made to make this a new course that will be offered to graduate students. After a successful recruiting season, the ETSU Department of Mathematics and Statistics has another large recruiting class of 28 new master's students, both supported and unsupported, this Fall.



Graduate Students hanging out at their favorite place, EC's, with Dr. Bob



Graduate Student, Samuel Kakraba, and Dr. Stephens enjoying lunch at EC's.

2013 - 2014 Graduate Student Award



Pamela Delgado receiving her outstanding graduate student award with Dr. Noland (ETSU president) and Dr. Bach (Provost and VP for Academic Affairs at ETSU)

The outstanding graduate student award went to **Pamela Delgado**. Pamela graduated this year with her master's degree in mathematics and will be attending the doctoral program at the University of Pittsburgh where she received the K. Leroy Irvis Fellowship. While at ETSU, she worked under the direction of Dr. Teresa Haynes and has three papers submitted/accepted.

Graduates 8/2013 - 8/2014

Bachelor of Science

Devanshu Agrawal
John Blackburn
Olivia Blair
Chelsea Booher
Timothy Burgner
Tara Carmichael
James Chandler
Amanda Elks
Walter Emmitt
Christian Moore
Meghan Nash
Billy Overton
Joel Shelton
Lisa Stacy
Samantha Vermillion
Timothy Wears
Adam White

Master of Science

Benedict Adjogah
Thesis: "Are Highly Dispersed Variables More Extreme? The Case of Distributions with Compact Support"

Connie Blalock
Thesis: "Properties of Small Ordered Graphs Whose Vertices are Weighted by Their Degree"

Pamela Delgado
Thesis: "Bipartitions in Graphs"

Cheng Deng
Thesis: "Time Series Decomposition using Singular Spectrum Analysis"

Whitney Forbes
Thesis: "Physiologically-Based Pharmacokinetic Model for Ertapenem"

Jie Hao
Thesis: "Some New Probability Distributions Based on Random Extrema and Permutation Patterns"

Amanda Justus
Thesis: "Permutation Groups and Puzzle Tile Configurations of Instant Insanity II"

Ivan Ramirez
Thesis: "Mathematical Modeling of Immune Responses to Hepatitis C Virus Infection"

Tony Rodriquez
Thesis: "Very Cost Effective Domination in Graphs"

Brett Shields
Thesis: "The Number of Zeros of a Polynomial in a Disk as a Consequence of Restrictions on the Coefficients"

Chao Tang
Thesis: "Analyses of 2002-2013 China's Stock Market Using the Shared Frailty Model"

Qi Tang
Thesis: "Comparison of Different Methods for Estimating Log-normal Means"



Whitney Forbes, Brett Shields, Amanda Justus, and Tony Rodriquez at graduation



Cheng Deng, Whitney Forbes, and Amanda Justus at graduation



Benedict Adjogah and Dr. Bob Gardner at graduation

Alumni News

Jessie Deering & Will Jamieson (BS) found love while attending school at ETSU and are now married. Both are currently working on their doctoral degrees at the University of Nebraska.



Will Jamieson, Jessie Deering, and Erin Middlemas at the departmental banquet

Haiyin Li (BS and MS) went on to obtain another master's degree in financial math and is currently working on her doctoral degree in financial math from the University of North Carolina at Charlotte. This September she started a job with Bank of America (Global Risk Technologies) in Charlotte.

Jessica Hold Pack (BS), formerly known as Jessica Lundsford, is currently in graduate school at Purdue in the interdisciplinary PULSe program.

Bethany Horton (BS), formerly known as Bethany Jablonski, earned her doctoral degree in biostatistics at the University of North Carolina. She currently is an assistant professor at the University of Virginia School of Medicine.



Dr. Edith Seier, Dr. Michele Joyner, and Chelsea Ross presenting CRAWL results at a seminar in the department

Aaron Cornett (BS) is currently in graduate school working on his doctoral degree in statistics at Texas A & M.

Chelsea Ross (BS) was a double major in mathematics and biology. She is now working on her doctoral degree in mathematical biology at North Carolina State. While at ETSU, she published a paper with Dr. Michele Joyner and Dr. Edith Seier in *Spatial Statistics*.

Kristen Holmes (MS) is working in Washington, DC, using her mathematics degree. She said she now has her dream job.

Brett Shields (MS) currently teaches high school math for Middlesex County Public Schools in Virginia. While at ETSU he published a paper in the *Journal of Classical Analysis* and it is available online at: <http://files.elemath.com/articles/jca-03-15.pdf>.

Ivan Ramirez (MS) is in the doctoral program at the University of Pittsburgh and he received the Arts and Sciences Fellowship.

Tony Rodriguez (MS) is currently attending the University of Tennessee on a fellowship where he is pursuing his doctoral degree in engineering.

Whitney Forbes (MS) is currently in the Ph.D. program in industrial engineering at University of Tennessee with a research assistantship.

Amanda Justus (MS) is currently attending the University of Tennessee pursuing her doctoral degree in mathematics.

For more Alumni news, visit the department webpage.

We Want To Hear From You!!

We would like to share information about your accomplishments and activities. If you have changed jobs, received a promotion or award, earned a new degree, married, traveled, or anything new has happened to you, please let us know. Send information to Bob Price: pricejr@etsu.edu along with any updates in your mailing and e-mail addresses.

The Department is now on Facebook! Become a friend of the department today!

2013 was a great year for alumni support. Thank you so much! Contributions can be made to the departmental funds. Your tax-deductible gifts can be use-restricted in any way you specify. Contributions to this fund will continue to help young mathematicians and statisticians in the future. Contribution forms for the fund are enclosed for your convenience at the end of this newsletter.

ETSU is an AA/EEO employer.

GIFT FOR THE DEPARTMENT OF MATHEMATICS AND STATISTICS GENERAL FUND

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E-mail _____

My Total Gift Will Be: \$ _____

This gift is to be restricted for the use of the Department of Mathematics and Statistics **RETURN TO: Mathematics and Statistics; 312 Gilbreath Hall; PO Box 70663; Johnson City, TN 37614**



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My Total Gift Will Be: \$ _____

This gift is to be restricted for the use of the Math & Stats Club

RETURN TO: Mathematics and Statistics; 312 Gilbreath Hall; PO Box 70663; Johnson City, TN 37614

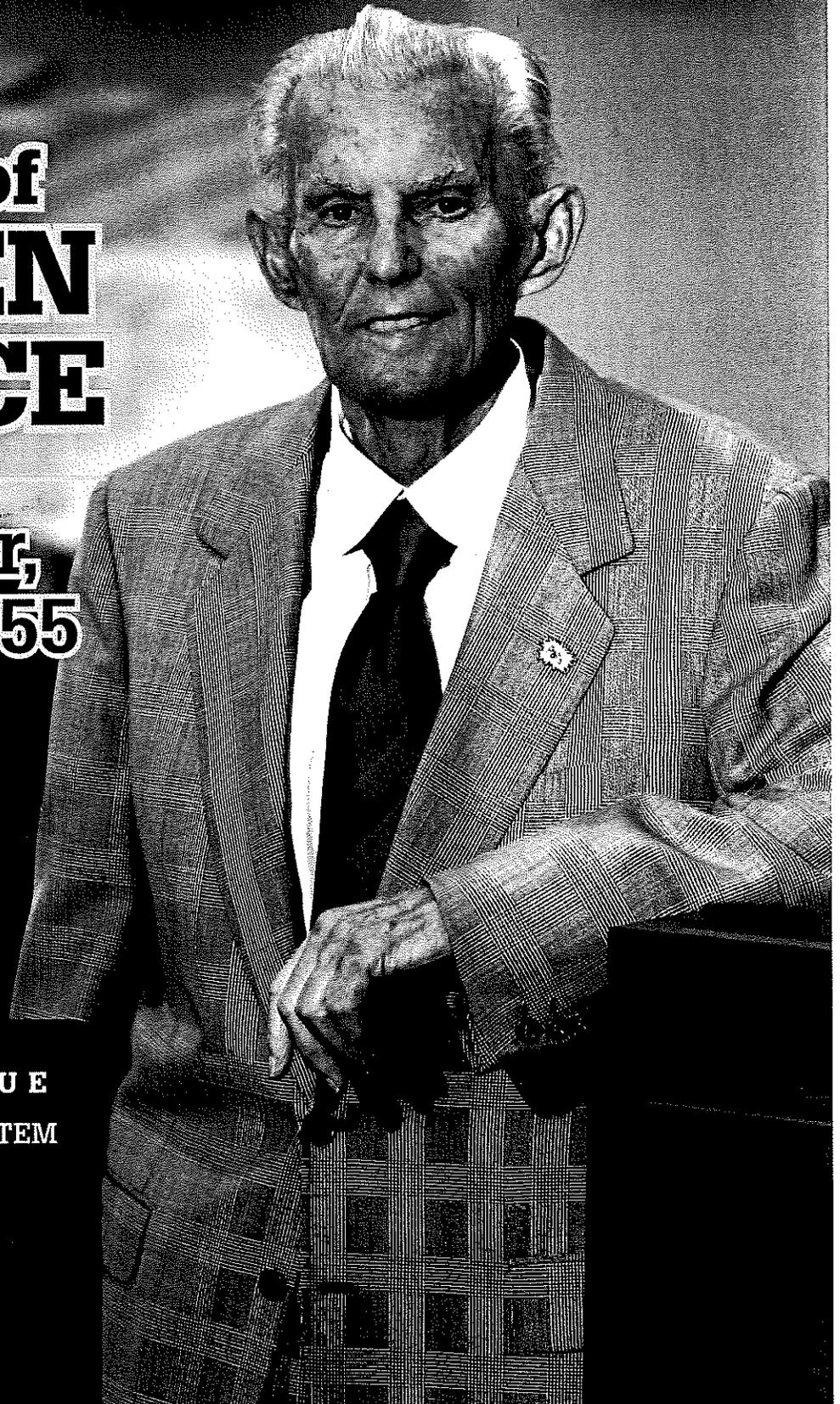
ETSU Today

The Magazine of East Tennessee State University

FALL 2016

60 Years of **SUDDEN SERVICE**

**Pal Barger,
Class of 1955**

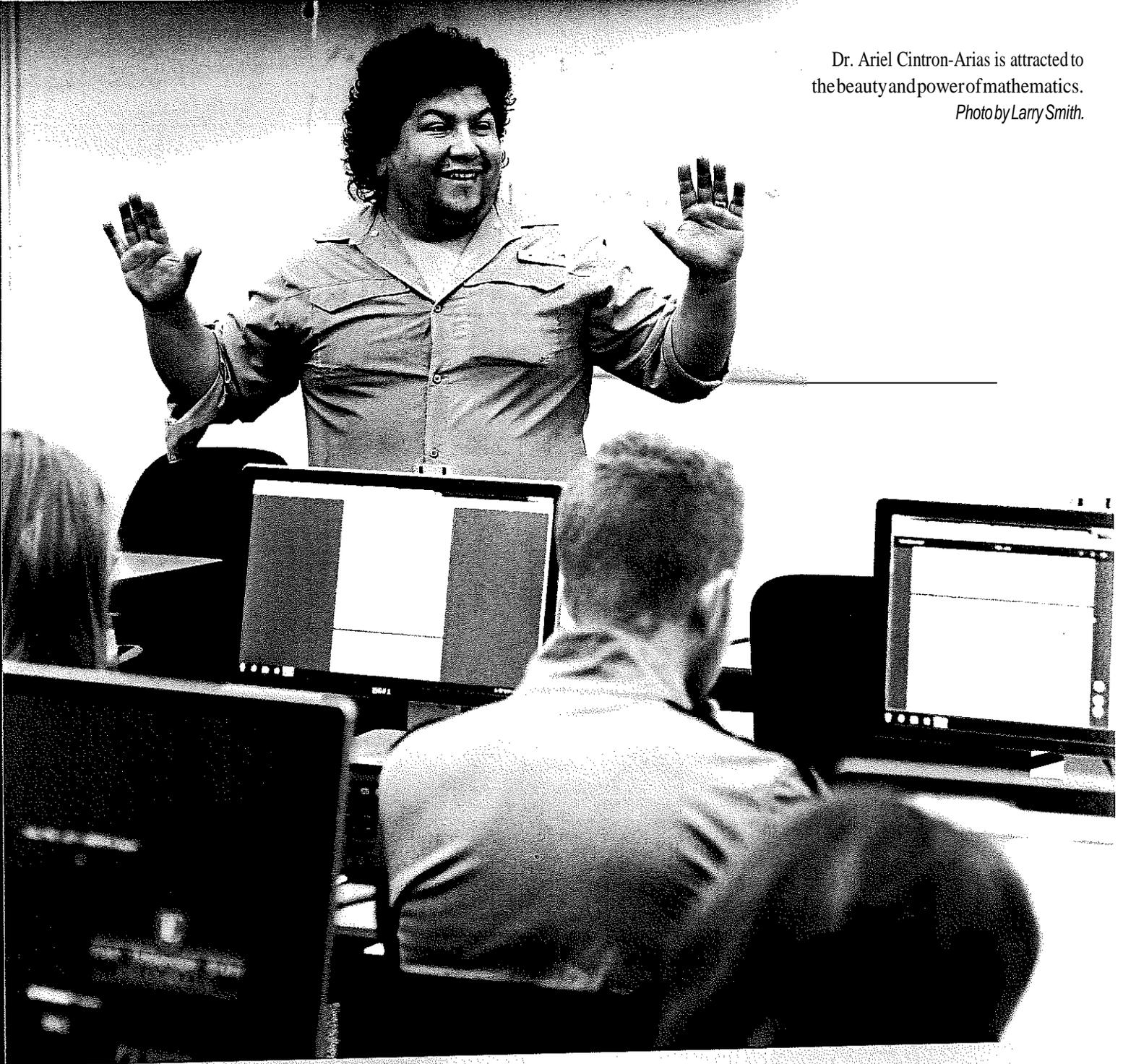


▼ IN THIS ISSUE

- ETSU's Leadership in STEM
- Herb Parker Coaches Young Actors
- The Life Journey of Steve DeCarlo
- Remembering a Special Season

Dr. Ariel Cintron-Arias is attracted to the beauty and power of mathematics.

Photo by Larry Smith.



ETSU EMERGES AS **STE-M Leader**

For those who might think university faculty members work short days and enjoy uncommitted summers, one visit to the East Tennessee State University Department of Mathematics and Statistics will dispel that erroneous notion.

The department is alive with activity, day and night and for all seasons.

Attracting grant funding that would be the envy of much larger universities and teaching an ever-increasing number of majors on the undergraduate and graduate levels, the department has quickly developed a reputation as a national leader in STEM: science, technology, engineering, and mathematics education.

"ETSU's reputation in STEM is strong, evolving, and continually changing," says Dr. Anant Godbole, Director of the Center of Excellence in Mathematics and Science Education. "Faculty members have partnered with, or received

grants from, industry and government to seek out new opportunities to improve STEM education at the K-12, undergraduate, and graduate levels. Amazingly, they have done this while continuing their own research in disciplines across several colleges and centers."

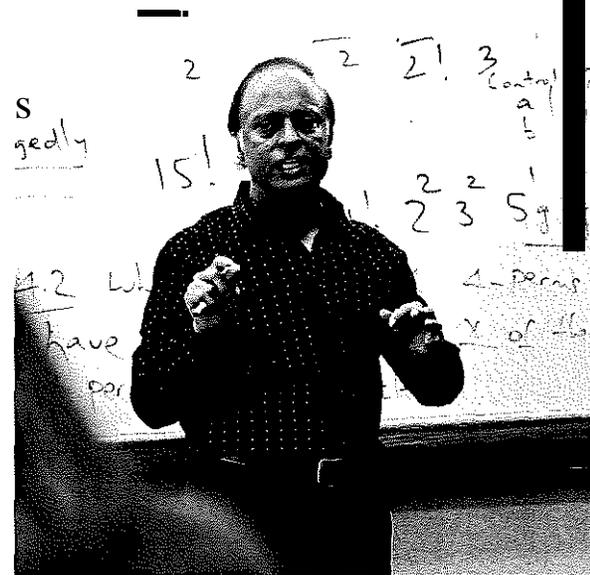
Indeed, STEM permeates the campus, from the College of Arts and Sciences to the Claudius G. Clemmer College of Education to the College of Business and Technology and

beyond. The university's Division of Health Sciences is an active participant in STEM-related teaching and research.

STEM may be a relatively new term, but the subject matter it entails is nothing new to ETSU. Mathematics and science courses date to the institution's earliest days. More recently, a Mathematics Research Experiences for Undergraduates Program has received funding from the National Science Foundation for the last 25 years. Participants have written 75 refereed papers, and 20 of them have earned NSF graduate fellowships. Godbole says that is a remarkable record for a university the

The center that Godbole directs dates to 2005. One of its creators was veteran faculty member Dr. Jack Rhoton, now retired, who built a national reputation for the university in the field of science education. The center serves as the Hub for STEM in Northeast Tennessee, connecting K-12 school, higher education institutions, businesses, foundations, and community organizations to design, develop, and demonstrate STEM learning experiences. Among the projects coordinated by the center are Eastman Chemical Company's MathElites program, a similar program developed in partnership with the Niswonger Foundation, the Upper East Tennessee Science Fair, and the annual Governor's School for Scientific Models and Data Analysis. Clearly, STEM education has become an integral part of the mission of ETSU.

"Undergraduate research in this department is quite substantial. It's required for all undergraduate students to do one semester of research," says Dr. Ariel Cintron-Arias, Associate Professor of Mathematics. "They immerse



Dr. Anant Godbole. Photo by Larry Smith.

••ETSU's reputation in STEM is strong, evolving, and continually changing. ••

ANANT GODBOLE

themselves in research, write reports, and do several

presentations throughout the course of 15 weeks."

Cintron-Arias is one of ETSU's STEM all-stars. A native of Costa Rica and Puerto Rico, he holds a Ph.D. in Applied Mathematics from Cornell University. He was attracted to the field, he says, because of the beauty and power of mathematics. He inspires his students at ETSU just as he was inspired at Cornell by professors like Dr. Anthony Kable.

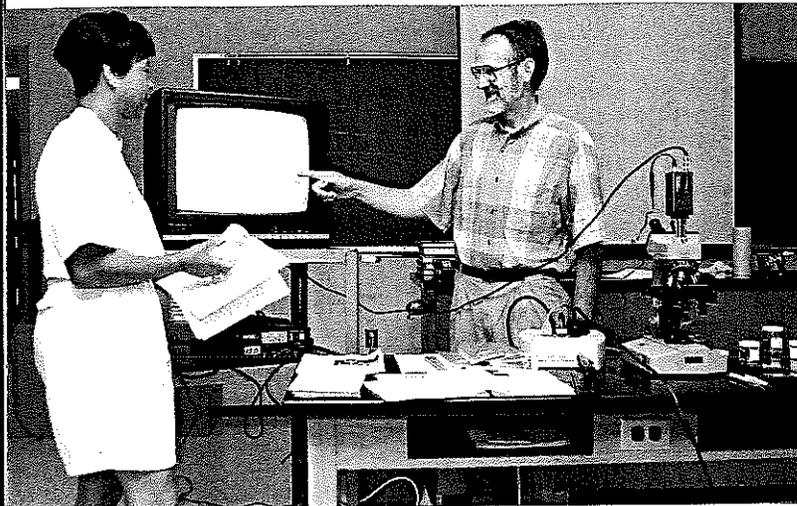
"I remember the way he wrote on a chalkboard, how he would write abstract mathematical proofs and symbols on that board. It was like something

size of ETSU.

out of a movie," Cintron-Arias recalls. "On the last day of class, when he finished writing and placed the chalk on the desk, students started applauding him."

In his teaching at ETSU, Cintron-Arias, too, is an encourager. He says he often sees potential in students that they cannot see themselves.

"It's important that students find their corner, where they feel comfortable," he says. "For STEM, we should be as aggressive as coaches are when they recruit athletes. I see many potential STEM stars. It's my role to tell them, 'You can do this. In a few years, this could be you in front of



Dr. Jack Rhoton built a nationwide reputation for ETSU in science education.

Photo courtesy ETSU Photographic Services.

the classroom *or* in charge of this computer system:"

In collaboration with colleague Dr. Debra Knisley, Cintron-Arias runs an eight-week summer program funded by the National Security Agency. "Strengthening Minorities Achievements via Research Training in Mathematics" also emphasizes the importance of undergraduate research. For the program's first year, ETSU received 108 applications from coast to coast and the Caribbean. Out of those, eight people were selected. The focus of the summer 2016 experience was Type II Diabetes, and students wrestled with the question of why certain demographics in the population are more prone to carry or inherit the disease. Cintron-Arias says that topic was selected because of the significantly higher occurrence of Type II Diabetes among the African American population in the United States.

Cintron-Arias also oversees the S-STEM program entitled "Preparation of the Data-Driven Mathematical Scientists for the Workforce." Funded by the National Science Foundation, it offers qualifying students three years of support, for a total of \$16,500. The program begins with an immersion in computational science. Students attend weekly seminars and engage in activities that emphasize data science, known as Big Data, as they complete their major or minor requirements at ETSU.

The influence of Ariel Cintron-Arias extends nationwide. He is a member of The National Alliance for Doctoral Studies in the Mathematical Sciences, an organization that sponsors a conference every fall and provides a support network for students all across America. He is a mentor for the organization, meaning that he can be called upon at any time to help students create a *OJ*, proofread their application letters for graduate school, remind them to take the GRE, or coach them about balancing work responsibilities with academics.

One of the faces of STEM in the College of Education is Dr. Ryan Nivens. For him, mathematics is a way of looking at the world, a way of appreciating the balance and harmony of the universe. Talk to Nivens for any length of time, and he sounds as much the poet as he does the mathematician.

"Mathematics is a beautiful language that can describe anything you see—the beauty of nature, the relationships between things," says the young Associate Professor in the Department of Curriculum and Instruction. "There is a

shape to numbers that is seldom taught to people. Math doesn't make the world go around; the world going around is what makes math."

A walk through an East Tennessee meadow in springtime illustrates the professor's point. There is mathematical theory behind the simple act of looking for four-leaf clovers.

"You can find them through brute force, picking every clover until you find the four leaves, or you can look for them in groups of threes, or you can look for the cross pattern that characterizes the four-leaf clover, as opposed to the shape of the three-leaf variety that looks something like the Mercedes logo in its configuration," explains Nivens.

To remind students of the profound presence of math in the universe, Nivens often laminates four-leaf clovers and attaches them to final examinations.

As faculty members have done on the Johnson City campus since 1911, Nivens teaches current and future teachers how to teach math. And he does it year-in-year-out. In summer, he teaches classes through ETSU's Department of Mathematics and Statistics, and he teaches Eastman Scholar MathElites, through a program under the auspices of Eastman Chemical Company in Kingsport.

Outreach to business and industry is a decided strength of STEM studies at ETSU. Dr. Michele Joyner, Associate Professor of Mathematics and Statistics, teaches a course called "Preparation for Industrial Careers in Mathematical Sciences." Students learn how mathematics is used every day in two major American industrial operations, Eastman Chemical in Kingsport and the MIT Lincoln Laboratory in Lexington, Massachusetts.

Such experience is made possible at several institutions across the country through a grant from the National Science Foundation. Joyner is the perfect person to teach the course, as her career bridges industry and academia. She once worked at Lincoln Labs.

The program is a joint effort of the Mathematical Association of America and the Society for Industrial and Applied Mathematics. Faculty attend a three-day summer workshop, where they receive information about non-academic careers and internship opportunities for students, guidance on developing business and industry connections, and training on how to develop skills in students that are valued by employers.

During the "Preparation for Industrial Careers in Mathematical Sciences" course, groups of students work on a problem proposed by an industrial partner. At the end of the course, a chosen team from the class submits a technical report and video presentation detailing a solution to the original problem.

The report and video are then submitted to a panel of judges, to compete against the work of students from across the country. The students present their results in person at a national mathematics meeting. And they can see their work in action as their ideas are adopted by industry.

In all, Godbole estimates that ETSU enjoys external funding for STEM-related activities to the tune of some \$8 million.

These talented and passionate ETSU faculty members are translating their love of numbers into an ever-expanding network of learning that will have a deep and lasting effect on the region. •

-Fred Sauceman is Editor at ETSU Today.

Appendix N: Tracks and Concentrations Curriculum

Tracks			Concentrations		
Course	Title	Credits	Course	Title	Credits
Mathematics Core (34) Credit Hours			Mathematics Core (19) Credit Hours		
MATH 1920	Calculus II	4	MATH 1920	Calculus II	4
MATH 2010	Linear Algebra	3	MATH 2010	Linear Algebra	3
MATH 2050	Foundations of Probability and Statistics – Calculus Based	3	MATH 2050	Foundations of Probability and Statistics – Calculus Based	3
MATH 2090	Mathematical Computing	2	MATH 2090	Mathematical Computing	2
MATH 2110	Calculus III	4	MATH 2110	Calculus III	4
MATH 2120	Differential Equations	3		In Concentration	
MATH 3000	Mathematical Reasoning	3	MATH 3000	Mathematical Reasoning	3
MATH 4010	Undergraduate Research	3		Moved to Other (Capstone)	
MATH 4127	Intro to Modern Algebra	3		In Concentration	
MATH 4217	Analysis I	3		In Concentration	
MATH 4257	Numerical Analysis	3		In Concentration	
	OR				
MATH 4267	Numerical Linear Algebra	3		In Concentration	
NOTE: The core number of credit hours is reduced by 15 hours (34 to 19).					
Mathematical Sciences Track (12) Credit Hours			Mathematical Science Concentration (24) Credit Hours		
			MATH 2120	Differential Equations	3
			MATH 4127	Intro to Modern Algebra	3
			MATH 4217	Analysis I	3
			MATH 4257	Numerical Analysis	3
				OR	
			MATH 4267	Numerical Linear Algebra	3
MATH 3340	Applied Combinatorics and Problem Solving	3	MATH 3340	Applied Combinatorics and Problem Solving	3
MATH 4137	Intro to Modern Algebra II	3	MATH 4137	Intro to Modern Algebra II	3
MATH 4337	Complex Variables	3	MATH 4337	Complex Variables	3
MATH 4347	Intro Graph Theory	3	MATH 4347	Intro Graph Theory	3
NOTE: The Mathematical Sciences Track's course work is the same as the proposed course work in the Concentration even though the number of credit hours in the track changed from 12 to 24 hours.					
			Note: Electives (MATH) 0 – 24 hours		
			Note: Electives (free) 0 – 24 hours		
Mathematical Education Track (12) Credit Hours			Mathematical Education Concentration (24) Credit Hours		
			MATH 2120	Differential Equations	3
			MATH 4127	Intro to Modern Algebra	3

			MATH 4217	Analysis I	3
			MATH 4257	Numerical Analysis	3
				OR	
			MATH 4267	Numerical Linear Algebra	3
MATH 3040	History of Mathematics	3	MATH 3040	History of Mathematics	3
MATH 3150	Mathematical Modeling	3	MATH 3150	Mathematical Modeling	3
MATH 3340	Applied Combinatorics and Problem Solving	3	MATH 3340	Applied Combinatorics and Problem Solving	3
MATH 4157	Intro to Modern Geometry	3	MATH 4157	Intro to Modern Geometry	3
NOTE: In order to complete the requirements for teacher certification, students in the Mathematics Education Track must select a minor in education which will include:			NOTE: In order to complete the requirements for teacher certification, students in the Mathematics Education Concentration must select a minor in education which will include:		
MATH 4417	Residency I: Teaching of Secondary Mathematics	3	MATH 4417	Residency I: Teaching of Secondary Mathematics	3
NOTE: The Mathematical Education Track's coursework is the same as the proposed course work in the Concentration even though the number of credit hours in the track changed from 12 to 24 hours.					
Quantitative Modeling Track (12) Credit Hours			Computational Applied Mathematics Concentration (24) Credit Hours		
			MATH 2120	Differential Equations	3
			MATH 3250	Stochastic Modeling*	3
			MATH 4027	Intro Applied Math*	3
			MATH 4127	Intro to Modern Algebra	3
			MATH 4217	Analysis I	3
			MATH 4257	Numerical Analysis	3
				OR	
			MATH 4267	Numerical Linear Algebra	3
MATH 3050	Statistical Modeling*	3		Deleted	
MATH 3150	Mathematical Modeling	3	MATH 3150	Mathematical Modeling	3
MATH 4337	Complex Variables	3	MATH 4337	Complex Variables	3
MATH 4347	Intro Graph Theory*	3		Deleted	
			Note: Electives (MATH) 0 – 24 hours		
			Note: Electives (free) 0 – 24 hours		
*NOTE: Two courses from the track have been replaced with two different math courses in the concentration.					
Statistics Track (12) Credit Hours			Statistics Concentration (26) Credit Hours		
			MATH 1530	Probability & Statistics-Noncalculus	3
			STAT 2090	Statistical Computing	2
			STAT 4307*	Sampling & Survey Techniques	3

			STAT 4327*	Time Series	3
MATH 3050	Statistical Modeling	3	STAT 3050*	Statistical Modeling	3
MATH 4287	Applications of Statistics	3	STAT 4287*	Applications of Statistics	3
MATH 4047	Mathematical Statistics I	3	STAT 4047*	Mathematical Statistics I	3
MATH 4057	Mathematical Statistics II	3	STAT 4057*	Mathematical Statistics II	3
				MATH ELECTIVE	3
			Note: Electives (MATH) 0 – 22 hours		
			Note: Electives (free) 0 – 22 hours		
			Note: * Rubric changes/Same courses		
NOTE: Four statistics courses have been added to the track to form the concentration. Also, moving from the track to the concentration there are three fewer mathematics courses required.					
Formally in Core			Other (Capstone Course)		
MATH 4010	Undergraduate Research	3	MATH 4010	Undergraduate Research	3
Additional Requirements: Students earning a BS in Mathematics must take 16-18 hours in the natural sciences; students must fulfill at least one of the following sequences			Additional Requirements: Students earning a BS in Mathematics must take 16-18 hours in the natural sciences; students must fulfill at least one of the following sequences		
PHYS 2110	Technical Physics I – Calculus Based	5	PHYS 2110	Technical Physics I – Calculus Based	5
PHYS 2120	Technical Physics II – Calculus Based	5	PHYS 2120	Technical Physics II – Calculus Based	5
OR			OR		
BIOL 1110	Biology for Science Majors Lecture I	4	BIOL 1110	Biology for Science Majors Lecture I	4
BIOL 1111	Biology for Science Majors Laboratory I	0	BIOL 1111	Biology for Science Majors Laboratory I	0
BIOL 1120	Biology for Science Majors Lecture II	4	BIOL 1120	Biology for Science Majors Lecture II	4
BIOL 1121	Biology for Science Majors Laboratory II	0	BIOL 1121	Biology for Science Majors Laboratory II	0
Note: A student can count “Technical Physics” and “Biology for Science Majors” to satisfy the Natural Sciences requirement.			Note: A student can count “Technical Physics” and “Biology for Science Majors” to satisfy the Natural Sciences requirement.		