Weber State University
Three -Year Program Review
Self-Study

Department of Mathematics

College of Science

Semester Submitted: Fall 2020

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1. INTRODUCTION

Mathematics is the language of choice for an increasing number of disciplines. The scientist, the engineer, the actuary, and the financial planner use algebra, calculus, statistics, geometry, and other mathematics areas. The voter also needs to understand these concepts, albeit at a less advanced level, to reach informed decisions about many issues from utility rates and retirement saving to information security and global warming.

Two departments are responsible for mathematics instruction at Weber State University. The Developmental Mathematics Program (Dev Math) oversees the courses Intermediate Algebra (Math 1010) and below. Only Math 1010 gives credit toward a student's degree.
The Mathematics Department oversees the courses of Math 1030 and above. Although the division of teaching duties started at the beginning of Summer 2007, the two programs work together at the interface and share some resources. Each of the instructors (or lecturers) in the Dev Math Program teaches one course a semester for Math as part of their contractual duties. The current Program Review is of the Mathematics Programs within the Math Department.

The Department of Mathematics is one of seven departments within the College of Science at Weber State University. It offers education in several areas of mathematics. Our students can obtain a Bachelor of Arts or Bachelor of Science in Mathematics, Applied Mathematics, Mathematics Teaching and Bachelor of Science in Computational Statistics and Data Science: a new program started two years ago.
Applied Math degree has several emphases: regular, computing, engineering, actuarial/financial, physical mathematics, and natural/life sciences. We also offer an Associate of Science in Mathematics. The department supports other degree programs on campus by providing minors in mathematics or mathematics teaching and provides mathematics emphasis areas for students pursuing a Bachelor of Integrated Studies (BIS). The department also provides service courses for other majors and minors in different colleges: College of Science, College of Applied Engineering and Technology, Goddard School of Business and Economics, and Dumke College of Health Professions.

The Department of Mathematics also supports the university's broader mission by providing quantitative literacy (QL) courses in general-education for all students and engaging with local communities. Mathematics faculty and Math Education faculty have been working with local districts to offer Concurrent Enrollment courses and evening classes for teachers pursuing elementary mathematics and STEM teaching certification. We also provide professional development workshops for K-12 teachers on the eight mathematical teaching practices outlined in *Principles to Actions,* which help teachers to improve math instructions. Section 7.2 provides more information.

The department is actively involved with undergraduate research and promotes high-impact educational practices. Over the last three years, our students have been engaged in research projects, presented posters at national mathematical or statistical conferences, gave presentations, and participated in several math contests: Integration Bee and Math Jeopardy at Intermountain MAA meetings. A team of math students was recognized and received an honorable mention in the international Mathematical Contest in Modeling that challenges students from over 900 institutions worldwide (Section 6.7).

One of the focuses of the department is retention and timely graduation. Since the last program review in 2017/2018, the Math Department graduated a total of 67 students awarding a bachelor's degree and 118 associate's degrees (the data includes Fall 2020). Our graduates find employment in middle or high schools, in the industry, and are accepted to graduate programs. Over one year, from Fall 2019 to Fall 2020, the department served 7,593 students enrolled in math or math education courses (Math 1030 and above). Half of those students, namely 52%, were students enrolled in QL courses. Over the same period (Fall 2019 to Fall 2020), we generated 26,628 student credit hours (SCH), with 55% in QL courses (Math 1030, 1040, 1050, 1080, 1810).

2. Standard A - MISSION STATEMENT

2.1 University Mission Statement

Weber State University provides associate, baccalaureate and master degree programs in liberal arts, sciences, technical and professional fields. Encouraging freedom of expression and valuing diversity, the university provides excellent educational experiences for students through extensive personal contact among faculty, staff and students in and out of the classroom. Through academic programs, research, artistic expression, public service and community-based learning, the university serves as an educational, cultural and economic leader for the region. (Approved by Board of Regents July 2011)

2.2 University Mission Statement for the General Education

QUANTITATIVE LITERACY

MISSION – It is the mission of Weber State University to produce graduates that can reason quantitatively within the context of their majors and career goals. This includes understanding information and reasoning that is numerical, geometric, algebraic, graphical, and statistical -- and at the level of sophistication of college algebra.

OBJECTIVES – A quantitatively literate person should be able to:

1. Interpret mathematical models such as formulas, graphs, tables, and schematics, and draw inferences from them.
2. Represent mathematical information symbolically, visually, numerically, and verbally.
3. Use arithmetical, algebraic, geometric, and statistical methods to solve problems.
4. Estimate and check answers to mathematical problems in order to determine reasonableness, identify alternatives, and select optimal results.
5. Recognize that mathematical and statistical methods have limits.

The above mission statement and learning objectives were developed (by the University Curriculum Committee for general education) to meet the goals stated in the 1999 report of the Regents' Task Force on General Education and current USHE policy (R470)

Established by The WSU Faculty Senate, Spring 2011.

2.3 Department of Mathematics Mission Statement

The Mathematics Department mission is to help students develop the knowledge and problem solving skills necessary to competently integrate mathematics into their personal and professional lives. Faculty endeavor to create an environment that makes that possible. Quality teaching of all departmental courses and the supervision of student projects including undergraduate research are central objectives.

The Mathematics Department is committed to providing excellent opportunities for all students: students majoring in pure or applied mathematics or computational statistics and data science, students majoring in science or engineering fields that depend heavily on mathematics, future teachers, in-service teachers, and all students seeking to improve their quantitative literacy. The department offers curricula that attend to the needs of the diverse educational and career goals of our students. Since mathematics is relevant to numerous fields, many of our course offerings are designed in a manner sensitive to other disciplines. A common emphasis in all our courses is the process of mathematical thinking and problem solving, as these skills will serve all students during college and for years to come.

Mathematics, computational statistics and data science, and mathematics education are growing and developing fields. We believe that faculty who are actively involved in scholarship and professional development tend to be highly effective teachers, and thus we value mathematical and educational scholarship, in-service teacher training, and course and curriculum development. Professional and scholarly work is both expected and encouraged.

Revised and edited October 2020

3. Standard B - CURRICULUM

3.1 Types of Degrees Offered:

The Department of Mathematics offers various courses (from general interest to advanced levels of applicability), three minors, departmental honors, and eight degrees. The Mathematics major may be the best choice for someone planning to go directly to graduate school; the Applied Mathematics major prepares one for a job that uses mathematics; the Mathematics Teaching major prepares students to be teachers of mathematics in middle or high school; Computational Statistics and Data Science is a new and fast-growing field that combines mathematics knowledge, statistics, and computer science.

- **Mathematics BS or BA** – 33 credits of required math courses, 10 credits of required support courses (physics) a minor is required or completion of two computer science courses.
  For the BA degree 14 credits of Language Art courses are required.

- **Mathematics Teaching BS or BA** – 48 credits of required math and math education courses, 5-10 credits of required support courses (physics, chemistry). For the BA degree 14 credits of Language Art courses are required.

- **Applied Mathematics BS or BA** –19 credit hours of core lower division mathematics courses, a minimum of 12 credit hours of upper division applied mathematics courses and additional upper division courses in specified fields, including mathematics, so the total upper division credit hours reaches at least 40. Applied Mathematics degree offers the following tracks (emphasis)

Regular Track	Engineering Mathematics Track
Computing Track	Actuarial/Financial Mathematics Track
Physical Mathematics Track	Natural/Life Sciences Track

- **Computational Statistics and Data Science BS** – 28 credits of required math and statistics courses, 20 credits of required computer science

- **Mathematics AS** - A total of 60 credit hours are required; a minimum of 18 credit hours are required in mathematics courses.

3.2 Types of Minors Offered:

- Mathematics
- Mathematics Teaching

Minimum of 20 credit hours for regular emphasis and 26 credit hours for Mathematics Teaching minor. At least one upper-division mathematics course for three credit hours must be completed at Weber State University.

3.3 Curriculum Map:

Curriculum Map for Mathematics Major (Regular Emphasis)

Core Courses in Department/Program	Department/Program Learning Outcomes Students who receive bachelor degrees in Mathematics at WSU are expected to have:			
	Knowledge of and the ability to apply the concepts of differentiable, integral and multivariable calculus.	Knowledge of and ability to apply concepts of matrices and Euclidean vector space and/or ordinary differential equations.	Ability to comprehend and write proofs that are logically, grammatically and mathematically correct.	Knowledge of and ability to prove results in analysis and algebra
Math 1210 Calculus I	1 - 3			
Math 1220 Calculus II	1 - 3			
Math 2210 Calculus III	1 - 3			
Math 2270 Elementary Linear Algebra		1 - 3	2 - 3	
Math 2280 Ordinary Differential Equations	2 - 3	1 - 3		
Math 3110 Foundations of Algebra			1 - 3	
Math 4110 Modern Algebra I			2 - 3	1 - 3
Math 4120 Modern Algebra II or Math 4320 Topology			2 - 3	1 - 3
MATH 4210 Intro Real Analysis I			2 - 3	1 - 3
MATH 4210 Intro Real Analysis II			2 - 3	1 - 3

Note: 1= introduced, 2 = emphasized, 3 = mastered

Curriculum Map for Applied Math Major

Core Courses in Department/Program	Department/Program Learning Outcomes Students who receive bachelor degrees in Applied Mathematics at WSU are expected to have:			
	Knowledge of and the ability to apply the concepts of differentiable, integral and multivariable calculus.	Knowledge of and ability to apply concepts of matrices and Euclidean vector space and/or ordinary differential equations.	Knowledge and ability to apply the concepts of several areas of applied mathematics (prob. and stats, numerical analysis, partial differential equations, etc)	Ability to comprehend and write correct mathematical arguments
Math 1200 Mathematics Computer Laboratory	1 - 3		1 - 3	
Math 1210 Calculus I	1 - 3			
Math 1220 Calculus II	1 - 3			
Math 2210 Calculus III	1 - 3			
Math 2270 Elementary Linear Algebra		1 - 3		1 - 3
Math 2280 Ordinary Differential Equations	2 - 3	1 - 3		
MATH 3410 Probability and Statistics I			1 - 3	
MATH 3410 Probability and Statistics II			2 - 3	1 - 3
Math 3550 Introduction to Mathematical Modeling			2 - 3	1 - 3
Math 3710 Boundary Value Problems or Math 3280 Dynamical Systems			2 - 3	1 - 3
Math 3610 Graph Theory			2 -3	1 -3
Math 3810 Complex Variables			2 -3	1 -3
Math 4610 Numerical Analysis I			2 -3	
Math 4610 Numerical Analysis II			2 -3	
Math 4710 Partial Differential Equations			2 -3	

Note: 1= introduced, 2 = emphasized, 3 = mastered

Curriculum Map for Math Teaching Major

Required Courses in Department/Program	Department/Program Learning Outcomes Students who receive bachelor degrees in Mathematics Teaching at WSU are expected to have:				
	Knowledge of and the ability to apply the concepts of differentiable, integral and multivariable calculus.	Knowledge of and ability to apply concepts of matrices and Euclidean vector space and/or ordinary differential equations.	Ability to comprehend and write proofs that are logically, grammatically and mathematically correct.	Knowledge of basic probability and statistics, analysis, and number theory.	Knowledge of and ability to teach concepts of high school level mathematics
Math 1210 Calculus I	1-3				
Math1220 Calculus II	1-3				
Math 2210 Calculus III	1-3				
Math 2270 Elementary Linear Algebra		1-3			
Math 2280 Ordinary Differential Equations or Math 3550 Intro to Math Modeling		1-3			
Math 3110 Foundations of Algebra or Math 4110 Modern Algebra I			1-3		
MTHE 2210 Geometry from a Teaching Perspective			1-3		1-3
Math 3120 Foundations of Euclidean and non-Euclidean Geometry			2-3		

MATH 3160 Number Theory			1-3	1-3	
MATH 3410 Probability and Statistics I				1-3	
MATH 4210 Intro Real Analysis	2-3		2-3	1-3	
MTHE 3010 Methods and Technology for Teaching Secondary Math					1-3
MTHE 3060 Probability and Statistics from a Teaching Perspective				1-3	1-3
MTHE 4110 Algebra from a Teaching Perspective					1-3

Note: 1= introduced, 2 = emphasized, 3 = mastered

Curriculum Map for Computational Statistics and Data Science Major

Required Courses in Department/Program	Department/Program Learning Outcomes				
	Students will understand the theoretical, conceptual, and applied underpinnings of Statistics	Students will understand the theoretical, conceptual, and applied underpinnings of Data Science	Students will demonstrate fundamentals and fluency in computation.	Students will effectively analyze and reason with data.	Students will be able to effectively communicate their results
Math 1210 Calculus I	1	1			
Math1220 Calculus II	1	1			
Math 2210 Calculus III	1	1			
Math 2270 Elementary Linear Algebra	1	1			
Math 3410 Probability and Statistics I	1-3	1		1	
Math 3420 Probability and Statistics II	2-3	1-2	1	2-3	1
Math 3450 Advanced Statistical Methods	1-3	2	1-3	2-3	1-3
Math 4400 Statistical Analysis of Big and Small Data	2-3	2-3	2-3	2-3	1-3

Note: 1= introduced, 2 = emphasized, 3 = mastered

4. Standard C - STUDENT LEARNING OUTCOMES AND ASSESMENT

The following describes the current state of assessment for the programs in the Mathematics Department. The department forms the set of goals, a curriculum grid for those goals, and an assessment plan based one the department mission statement (see the first part of this document) which was revised in October 2020. The goals are reviewed periodically and used as a basis to establish program learning outcomes for each of the department's majors and measurable course learning outcomes for each of the required courses. The course learning outcomes provide another set of data that can be collected, analyzed, published, and used to improve instruction. They also provide direct evidence that learning is taking place.

Goals

Mathematics students should enjoy resources that are sufficient for achieving their goals. While obtaining mathematical knowledge, they should also have a reasonable freedom in the choice of their courses. The education of a student is a cooperative effort between the student, many faculty in different disciplines, and other university community members such as advisors, librarians, administrators, etc. The following goals have been established for each of our major:

- Mathematics majors should gain a substantive knowledge and comprehension of the major ideas in the core areas of their fields of study.
    - Mathematics: The main topics are modern and linear algebra and analysis of real-valued functions.
    - Applied Mathematics: The main topics are numerical and statistical analysis, linear algebra, mathematical modeling and differential equations.
    - Mathematics Teaching: The main mathematical topics are the ones contained in mathematics courses required for certification. Mathematics teaching majors should also learn effective approaches for teaching mathematics.
    - Computational Statistics and Data Science Major: The main topics are computational statistics and data analysis.
- All mathematics majors should learn a fundamental set of skills that will enable them to succeed in today's changing world.
    - Problem Solving & Independent Learning: They should be adequately trained to apply their mathematical knowledge in both familiar and new situations. They should also be able to seek new knowledge to help in those endeavors.
    - Technology: They should learn to use appropriate technology, such as computers, as an aide in investigating mathematical problems and teaching.
    - Communication: They should learn to successfully communicate mathematical ideas and solutions of problems with others at the appropriate level.
- Students pursuing Mathematics Minors, Mathematics Teaching Minors, or Elementary Mathematics Endorsements should be able to effectively apply appropriate mathematical ideas and/or teaching approaches in their field.
- Mathematics service courses should meet the overall varied needs of client departments. Students in these courses should obtain the required mathematical knowledge.

4.1 Measurable Program Learning Outcomes:

Mathematics Major (Regular Emphasis): Students who receive bachelor degrees in Mathematics at Weber State University will have:

1. Knowledge of and the ability to apply the concepts of differentiable, integral, and multivariable calculus.
2. Knowledge of and ability to apply the concepts of matrices and Euclidean vector spaces, and ordinary differential equations.
3. Ability to comprehend and write proofs that are logically, grammatically, and mathematically correct.
4. Knowledge of and ability to prove results in analysis and algebra.

Applied Mathematics Major (Applied Emphasis): Students who receive bachelor degrees in Applied Mathematics at Weber State University will have:

1. Knowledge of and the ability to apply the concepts of differentiable, integral, and multivariable calculus.
2. Knowledge of and ability to apply the concepts of matrices and Euclidean vector spaces, and ordinary differential equations.
3. Knowledge and ability to apply the concepts of several areas of applied mathematics (probability and statistics, numerical analysis, partial differential equations, etc.).
4. Ability to comprehend and write correct mathematical arguments.

Mathematics Teaching Major (Math Teaching Emphasis): Students who receive bachelor degrees in Mathematics Teaching at Weber State University will have:

1. Knowledge of and the ability to apply the concepts of differentiable, integral, and multivariable calculus.
2. Knowledge of and ability to apply the concepts of matrices and Euclidean vector spaces, and ordinary differential equations or modeling.
3. Ability to comprehend and write proofs that are logically, grammatically, and mathematically correct.
4. Knowledge of basic probability and statistics, analysis, and number theory.
5. Knowledge of and ability to teach concepts of high school level mathematics.

Computational Statistics and Data Science Major: Students who receive bachelor degrees in Computational Statistics and Data Science at Weber State University will have:

1. Students will understand the theoretical, conceptual, and applied underpinnings of Statistics
2. Students will understand the theoretical, conceptual, and applied underpinnings of Data Science.
3. Students will demonstrate fundamentals and fluency in computation.
4. Students will effectively analyze and reason with data.
5. Students will be able to effectively communicate their results.

4.2 General Education:

The Department of Mathematics supports General Education Programs at Weber State University by offering Quantitative Literacy (QL):

- Math 1030 QL Contemporary Math (3 credits)
- Math 1040 QL Introduction to Statistics (3credits)
- Math 1050 QL College Algebra (4 credits)
- Math 1080 QL PreCalculus (5 credits)

Several sections of each course are regularly offered each semester. We offer the courses in different formats (face-to-face and online) using various teaching methodologies (lecture style, problem-solving approach, flipped class).

To meet the demand of other departments and to better serve our students, the department of mathematics is currently in the process of developing three new quantitative literacy courses:

- Math 1035 QL Contemporary Math with Pre-requisite Topics (6 credits)
- Math 1090 QL Business Algebra (3 credits)
- Math 1120 QL Foundation of Data Science (3 credits)

The math faulty also developed and offered innovative cross disciplinary courses, WSU courses

- WSU 2350 Writing with Numbers HU/QL (4credits)
- WSU 2340 Pattern Play: Move/Math CA/QL (5 credits)

WSU 2350 Writing with Numbers gives students credit in Quantitative Literacy and Humanities. The course covers the curriculum of Math 1030 with an emphasis on writing. The topics from mathematics fulfill the quantitative literacy requirement that prepares students for real-life problems and conveys the beauty and utility of mathematics in modern society. The course's communication portion helps students develop language to speak accurately about mathematical concepts in a way a layperson would understand and practice in writing about these concepts.

WSU 2340 Pattern Play: Move/Math, also known as Math and Dance, satisfies the requirements of Creative Arts and Quantitative Literacy. Pattern Play is an interdisciplinary course that allows students to explore pattern recognition, creation, and analysis through a simultaneous study of mathematics and dance.

4.2.1 Support of the General Education Improvement and Assessment Committee:

Math faculty actively participated in the General Education Revitalization project (2017-2019). The project was led by General Education Improvement and Assessment Committee (GEIAC), where changes were developed and implemented across the university. The Math Department held several departmental-level meetings to learn and discuss Big Question (BQ) and Signature Assignment (SA). Math faculty stand up to the challenge and developed several examples of Signature Assignments for each QL course. Those examples were shared with adjunct instructors, and Signature Assignments have been a valuable part of all QL math courses since Fall 2019.

4.3 Concurrent Enrollment and Other Campuses:

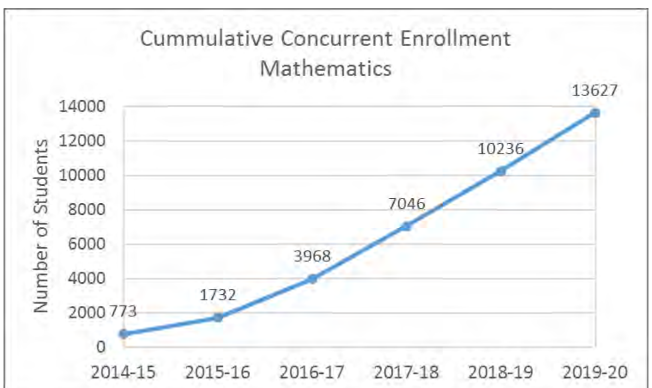
4.3.1 Concurrent Enrollment:

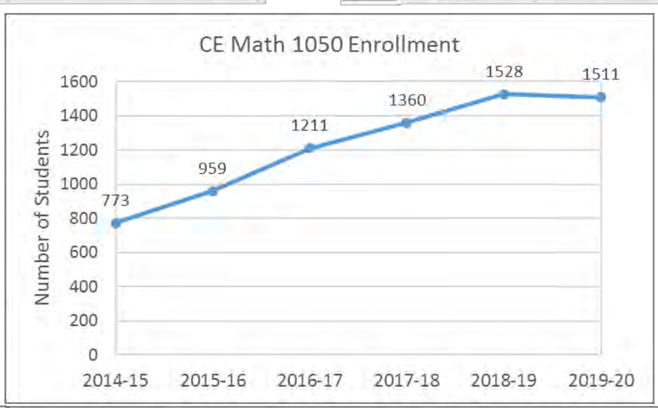
The Mathematics Department, in partnership with Continuing Education, offers concurrent enrollment courses. Currently, we are serving four school districts: Davis, Morgan, Ogden, and Weber. We also work with four charter schools and one private school. The enrollment in concurrent enrollment courses has doubled since we started this program. The number of schools offering math classes and the number of teachers teaching concurrent enrollment classes are also increasing. In the 2019-2020 academic year, we had more than 2000 students enrolled in Math 1030 CE Contemporary Math and Math 1050 CE College Algebra. The Mathematics Department is continually struggling to support those courses because of a lack of adequate resources. Currently, six math faculty are working with the concurrent enrollment program in addition to the CE program coordinator, who is reporting to the dean. The faculty create midterm and final exams, create rubrics for the exams, provide training to teachers regarding rubrics (so-called "rubric parties"), provide professional development and training for new teachers.

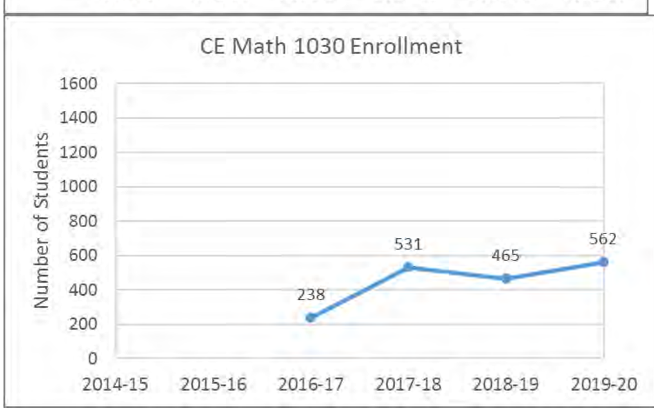
CE Math	Semester	Course	Teachers	Class Periods
	Fall '19	1010	23	56
		1030	4	6
		1050	10	16
	Spring '20	1030	21	25
		1050	31	51
	Fall '20	1010	24	47
		1030	7	9
		1050	9	24
	TOTAL			234

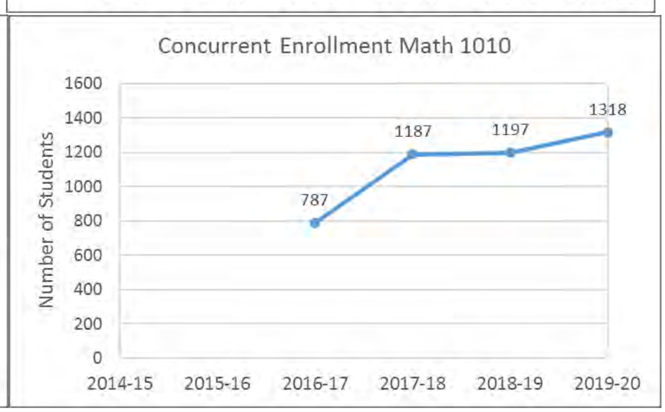
CE Math 2019-20	District	Schools	Teachers
	Davis	9	20
	Morgan	1	2
	Ogden	2	6
	Weber	4	11
	Charter	3	6
	Private	1	1
	TOTAL	20	46

CE Math 2020-21	District	Schools	Teachers
	Davis	9	19
	Morgan	1	2
	Ogden	2	4
	Weber	4	12
	Charter	4	8
	Private	1	1
	TOTAL	21	46









4.3.2 Mathematics Courses on Other Campuses:

The department has been working with the Division of Continuing Education to offer evening classes and courses on other campuses: Davis campus, Farmington, and West Center (Roy). We offer daytime and evening courses at Davis and Roy campuses, but in Farmington, only evening classes. Most of the courses are QL courses, but we see a growing interest in calculus courses offered in the evening at Davis. The increasing interest in calculus classes at Davis is probably because of the location of Hill Air Force Base.

Courses offered on other campuses 2019/2020 (before pandemic)	
WSU Davis	Math 1030 Contemporary Mathematics (2 sections) Math 1050 College Algebra (2 sections) Math 1080 Pre-Calculus (1 section) Math 1210 Calculus I (1 section) Math 1220 Calculus II (1 section) Courses added because of Computer Science moved to Davis Math 1040 Introduction to Statistics (2 sections) Math 1050 College Algebra (1 section) Math 1210 Calculus I (2 sections) Math 1220 Calculus II (1 section)
West Center (Roy)	Math 1030 Contemporary Mathematics (1 section) Math 1050 College Algebra (2 sections)
Farmington	Math 1050 College Algebra (1 section)

4.4 Three-year Assessment Summary

Assessment is an ongoing process in the Mathematics Department. Externally, broad reviews are conducted regularly by the Board of Regents and by Northwest, ABET, and NCATE accrediting agencies. These generally include reviews of departmental offerings, course content, textbooks, and examinations. Usually, experienced professionals compare our programs with others and provide the department with reports where math programs' strengths and weaknesses are identified. Other programs also undergo similar external reviews. Based on all these reviews and in consultation with other departments, the Mathematics Department makes necessary changes to improve its courses.

Internally, the Mathematics Department reviews its entire curriculum periodically, has dialogs with departments that we provide service courses, re-evaluates textbooks annually, keeps current on national curriculum trends, and studies course grade distributions from time to time. Also, faculty share and review examinations, regularly collect student evaluations of teaching, and undergo annual reviews for merit. Faculty also consult with local school districts, graduate schools, and employers.

Over the last three years, the department collected assessment data.

In 2018/2019, the department collected assessment data from one QL course, Math 2020 Mathematics for Elementary Teachers II (changed to Geometry for Elementary Teachers). Students performed quite well, and the thresholds of all learning outcomes were met. The department also collected assessment data from three sections of Calculus I and Calculus II. Some of the thresholds were not met because the data included only a small sample of students and only questions from the final exam were used. To properly evaluate Calculus courses, we need to collect more data using not only final exam questions. Students usually perform lower on a cumulative final exam.

Academic year 2019/2020:
In Fall 2019, the assessment was collected from all QL courses and all courses required for math majors. The results of the assessment are reported in Appendix G.
For QL courses, we met most of the thresholds for each learning outcome. In Math 1080 PreCalcus, our passing rate was 67.33%, which is lower than our target performance of 70%. This course is a very fast-paced course that, during one semester, covers the material of two courses, Math 1050 College Algebra and Math 1060 Trigonometry. Only a small number of our students can keep up with the amount of material covered over such a short time.

In courses required only for our majors, students met all learning outcomes, and the assessment was measured using questions on exams, quizzes, homework, or group work. Calculus sequence is also required for our majors, but more than half of the students in those courses are engineering majors or other science majors. Therefore, Calculus courses' data does not give us a good picture of how students in our majors perform. In general, the faculty noticed more and more students come to calculus courses with poor algebra skills, making it difficult for them to complete the course successfully.

Assessment of Graduating Students
Graduating majors are assessed mainly by their course grades. There are courses particular to each emphasis:

Applied Mathematics:
The main topics are numerical and statistical analysis, linear algebra, mathematical modeling, and differential equations. Besides the core courses required for all math majors, applied math graduate must pass Math 3550, Introduction to Mathematical Modeling. In addition, each graduate must pass a selection of applied mathematics courses, where students work on projects and presentations.

Mathematics:
The main topics are modern, linear algebra and analysis of real-valued functions. Each graduate must pass: Foundations of Algebra, an introduction to advanced math and proof-writing course, Real Analysis I and II, Modern Algebra I, and either Modern Algebra II or Topology.

Mathematics Teaching:
Each graduate must pass courses on concepts and teaching methodology in algebra, geometry, probability and statistics, and problem-solving. Each graduate must also pass required courses in the college of education, including a student teaching course. The latter course is a semester-long course where the student is paired with and mentored by a junior or senior high school teacher. In addition, the student is observed and mentored by a math faculty member. To become a licensed teacher, students must pass the Praxis Exam. Praxis Exam is a test that measures general and subject-specific content knowledge that students need for beginning teaching. The Praxis tests help Utah educators demonstrate their knowledge of content, pedagogy, and instructional skills for the classroom.

Computational Statistics and Data Science:
The main topics are computational statistics and data analysis. Each students must pass: Probability and Statistics I and II, MATH 3450 - Advanced Statistical Methods, MATH 4400 - Statistical Analysis of Big and Small Data.

The program description in the WSU Catalog and the department flyers provide more details about course requirements. All majors are encouraged to do a senior research project. Several students complete projects and give a presentation in a math club sponsored colloquium.

Students completing an associate's degree are required to pass 18 credit hours of math courses starting with calculus. A minor in math requires 20 credit hours while a math teaching minor requires 23 credit hours of math and a math education methods course.

5. Standard D - ACADEMIC ADVISING

5.1 Advising Strategy and Process:

The chair and assistant chair of the department are the main academic advisors for all mathematics majors and minors. Although some students receive advising in small groups during new student orientation, the majority of advising occurs in a one-on-one manner in a different setting. Students who are either currently mathematics majors or are considering a mathematics major use an online form to book an appointment. It is through the ensuing appointment that most decisions regarding a possible mathematics major or regarding course plans are made.

Depending on the needs of the student, a typical advising appointment lasts between 30 and 45 minutes. When students reserve an appointment, they indicate any pressing concerns that they have. Based on this information, the major advisor may need to investigate certain issues related to credit transfer or placement tests. Often, the advisor also prepares a tentative course plan (to be used as a starting point for discussion) for the student's next few semesters or years. This tentative plan is made with an eye toward the past academic performance of the student. In particular, the intent is for the plan to be realistic for the individual student in question.

In straightforward advising sessions, the discussion primarily centers on course sequencing and course emphases (such as how to be as prepared as possible for certain challenging courses). In some cases, students are either exploring the possibility of being mathematics majors or are trying to decide which mathematics major (e.g. applied mathematics) is the best fit for them. In these cases, a substantial amount of time is spent discussing issues ranging from mathematical content to careers, and students are often given information from sources such as MAA publications related to careers in mathematics.

After an advising appointment, each student is given a detailed course plan showing what that student will take in upcoming semesters or years. In some cases, students prefer (or even need) a course plan extending through their tentative graduation date. At the end of each advising appointment, students are encouraged to make another appointment the following semester to check in, and many, if not most, mathematics majors seek advising at least once per semester. Detailed records of course plans are kept so that future communication with students can be as clear and informed as possible. If there are lingering questions regarding course transferability or prerequisites, the advisor may need to have a discussion with the department chair to sort out these issues.

Since the onset of the COVID-19 pandemic, all advising has been done virtually via video conferencing software. Although it has not been possible to supply students with printed materials related to course plans or careers, students are almost always provided with links to websites (related to careers) as well as electronic documentation of tentative course plans.

Future elementary school teachers that want to specialize in mathematics are advised by our math education faculty on an as needed basis. These students also receive advice from the College of Education.

5.2 Navigating Quantitative Literacy (QL):

In light of the quantitative literacy (QL) graduation requirement, most Weber State students interact with the Mathematics Department in some capacity. Due to the variety of QL courses, varying requirements of other departments, nuances that impact individual students, varying pathways (prerequisites), and details surrounding testing and placement, it is extremely common that students have questions about QL.

Currently, the process of helping students navigate QL is informally distributed across the university. Each academic college has one or two advisors responsible for their programs and for general education advice, and the Student Success Center has advisors that are often asked to help students navigate QL. Individual faculty, department chairs, and administrative assistants in other departments are often asked about QL requirements. The Mathematics Department Chair and major advisor are also frequently asked to answer questions on QL. The Mathematics Department administrative assistant spends an enormous amount of time answering questions surrounding QL, and this allotment of time is typically in conflict with the need to address other departmental priorities.

Several problems result from the current environment in which the technicalities of helping students navigate QL are distributed across many places and people on campus. It is frequently the case that mistakes are made and students receive incorrect information about issues related to needed QL courses, placement, prerequisites, and other aspects. It is unrealistic to expect advisors, faculty, and staff across campus to know all the technical details needed to help students efficiently navigate QL. Moreover, there are frequently changes in curriculum in the Mathematics Department or in the Developmental Mathematics Program. It is a large job to communicate both existing policies and impending changes to all the needed parties across campus, and the department currently does not have capacity to engage in this. Thus advisors, faculty, and staff across campus are frequently unaware of policies and/or policy changes surrounding QL or they are forced to invest substantial time trying to understand QL on their own. When they elect to contact someone from the Mathematics Department to try to find answers to their questions, it is not clear whom they should contact, and it puts a substantial strain on several members of the department, particularly the administrative assistant.

These difficulties manifest themselves at the level of Weber State students in several concrete ways. The following statistics give just a few examples of this.

- As of fall 2020 836 Juniors and Seniors have not completed their general education QL math requirement. Only 146 of these Juniors and Seniors are currently (Fall 2020) taking a QL math course.
- In the fall 2020 semester, 7% of students (55 out of 833) enrolled in MATH 0970 or 1030 have a declared major that requires MATH 1050 or 1080. MATH 0970 and MATH 1030 are not part of a pathway to MATH 1050 or 1080, so these students are potentially taking more math courses than required for their degrees.
- In the fall 2020 semester, 30% of students enrolled in MATH 1050 have a declared major for which lower math courses (MATH 1030 or MATH 1040) would be sufficient. Similarly, 8% of students enrolled in MATH 1080 have a declared major for which lower math courses would be sufficient.

The university community and the department would benefit tremendously from a full-time Mathematics Department staff member dedicated to filling these voids and helping attending to students' needs. In the proposed solution in the staff section, we are proposing to have two administrative assistants. The first such staff member (9 months employment) would take care of customary departmental needs, and the second such staff member currently employed in the math department (12 months employment) would attend to students' needs and university needs pertaining to quantitative literacy. See the Adequacy of Staff section for more details.

5.2 Effectiveness of Advising:

We collect information about advising effectiveness by asking questions on the frequency and quality of advising during an exit survey of graduating students. Many mathematics major students seek advising at least once per semester, and most students met regularly with a department advisor. For the last two years, the survey results indicate that students were very satisfied with the advising quality. We received a rating of 6-7 on a 1 to 7 scale. The results suggest that misadvising is not an issue within our programs. We encourage students to keep in contact with us, and many do. Most graduates are finding employment or attending grad schools.

5.3 Past Changes and Future Recommendations:

Since the last program review, the department's advising system has changed from a decentralized system where every faculty member was involved in advising to a more centralized system where the department has a designated faculty as a major advisor. This approach was taken to ensure a consistent message was given to students and release faculty from this duty. Our current math major advisor, Dr. Ondrus, does an excellent job of advising. He offers students personal attention to help them choose courses that certainly set them up for success.

6. Standard E - FACULTY

The department has 18 faculty (one of them is an instructor) which constitute 17.25 FTE since one faculty member is ¾ time and one math education faculty is assigned half time in the CSME (Center for Science and Mathematics Education).

Full-time Status	COUNTA of Full-time Status	COUNTA of Full-time Status
3/4 Time	1	5.56%
Full-time Status	16	88.89%
Half Time	1	5.56%
Grand Total	**18**	**100.00%**

Gender	COUNTA of Gender	COUNTA of Gender
F	6	33.33%
M	12	66.67%
Grand Total	**18**	**100.00%**

Rank	COUNTA of Rank	COUNTA of Rank
Assistant Professor	3	16.67%
Associate Professor	6	33.33%
Instructor	1	5.56%
Professor	8	44.44%
Grand Total	**18**	**100.00%**

The Math Department coordinates with the Developmental Mathematics Program (Dev Math) that is responsible for courses that serve as prerequisites for QL courses, including MATH 1010, Intermediate Algebra. Each of the Dev Math Instructors (about 12) teaches one QL course a semester. The department also employs about 13 Adjunct Instructors each semester, teaching about two courses each.
The Adjunct Instructor course work is equivalent to 10 regular faculty. Depending on qualifications, adjuncts mostly teach QL courses and sometimes Calculus I.

The Math Department is in **desperate need of a statistician** and/or data scientists to support the growing demand for statistics courses and to grow Computational Statistics and Data Science Program. Our faculty are constantly asked to assist faculty from other colleges with analyzing data that are part of faculty research. If we could get one or two faculty lines for statisticians, we could increase the offering of statistics courses, like Math 3410 Probability and Statistics I (see the table below), and we could also create a statistics center, where faculty and students could get help with data analysis and statistical inferences. Statisticians are so needed for this university to grow programs, provide quality instructions, and satisfy the needs of today's world regarding data science. In the last year's strategic plan, the department offered thorough justification for a need for a statistician.

The department also **needs a math faculty to support engineering programs**. About five years ago, the College of Engineering, Applied Science and Technology (EAST) started new engineering programs: mechanical engineering and electrical engineering. Mathematics plays a significant role in engineering. The math department did not receive any support from the administration in satisfying the demand for a growing number of math courses required by the engineering programs. Since the engineering program started, we had to add sections in Calculus I, Calculus II, Calculus III, Linear Algebra, Differential Equations and Probability and Statistics (see the table below). We provided data and detailed justification for a math faculty in the last year's strategic plan.

Percentage Increase in SCH Compared to 2013-2014 Academic Year						
Year (summer to spring)	**2014-2015**	**2015-2016**	**2016-2017**	**2017-2018**	**2018-2019**	**2019-2020**
Math 1210 (Calculus I)	10.5%	11.5%	16.4%	21.4%	18.3%	5.7%
Math 1220 (Calculus II)	20.5%	28.0%	43.9%	44.8%	66.5%	39.3%
Math 2210 (Calculus III)	-7.0%	52.0%	45.0%	41.0%	32.0%	50.0%
Math 2250 (Linear Alg & Diff Equns)	-3.7%	-29.6%	-7.4%	7.4%	-14.8%	3.7%
Math 2270 (Linear Algebra)	4.0%	38.7%	16.0%	50.7%	50.7%	84.0%
Math 2280 (Differential Equations)	0.0%	-17.9%	-4.5%	13.4%	56.7%	53.7%
Math 3410 (Probability & Stats I)	-6.3%	43.8%	43.8%	37.5%	42.2%	85.9%
Math 3710 (Boundary Value Problems)	4.8%	0.0%	-14.3%	-14.3%	0.0%	104.8%

From the table above, we can see that the demand to offer more sections of math courses required by engineering programs grew significantly over the last five years. The math department can barely keep up with the demand for those courses due to a faculty shortage in this area.

6.1 Departmental Teaching Standards:

The department keeps good teaching standards determined by the university's policies and communicated to the faculty during the annual reviews and the tenure and promotion process. The peer-review process focuses on reviewing faculty teaching by fellow math faculty. The process gives faculty feedback on teaching methods, exam standards, and other aspects of teaching.

Adjunct Faculty are required to attend an annual meeting at the beginning of the semester, where department policies and standards are clearly communicated. Each new adjunct is required to submit their exams to the course advisor for feedback and approval.

For the last three years, the department has been running a common final exam for Calculus I and Calculus II. The exam is prepared by the Calculus Committee and administered at the same time for all day-time sections. The final exam is also commonly graded by the faculty teaching the courses. Usually, one faculty grades two to four questions for all sections. This process ensures that all students get the same points for the same error. The department feels that the common final exam helps us keep the same standards for all Calculus I and II sections.

6.2 Faculty Qualifications:

We have one instructor with a master degree, one math education faculty with E.ED and the rest 16 faculty members hold Ph.D degree.
Areas of Expertise: algebra, real analysis, combinatorics, linear algebra, differential equations, differential geometry, geometry, math education, matrix theory, statistics
Faculty CVs are in the math department.

Highest Degree	COUNTA of Highest Degree
E.ED	1
MS	1
Ph.D	16
Grand Total	**18**

6.3 Faculty Scholarship:

Math faculty have been actively involved in the research. In the past three years, faculty have published 29 papers and delivered numerous presentations at international and national conferences, local conferences and workshops, and departmental colloquia. The subject areas of publications were algebra, real analysis, matrix theory, combinatorics, approximation theory, discrete dynamical systems, math education, probability, and statistics. The faculty collaborated with other departments on several research papers. For example, two faculty provided statistical analysis for faculty from the College of Health Professions and the College of Education. Math Education faculty collaborated with colleagues from the College of Science and the College of Education. The faculty also received several grants, for example, STEM Action Center, "The NUCC 8x8 Project," 2018-2020, $209,791.31. The project collaborates with local school districts; see the section on community involvement.

6.4 Mentoring Activities:

Each tenure track faculty have one assigned faculty mentor. The faculty mentor regularly meets with the faculty and discusses courses, university policies and provides information on resources available to each faculty. WSU also has new faculty activities such as a retreat.

In consultation with the department chair, regular faculty members set their goals for the next academic year and evaluate the previous year's goals during an annual review. During the annual review meeting, the chair goes over the student teaching evaluations with faculty and discusses strengths, weaknesses, and plans for improvement.

Adjunct faculty receive very active mentoring during their first year. New adjuncts are required to have an initial meeting with the chair to go over procedures and policies. They are required to submit midterms and finals for review and feedback to an adjunct faculty advisor. Each lower-level course (such as each QL course) has one faculty assigned to assist with course content to adjuncts. Adjunct faculty are encouraged to email or meet with the chair if they have questions regarding students or classroom management. Changes in course material and assessment are regularly reviewed. All adjuncts must submit their graded final exams for review. The chair or the assistant chair reviews their student teaching evaluations. If there are problems, there is a meeting with the chair.

6.5 Diversity of Faculty:

The department faculty is diverse in the sense of what nationalities are present and where people received their degrees, through conscious efforts to develop a broad applicant pool. The department has eighteen faculty members, twelve are male, and six are female. We have two male Asian and one male Middle Eastern and one female Asian the rest of the faculty body is white. We will continue to make efforts to increase diversity.

Ethnicity	COUNTA of Ethnicity	COUNTA of Ethnicity
Asian	3	16.67%
Caucasian	14	77.78%
Middle Eastern	1	5.56%
Grand Total	**18**	**100.00%**

6.6 Ongoing Review and Professional Development:

Each year faculty members are evaluated in teaching, research, and service by the department chair using a college-wide annual review process. This process includes a review of the document prepared by the faculty, a review of student evaluations, and an interview with the chair. During the interview, the faculty goals are evaluated from the previous year, and new goals are set up for the next year. Also, each faculty member is evaluated by students using an end-of-semester course evaluation. Student evaluations provide feedback to faculty on how the course was set up and whether the instructional methods were effective. Course evaluations are discussed with the chair during the annual review process. Results from annual reports are later reviewed by the Dean, in consultation with the department chair.
Faculty also receive feedback on their effectiveness of teaching from course assessment that is conducted periodically.

The department encourages faculty to attend workshops, conferences, and other professional meetings to stay current with their research and improve their teaching. The department provides limited funds for professional development and travel. Additional funds are available through the Research, Scholarship, and Professional Growth Committee (internal grants), external grants and the Dean's office. Faculty can also apply for a sabbatical leave, subject to administrative approval. Faculty members take advantage of those funds, and several math faculty attend and give talks at professional gatherings, like conferences or workshops. The department also holds regular seminars and talks in the department.

6.7 Use and Effectiveness of High-Impact Educational Experiences:

The Department of Mathematics offers its students many different high-impact educational practices. For example, group work, presentation, writing a paper, or solving problems from mathematical journals. Several students submitted their solutions to mathematical problems to College Mathematics Journal or Mathematical Magazine. Mathematics students also give presentations at Math Factor (mathematical club) and participate in different mathematical contests. For example, our students participated in Math Jeopardy or Integration Bee at the regional MAA meetings (Mathematical Association of America). A team of math students under the supervision of Dr. Afshin Ghoreishi received an honorable mention in Mathematical Contest in Modeling. The contest is an international contest for high school students and college undergraduates. It challenges teams of students to clarify, analyze, and propose solutions to open-ended problems. The contest attracts diverse students and faculty advisors from over 900 institutions around the world.

6.7.1. High Impact Educational Experiences:

The following tables show high impact educational experiences that are regularly used in math courses.

	Applied Mathematics Department/Program use of High Impact Educational Experiences				
Courses	Group Project	Presentation	Write paper	Individual Project	Problem Solving
3710 Boundary Value Problems	x	x			x
3550 Introduction to Mathematical Modeling	x	x	x		
4620 Math 4620 Numerical Analysis II		x	x	x	x
2920 Mathematics Monday changed to Wednesday Mathematics	x	x	x	x	x
1200 Mathematics Computer Laboratory				x	x

Courses	Applied Statistics and Data Science Department/Program use of High Impact Educational Experiences				
	Case Study with Real Data	Understanding the world through data homework	Computer Simulation or Real Data Project	Signature Assignment	Group Work and Problem Solving
Math 3450 Advanced Statistical Methods	x	x			
Math 4400 Statistical Analysis of Big and Small Data		x	x		x
Math 3410/3420 Probability and Statistics I and II		x			x
Math 1040 Introduction to Statistics				x	
Math 2910 Mathematics Monday changed to Wednesday Mathematics					x

Courses	Mathematics Department/Program use of High Impact Educational Experiences			
	Write a paper	Presentation or present problems on the board	Practicing technical writing	Undergraduate Research
4120 Modern Algebra II	x	x	x	
4220 Intro Real Analysis II	x	x	x	
4110 Modern Algebra I			x	
4210 Intro Real Analysis I			x	
4910 Senior Research Project	x	x		x
2920 Mathematics Monday changed to Wednesday Mathematics	x	x	x	x

Courses	Mathematics Teaching Department/Program use of High Impact Educational Experiences				
	Simulation of Teaching Practices	Observation and reflection in local schools	Writing lesson plans	Collaboration in Professional Learning Communities	Group Work and Problem Solving
MTHE 3010 Methods and Technology for Teaching Secondary Math	x	x	x	x	x
MTHE 4110 Algebra from a Teaching Perspective	x		x		
MTHE 3060 Probability and Statistics from a Teaching Perspective	x		x		
MTHE 2210 Geometry from a Teaching Perspective	x			x	
Math 2920 Mathematics Monday					x

6.7.2. Undergraduate Research

Math students participate in undergraduate research. Several students presented posters at undergraduate research conferences, and we had students presented their work at a national mathematical conference, MAA Math Fest. Examples of student posters and math papers are in the Math Department

Student Research and BIS (Bachelor of Integrated Studies) Mentorship during the last three academic years

Dr. Cora Neal

Student	Title of work	semester
Kael Harris	Attrition in the STEM Pipeline, Master's Thesis in Education. The faculty served on his committee and assisted/advised on statistical analysis.	Spring
Mizuho Obayashi	The Effect of Natural Antioxidants on Reducing Oxidation, Poster presented at International Science and Engineering Fair. Poster won one of 12 awards from the American Statistical Association for outstanding use of statistics	Spring
Ethan Erickson, Landon Foulger David Merkely	The Effects of Platelet-Rich plasma on Post-Operative Pain levels and Pain Medication Use, a study being done in collaboration with the Oral and Maxillofacial Surgeons of Utah and Dr. Barb Trask students. Study and analysis are complete. Article is being written.	Spring Summer Fall

Dr. Afshin Ghoreishi

Student	Title of work	semester
Emily Owen	The Tower of Hanoi and its Hanoi-ing Problem - Math Club Talk	
Colleen Mills	Fibonacci Sequence – Math Club Talk	
Emily Owen and others	Solution to Problem 2063 in the Mathematics Magazine Solution to Problem 1132 in The College Mathematics Journal	Spring Fall
Emily Grotepas, Alexandria Kohler Alexis Wilding	Brief Biography of Four Mathematicians, Math Factor talk under joint direction with Dr. Sandra Fital-Akelbek	Spring
Marshall Johnson	Number e, Joint (with me) Math Factor talk	Spring
London Bolos and Colleen Mills	Food, Fun and Fibonacci, Math Factor talk	Fall
Michael Woodruff	Solution to Problem 1129 in CMJ	Fall

Dr. Julian Chan

Alexander Nielson	Statistical analysis of nutrition data	Summer
Alexander Nielson	Dietary Determinants of Metabolic Syndrome Parameters Differ by Gender in College Students.	Spring Fall
Paul Gaona-Partida	Effects of Indigenous Diet and Location on Hemoglobin Levels of Ghanaians	Fall

Dr. Mahmud Akelbek

Emily King	Determinants of Boolean Matrices with Equal Line Sums	Summer
Matthew Jensen	Interpolation Algorithm	Spring
Elizabeth Jenkins	Numerical Approximations to First Order Differential Equations	Spring
Darrell Gehring	Cubic Spline Interpolation and Robotic Path Finding	Fall
Joshua Boucher	Depth of Field	Fall
Anthony Frazier	Investigating Lotka-Volterra Predator-Prey Model	Fall

Dr. Chloe Cai

Kramer McCausland	Peer-review conference proceedings: abstract accepted, Maomao Cai, Yong Zhang, Cora Neal, Kramer McCausland, Applying a Self-Peer Review Model on STEM Higher Education. Accepted for presentation at 9th Annual STEM/STEM& Education Conference, Honolulu, HI	

Dr. Matt Ondrus

Jessica Sume (BIS)	The Science of Storytelling, BIS thesis	
Nathan Kilcrease (Honors)	Mathematical Results Concerning Card Shuffling and Permutations	

Dr. Sandra Fital-Akelbek

MaryAnn Moss (Danci)	Does incorporating music into mathematics help student learn more easily? BIS degree combining music, math and psychology	Fall Spring
Alexis Wilding	Investigating Properties of Magic Matrices poster presented at a national mathematical conference, MAA MathFest (Mathematical Association of America) in Denver, CO	Summer
Alexandria Kohler	Enrichment problems for middle and high school students: Using Vanishing Points to Solve System of Linear Equations, Using Angles to Form Tessellations, Experimental Probability and Statistics	Summer
Blair Levis	Geometry in Paintings Where Two Dimensional Becomes Three Dimensional talk given at MAA MathFest in Washington, DC	Summer

Dr. Rachel Bachman

Janessa Richardson	A new take on an old square	Spring
G. Aidan Gray	Pythagorean Triple Threat	Spring
Boston Workman	The role of emotional response in the learning of mathematics.	Fall

Dr. Shawn Broderick

Boston Workman	Preservice Teachers' Affect Towards Mathematics	Summer
Marlise Weyburn	Preservice Teachers' Learning of Fraction Multiplication and Division	Fall
Sariah Dinges Madylin Howard	Preservice Teachers' Understanding of Fraction Multiplication and Division	Fall

Dr. C.David Walters

Mandy Curtis Shaylee Overdiek Maude Beckman Christina Wallace	The 8x8 Math Teacher Leader Project, funded by the Utah STEM Action Center, is a sustained professional development for K-12 math teachers in Northern Utah. The students listed assist with the planning and day-to-day operations of the project. They are future math teachers, so this project aligns nicely with their career goals	Fall

6.8 Evidence of Effective Instruction:

6.8.1 Regular Faculty: Tenure-track faculty and full-time faculty are systematically evaluated by the department, college, and university through the following evaluations:

- <u>Student Evaluations</u> of all math courses are conducted each semester following college and institutional policies and procedures using a standardized instrument;
- <u>Annual Reviews</u> – each faculty prepares an end-of-year document using a College of Science evaluation form where each faculty addresses teaching, scholarship, and services. There is a meeting with the chair where the faculty is rated, and the goals are discussed. The results are reported to the College Dean;

- Ranking and Tenure Reviews are conducted periodically by the Ranking and Tenure Committees at appropriate levels according to the university policy. The review evaluates teaching, scholarship, and service.
- Peer Reviews - the Math Department Peer Review Committee conducts peer reviews. This review focuses on teaching, where the committee members review courses, exams, student evaluations, and conduct classroom observations.
- Second-Year Reviews of new tenure-track faculty made by the department chair according to university policy, with the results submitted to the faculty professional files;
- Post-Tenure Review is a review of tenured faculty conducted every five years. Faculty submit a summary with the most recent annual reviews to the chair. The chair rates the faculty as satisfactory/unsatisfactory and forwards the results to the dean.

The results from all those different evaluations are kept in the faculty's professional file. Student evaluations are stored electronically in the department. The rigorous review process helps faculty to improve their teaching, research, and service to the institution and our community. The reviews also provide data to the administration, department chair, and the dean on faculty performance regarding the department and college expectations.

6.8.2 Adjunct Faculty:

Part-time, adjunct faculty

- attend an orientation meeting at the beginning of the fall semester, where departmental policies and procedures are discussed

Adjunct faculty are systematically evaluated using the following evaluations instruments:

- Student Evaluations are conducted for every math class taught following College and institutional policies and procedures using a standardized instrument.
- Periodically/irregularly (because of the time constraints), the department chair conducts classroom observations, and in case of problems, a meeting is set up to discuss more effective teaching methods.
- All adjunct instructors are required to turn in their final exams. The department chair reviews these finals, grade distributions and students evaluations and discusses them with the instructors if there are any problems.

Each course taught by adjunct faculty has a faculty advisor assigned to it. The faculty advisor provides support on the course content and department teaching standards. For example, we have a faculty advisor for Math 1030, Math 1040, Math 1060, Math 1080. New adjunct faculty are required to submit their exams to the faculty advisor for approval and feedback during their first two years of teaching. The department chair takes care of issues related to students' complaints.

7. Standard F – PROGRAM SUPPORT
Support Staff, Administration, Facilities, Equipment, and Library

7.1 Adequacy of Staff:

The Mathematics Department has only one Administrative Specialist who is serving the department and takes care of students' needs. The position requires more work than other departments because every student must meet the QL requirement.

The Administrative Specialist helps immensely with the administration of the Math Department. She keeps supplies and equipment organized and arranges for repairs. She has provided very useful signage for courses, faculty, and safety. She is very adept at using the computer for administration: schedules, budgets, purchasing, records, etc. Also, she supports the faculty with data collection and analysis: pass rates, surveys, teaching evaluations, etc. She is very helpful with students, providing information and directions.

The amount of work required from her is significantly above what is required in other departments. Below we provide data comparing the Math Department to the Developmental Math Program. Developmental Math has two staff members, and as we see below, they offer fewer SCHs and have fewer students enrolled in their courses.

MATH/MTHE Courses Fall 2019 to Fall 2020				
Math Department			**Developmental Math Program**	
Total **# Students** All MATH/MTHE (MATH 1030 and above)	7,593	100%	Total **# Students** Dev Math (MATH 0950, 0970, 0990, 1010)	4,968
Total **# Students** QL Only (MATH 1030, 1040, 1050, 1080, 1810)	3,944	52%	*No QL Courses taught in Dev Math*	
Total **# SCH** All MATH/MTHE Courses (MATH 1030 and above)	26,628	100%	Total **# SCH** Dev Math Courses (MATH 0950, 0970, 0990, 1010)	20,922
Total **# SCH** QL Only Courses (MATH 1030, 1040, 1050, 1080, 1810)	14,540	55 %	*No QL Courses taught in Dev Math*	

The Department of Mathematics' SCHs typically average 25% of the total College of Science SCHs which includes 6 other academic departments and the Developmental Math program.

QL courses constitute about 50% of the courses that we offer. The university also makes efforts to support QL and put emphasis on QL completion. We currently offer five different QL courses, and three new ones have been developed.

QL Courses – Current:

1. MATH 1030 Contemporary Math (3)
2. MATH 1040 Intro to Statistics (3)
3. MATH 1050 College Algebra (4)
4. MATH 1080 Precalculus (5)
5. MATH 1810 Experimental Co-requisite Contemporary Math (6)

QL Courses – New and Pending University Approval Process:

1. MATH 1035 Co-requisite Contemporary Math (6)
2. MATH 1090 Business Algebra (3)
3. MATH 1120 Foundations of Data Science (3)

As it is stated in the advising section the university community and the department would benefit tremendously from a full-time Mathematics Department staff member dedicated to work with students. The staff member could address issues described in the advising section, such as:

- <u>Juniors and Seniors Not Completed General Education Math</u>
  As of fall 2020 836 Juniors and Seniors have not completed their general education QL math requirement. Only 146 of these Juniors and Seniors are currently (Fall 2020) taking a QL math course.
- <u>Students in Potentially Wrong Math Course</u>
  In the fall 2020 semester, 7% of students (55 out of 833) enrolled in MATH 0970 or 1030 have a declared major that requires MATH 1050 or 1080. MATH 0970 and MATH 1030 are not part of a pathway to MATH 1050 or 1080, so these students are potentially taking more math courses than required for their degrees.
- <u>Students Enrolled in QL beyond Major Requirements</u> – *not necessarily a bad thing…*
  In the fall 2020 semester, 30% of students enrolled in MATH 1050 have a declared major for which lower math courses (MATH 1030 or MATH 1040) would be sufficient. Similarly, 8% of students enrolled in MATH 1080 have a declared major for which lower math courses would be sufficient.

More contact with students and outreach is required to help these non-math major students who make up >=50% of students enrolled in math courses.

<u>Proposed Solution:</u>

Propose reconfiguring staff:

- Add part-time Administrative Specialist I to handle all department duties and assist Administrative Specialist II as needed.
  - 9-month (.75) basis
  - N23 pay range from $16,800 to $25,200
- Change focus of the current full-time Administrative Specialist II to work mostly with students. Debi Larson, who is our current admin, already has substantial knowledge of QL requirements,

and she has already provided information sessions about QL for other colleges: Goddard School of Business and Economics. So it makes more sense to hire an admin who could take care of the department needs rather than hire a person who would require substantial training to help students navigate QL requirements.

- 12-month (1.0) basis
- N24 pay range from $23,600 to $38,900 (we already have this position)

Potential job description for staff working with students:

- Provide current and future students with accurate information and guidance related to assessment of math skills, placement in appropriate general education QL (quantitative literacy) math courses and registration needs.
- Provide resources and connect students to additional learning resources.
- Identify, refer, and track students who need interventions due to lack of progress in completing QL math courses.
- Collaborate with department to develop and implement a variety of high-quality support systems, programs, and initiatives related to QL student success.
- Problem solve with faculty, administration and staff on student academic problems, issues, and concerns as an advocate for students.
- Maintain confidential student records using computer applications relevant for file maintenance and organization of caseload.
- Collaborate with faculty, departments, and campus entities to improve student success in QL.
- Develop informative services, events, materials, and resources for students, advisors, counselors, service units, and faculty to support QL student success.
- Work with Math Major Advisor as needed.
- Prepare written reports related to job duties.

7.1.1 Ongoing Staff Development:

Every year the administrative specialist with the department chair sets performance goals using the university's Performance Review and Enrichment Program (PREP). The chair set up an interview with the administrative assistant to evaluate the goals and the admin's performance. New goals are also discussed during that time. The administrative specialist is encouraged to participate in professional development classes/seminars given by the university. Over the last three years Debi Larson, department Administrative Specialist, has completed over 30 training sessions/courses, ranging from advising, branding, Excel, communication, to customer service.

Certifications were earned in Coach Certification to meet the needs of our diverse student body with nine different courses and the Certified Administrative Professional designation from the International Association of Administrative Professionals organization. The CAP exam included topics such as organizational communication, business writing and document production, technology & information distribution, office & records management, event and project management, and operational functions. A staff development grant was applied for and received to fund the $375 CAP exam.

7.2 Adequacy of Administrative Support:

During the pandemic, the administration was very supportive of the needs of the math department. Teaching mathematics remotely is very challenging for instructors and students, and mathematics has its challenges: writing math equations. The dean well communicated our needs, and together with the administration were able to find good solutions. For example, the provost provided additional funding to reduce class size to 25 students. The reduced size made the virtual/online learning more manageable, and instructors could engage students in active learning rather than lecturing. The administration also looked at different options for secure remote testing. And as a result, paper exams were administered through Proctorio and in a testing center. The department is very grateful for all this support.

The Solution Space (tutoring lab) was run by the Developmental Mathematics Program up to 2010 for developmental math students. In 2010 a new program (TERM) began. The operation was transferred to Student Support Services. They provide some training for the tutors and have worked with us to hire tutors that can tutor up through Calculus II. The tutors are mostly math majors, and they do a great job, based on reports from students who use them. Many students take advantage of this help. Continual efforts are made to advertise that help is available on a walk-in basis.

7.3 Adequacy of Facilities and Equipment:

The Department of Mathematics is housed in the new Tracy Hall Science Center, which provides new classrooms and furniture that are mostly adequate. Only nine classrooms are assigned to math, and a few others may be available from the college shared classrooms. Sometimes it is hard to find a classroom for courses at popular times, like 9:30 or 10:30.
One of our classrooms is an excellent elementary math education teaching lab with an attached storage room. The classroom is constantly updated, and teaching aids: new manipulatives are regularly purchased.

This year College of Science has remodeled Lind Lecture Hall, and a new computer lab was created, but because of the Covid-19, we had no chance to use it yet. The math department has a set of 24 laptops for classroom use. The laptops are used for labs in statistics, numerical analysis, and other courses. These are mostly adequate.

The department was well supported during the pandemic by the college and the university. The college purchased IPads with the stylus pen, which were available for faculty to rent. IPads made grading of math work much more manageable. The university technical classroom support provided cameras and document readers that were used for lectures.

7.4 Adequacy of Library Resources:

Library resources are mostly adequate. Math faculty, staff, and students have access to the university library resources. Students use various library materials for writing exercises, literature searches in several classes, and research projects. The Stewart Library has a dedicated science librarian who consults with math faculty to update and add library resources and notifies them of new items of interest. The department and individual faculty members recommend the purchase of new books and other materials. Traditional (hard copy) journal subscriptions continue to decrease due to high costs and the emerging preference for online full-text access. Students and faculty also have access to an interlibrary loan system that provides materials available from other libraries.

8. Standard G - RELATIONSHIPS WITH EXTERNAL COMMUNITIES

8.1 Description of Role in External Communities:

Over the past few years, the department has steadily improved its relationships and interactions with the school districts within the Weber State University service area. For example, in 2016 Dr. Rachel Bachman secured Mathematics Science Partnership (MSP) funding to create The 8x8 Mathematics Teachers Leadership Project which provides professional development workshops for K-12 teachers on the eight mathematical teaching practices outlined in *Principles to Actions* to help teachers support student use of the standards of mathematical practice. In 2018, the project was expanded through funding from the Utah STEM Action Center to serve twelve school districts and around 75 K-12 teachers across northern Utah. Several faculty members (Shawn Broderick, Alees Lee, Cora Neal, and C. David Walters) have collaborated with Rachel Bachman on this project over the past five years. In addition to The 8x8 Project, the mathematics educators in the department regularly facilitate workshops for other grant projects (Reach for the Top, Math + Dance, BS PD, etc.) and teach evening classes for area teachers pursuing elementary mathematics and STEM teaching certification. Just this year, Adam Johnston from the physics department and Rachel Bachman from the mathematics department collaborated to propose NSF Noyce funding for a scholarship program that would further unite the department with local districts to better prepare preservice teachers and support in-service teachers. What is more, the department has been working with local districts to offer Concurrent Enrollment courses since 2014. As part of this effort, various members of the department also offer training for the local high school teachers teaching such courses. Numerous members of the department have been involved in this effort.

8.1.2 Math State Contest

Every three years, each of the math departments in the major universities in Utah host the state math contest. Weber State's turn was for the years 2018, 2019, and 2020. The state math contest is a math test created by the professors in the math department and given to junior high and high school students. There are two tests with 40 questions each. The junior test is for 7th-9th grade students and the senior test is for 10th-12th grade students. The junior test covers topics from arithmetic, algebra, geometry, number theory, probability, and combinatorics. The senior test covers the same topics plus trigonometry and calculus. There were 1300 participants from districts all over the state in 2018 and 1600 participants each year in 2019 and 2020. Each year, we recruited 40 volunteers to serve as proctors. Each year prior to the exam, goodie bags were assembled for each participant by a team of approximately 10-15 people. The test was administered at 9:30 a.m. and the students had two hours and 30 minutes to complete it. At noon, a lunch was served for the participants, their chaperones, and the proctors. In 2018 and 2019, about a month after the test, we held an awards banquet for the top 7 finishers from each grade and two guests, which were usually their parents. In 2020, we had to cancel the banquet because of COVID-19. The top finishers' banquet featured a dinner for all invited guests and awards for the students. The awards included a trophy and an Amazon gift card. The state math contest was a great opportunity for Weber State's math department to better their ties to the community and they did.

8.2 Summary of External Advisory Council Activities:

During Spring 2020, math advisory committee members were interviewed about the strengths and weaknesses of the WSU Math Department and programs.

8.2.1 Math Advisory Committee Members

Pure Math:

- Jake Rhodes – 2017 pure math graduate – doctoral student in mathematics at USU
- Emily Coulam – 2018 pure math graduate – math teacher at Ben Lomand HS
- Eric McKinney – pure math graduate – doctoral student in statistics at USU

Teaching:

- Stacie Levitt – 2018 math teaching graduate – math teacher at Roy HS
- Kimberlee Duffin – 2014 math teaching graduate – math dept co-chair at Ogden HS
- Lindsey Henderson – K-12 math specialist in Davis School District

Applied Math:

- Alex Nielson – 2019 applied math graduate – pursuing career in data science

Industry:

- Craig Gale – data analyst/statistician at Health Catalyst
- David Neal – analytics manager at Wells Fargo Bank
- Sterling Patterson – PAQ program manager at Hill Air Force Base

Summary:

Advisory Members felt that the level of rigor in their pure math classes prepared them well for graduate school. Some felt that the level of rigor was lacking in the applied math classes, and mentioned that their peers in graduate school had better preparation in the use of technology. They cited university tutoring programs as both an invaluable place to receive support and an opportunity for part-time employment that allowed them to strengthen their math skills.

Teaching majors expressed appreciation for the level of support given to them by individual instructors. They favorably mentioned the recent increase in courses designed specifically for future teachers. There is some level of disconnect between the math education courses and the courses taken within the College of Education, as well as a disconnect between the upper division math content of required courses and their applicability to teaching in a high school. Teachers praised the concurrent enrollment program and the "phenomenal" professional development opportunities offered by Weber State. Both programs are presenting student-centered best practices and have worked to strengthen the bonds between the K-12 institutions and the university.

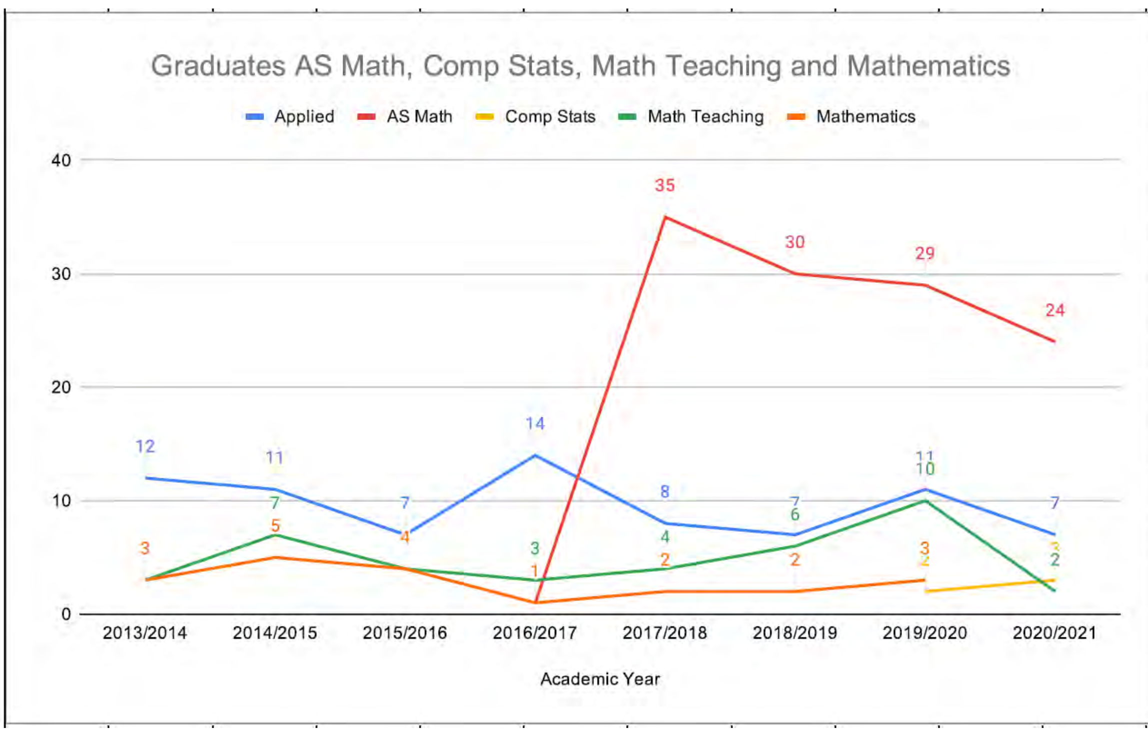
A recent graduate in applied math emphasized the importance of using current software. Students felt that the applied courses did not take advantage of recent developments in technology. The current computing course is taught using Mathematica, a program that they felt was not being used in their future career fields and that programs such as R, Python, or even SQL would have been more applicable.

Advisory Members from industry work places appreciate the variety of options in the new Statistical Computing and Data Science major. They feel that the course offerings are relevant for potential jobs. They expressed the need for students to know more than just STEM subjects noting that skills such as writing, presenting and interpersonal relations are important for success in the business world.

8.3 Success of Math Graduates:

Since the last program review in 2017/2018, the Math Department graduated 33 students in Applied Math, 22 students in Math Teaching, 7 students in Mathematics and 5 students in Computational Statistics and Data Science. The Data Science program started in 2019/2020. The department also awarded 118 Associates degrees in Mathematics. Our graduates find employment in the industry, at middle or high schools, and our graduates are accepted to graduate programs.

COUNTA of W#	*Major*					
Academic Year	Applied	AS Math	Comp Stats	Math Teaching	Mathematics	Grand Total
2013/2014	12			3	3	18
2014/2015	11			7	5	23
2015/2016	7			4	4	15
2016/2017	14	1		3	1	19
2017/2018	8	35		4	2	49
2018/2019	7	30		6	2	45
2019/2020	11	29	2	10	3	55
2020/2021	7	24	3	2		36
Grand Total	**77**	**119**	**5**	**39**	**20**	**260**



8.3.1 A Success Story of an Applied Math Graduate

One of our 2017 Weber State University graduate in applied mathematics , Andrew Whetten, was named the 2020 winner of the inaugural ENVR Data Challenge sponsored by the American Statistical Association (ASA) for his research using high-dimensional satellite weather data to identify the impact of climate change and water levels of the Great Lakes.

Whetten, with support from brother Ryan Whetten and friend Joseph Paulson, identified that a relatively new branch of statistics, Functional Data Analysis, had not been implemented on high-dimensional satellite weather data to explore climate change. Functional Data Analysis methods provide information about curves varying over some continuum, such as time. The sample element, in such an analysis, is the functional behavior of both temperature and precipitation rather than a single measurement of the respective variables.

The group analyzed the ERA-Interim, an atmospheric data set, generously provided by Jupiter Intelligence, a climate science research corporation. This data captured daily precipitation, maximum temperatures, and minimum temperature readings that spanned from Mexico to central Canada and ranged from the years 1979-2017 on a 80 km (kilometer) resolution. “That is a lot of data, approximately 227 million observations or somewhere around 4 gigabytes,” Whetten said.

Andrew Whetten graduated with applied math degree from Weber State University. He has completed his master’s degree in statistics from Utah State University and is now working on his Ph.D. at University of Wisconsin-Milwaukee.

9. Standard H - PROGRAM SUMMARY

9.1 Results from 2017-2018 Program Review:

The external review team's report identified some challenges and made five recommendations to improve the Department's programs. For the last three years, we have been able to implement each of the recommendations as best as we could, with the Dean's Office and the central administration's support. Our actions are summarized below.

Problem Identified	Action Taken	Progress
<u>Recommendation 1.</u> Rewrite Mission Statement and Strategic Plan in order to find common goals and set priorities so that all faculty have a role in working together on re-evaluating and improving their mission.	The department reviewed and edited the Mission Statement to reflect our goals and set priorities for collaboration within the department and with other Colleges.	Revision of the Mission Statement was completed in October of 2020.
<u>Recommendation 2.</u> Hiring full-time faculty rather than contract faculty/adjuncts will help in several areas.	Even though the department hired a Math Education Faculty in Fall of 2020, we have identified a desperate need for a statistician and a faculty in applied math to support math courses required for engineering programs.	The recommendation was completed in 2019-2020 academic year and hopefully will continue for the next academic year.
<u>Recommendation 3.</u> Hiring an additional staff member, even part-time, will alleviate pressure on faculty and the one current staff member.	This recommendation is also identified in this program review. Funding for hiring an additional staff member needs to come from the administration.	The recommendation is not completed.
<u>Recommendation 4.</u> Classroom space should be improved by scheduling classes in larger rooms or by	Classroom space had been better utilized, and some of the classes are scheduled in larger rooms shared	This recommendation is completed.

making available additional classroom space. Workroom space/facilities should be re-evaluated and improved.	within the college. Workroom space had been rearranged so that space is better utilized.	
Recommendation 5. We recommend assigning course coordinators for multi-section courses.	We have assigned a faculty advisor for each QL course. Since most of our QL courses are taught by adjuncts, one faculty is assigned to help with course content and look over exams of new adjuncts.	This recommendation has partially been addressed and is still a working progress.

9.2. Action Plan for Ongoing Assessment Based on Current Self Study Findings:

Action Plan for Evidence of Learning Related Findings

Problem Identified	Action to Be Taken
Issue 1 Look for more efficient and more meaningful assessment of our programs.	Currently, our programs are assessed mainly by assessing the required courses in each program. This assessment is very time-consuming. We will check how other departments evaluate their programs, learn more about assessment using portfolios, and discuss what we can do to have a more meaningful assessment.
Issue 2 Each course has a set of learning outcomes specific to the course. QL courses have a common set of learning outcomes adopted by the university level General Education Committee. Most of the learning outcomes for every course were met.	Identify, discuss, and suggest changes individually and in the responsible committees as we have always done to improve learning. Adjust teaching methods, content, computer programs, textbooks, tutoring services, recitations. Some faculty provide recitation-type office hours by meeting students in a classroom for an hour of tutoring and problem-solving.

9.3. Action Plan for Staff, Administration, or Budgetary Findings:

Problem Identified	Action to Be Taken
Issue 1 Need for a new faculty line - Statistician	In the last year's Strategic Plan, the department provided data, and thorough justification for a new faculty line in statistics based on a growing number of statistics courses, the need for an ever-increasing Applied Statistics and Data Science program, and the need to provide statistical support for faculty collaborating on various research projects throughout the university.
Issue 2 Need for a new faculty line – Applied Math to support math for growing Engineering Programs	Five years ago, the College of Engineering and Applied Technology started to offer two new engineering programs. Mathematics is a big part of engineering. The Math Department never received a new faculty line to support the growth. We are coming to the point that we might not be able to offer enough math courses to satisfy students' demands.
Issue 3 Hire an additional staff member	As it was identified in the last program review, hiring an additional staff member would alleviate pressure on faculty and the one current staff member.
Issue 4 Summer Budget	Although not addressed in this report, engineering students asked for more math courses to be offered during the summer. By offering more math courses, students could complete math during the summer and have a lighter load in the fall. That would allow them to spend more time on engineering courses and make their study more manageable.

APPENDICES

Appendix A: Student and Faculty Statistical Summary
Note: Data provided by Institutional Effectiveness.

Mathematics	2015-16	2016-17	2017-18	2018-19	2019-20
Student Credit Hours Total [1]	**17,753**	**18,232**	**18,715**	**18,981**	**18,860**
Student FTE Total [2]	**591.77**	**607.73**	**623.83**	**632.70**	**628.67**
Student Majors [3]	114	104	109	119	117
(bachelor intent)					
(associate intent)	0	2	7	4	5
Program Graduates [4]					
Associate Degree	0	1	35	30	30
Bachelor Degree	14	16	12	15	24
Student Demographic Profile [5]					
Female	53	49	58	59	59
Male	61	55	51	60	58
Faculty FTE Total [6]	**29.35**	**25.71**	**28.25**	**28.93**	n/a
Adjunct FTE	12.78	11.38	11.61	10.28	n/a
Contract FTE	16.57	14.33	16.64	18.65	n/a
Student/Faculty Ratio [7]	**20.16**	**23.64**	**22.08**	**21.87**	n/a

1 **Student Credit Hours Total** represents the total department-related credit hours for all students per academic year. Includes only students reported in Banner system as registered for credit at the time of data downloads

2 **Student FTE Total** is the Student Credit Hours Total divided by 30

3 **Student Majors** is a snapshot taken from self-report data by students in their Banner profile as of the third week of the Fall term for the academic year. Only 1st majors count for official reporting.

4 **Program Graduates** includes only those students who completed all graduation requirements by end of Spring semester for the academic year of interest. Students who do not meet this requirement are included in the academic year in which all requirements are met. Summer is the first term in each academic year.

5 **Student Demographic Profile** is data retrieved from the Banner system.

6 **Faculty FTE** is the aggregate of contract and adjunct instructors during the fiscal year. **Contract FTE** includes instructional-related services done by "salaried" employees as part of their contractual commitments. **Adjunct FTE** includes instructional-related wages that are considered temporary or part-time basis. Adjunct wages include services provided at the Davis campus, along with on-line and Continuing Education courses.

7 **Student/Faculty Ratio** is the Student FTE Total divided by the Faculty FTE Total.

Appendix B:

Faculty (academic year 2020/2021)

	Tenure and tenure-track	Contract	Adjunct
Number of faculty with Doctoral degrees	17	0	0
Number of faculty with Master's degrees	0	1	7
Number of faculty with Bachelor's degrees	0	0	18
Other Faculty	0	0	0
Total	17	1	25

Mathematics Faculty

Name	Gender	Ethnicity	Rank	Tenure Status	Highest Degree	Full-time Status	Start Year	Years at WSU	Areas of Expertise
Akelbek, Mahmud	M	Asian	Associate Professor	Tenured	Ph.D	Full-time	2010	10	Combinatorics, Graphy Theory
Bachman, Rachel	F	Caucasian	Associate Professor	Tenured	E.ED	Full-time	2013	7	Math Education
Broderick, Shawn	M	Caucasian	Assistant Professor	Tenure Track	Ph.D	Full-time	2016	4	Math Education, Geometry
Cai, Chloe	F	Asian	Professor	Tenured	Ph.D	Full-time	2008	12	PDEs, Math Education
Chan, Julian	M	Asian	Associate Professor	Tenured	Ph.D	Full-time	2012	8	Cohomology, Statistics
Cocos, Mihail	M	Caucasian	Associate Professor	Tenured	Ph.D	Full-time	2007	13	Geometric PDEs, Differential Geometry
Dixon, Shannon	F	Caucasian	Instructor	Non-Tenure	MS	Full-time	2018	2	
Fital-Akelbek, Sandra	F	Caucasian	Professor	Tenured	Ph.D	Full-time	2008	12	Matrix Theory

Ghoreishi, Afshin	M	Middle Eastern	Professor	Tenured	Ph.D	Full-time	1992	28	Applied Mathematics
Kidman, Kent	M	Caucasian	Professor	Tenured	Ph.D	Full-time	1990	30	Linear Algebra, Matrix Theory
Kvernadze, George	M	Caucasian	Professor	Tenured	Ph.D	Full-time	1998	22	Approximation Theory
Lee, Alees	F	Caucasian	Assistant Professor	Tenure Track	Ph.D	Full-time	2020	0	Math Education
Neal, Cora	F	Caucasian	Associate Professor	Tenured	Ph.D	Full-time	2015	5	Combinatorics, Probability and Statistics
Ondrus, Matt	M	Caucasian	Professor	Tenured	Ph.D	Full-time	2004	16	Representation theory of quantum groups and related algebras
Peters, James	M	Caucasian	Associate Professor	Tenured	Ph.D	Full-time	1988	32	PDEs, Numerical Analysis
Steele, TH	M	Caucasian	Professor	Tenured	Ph.D	3/4 Time	1994	26	Real Analysis
Talaga, Paul	M	Caucasian	Professor	Tenured	Ph.D	Full-time	1980	40	Differential Equations
Walters, C David	M	Caucasian	Assistant Professor	Tenure Track	Ph.D	Half Time	2017	3	Math Education

Contract/Adjunct Faculty Profile

Developmental Math Faculty teaching math courses

Name	Gender	Ethnicity	Position	Highest Degree	Start Year	Years Taught	Courses Taught
Acor, Brenda	F	Caucasian	Faculty	MA	2003	17	1050, 1060, 1210, 2010
Baker, Loyal	M	Caucasian	Faculty	MS	2002	18	1030
Dunn, Chris	M	Caucasian	Faculty	BS	2017	3	1050, 1810 (1035)
Hansen, Amber	F	Caucasian	Faculty	M.Ed.	2018	2	1810 (1035)
Imig, David	M	Caucasian	Faculty	MS	2003	17	1050, 1060, 1210

Jones, Charity	F	Caucasian	Faculty	BS	2013	7	1050
Lewis, Christine	F	Caucasian	Faculty	BS	2013	7	1040, 1060
McKee, Debi	F	Caucasian	Faculty	MS	2011	9	1050, 2010
Penrod, Janette	F	Caucasian	Faculty	BS	2012	8	1050, 2020
Poore, Darrell	M	Caucasian	Faculty	BS	2000	20	1040, 1060, 1080, 1210
Quesnell, Carrie	F	Caucasian	Faculty	M.Ed.	2004	16	1030, 1050, 1080, 1810 (1035)
Symonds, Kassidy	F	Caucasian	Faculty	BS	2019	1	1030

Outside Adjuncts (Academic Year 2020/2021)

Name	Gender	Ethnicity	Position	Highest Degree	Start Year	Years Taught	Courses Taught
Grotepas, Emily	F	Caucasian	Adjunct	BS	2019	1	1030, 1050
Haueter, Gordon	M	Caucasian	Adjunct	BS	2008	12	1050, 1060
Hollopeter, Allen	M	Caucasian	Adjunct	BS	2008	12	1050
Kent, Randall	M	Caucasian	Adjunct	BS	2013	7	1050, 1060, 1110, 1210
Kunimura, Dennis	M	Asian	Adjunct	MS	2013	7	1040, 1050, 1060
Lewis, Blair	M	Caucasian	Adjunct	BS	2019	1	1040
Peterson, Cameron	M	Caucasian	Adjunct	BS	2020	0	1030
Quintrequeo, JeRee	F	Caucasian	Adjunct	BS	2014	6	1050, 1060
Rhodes, Jake	M	Caucasian	Adjunct	BS	2017	3	1030, 1050, 1060
Sandoval, Suzanne	F	Caucasian	Adjunct	BS	2016	4	1030, 1050, 1060
Walthers, Phil	M	Caucasian	Adjunct	MS	2008	12	1050, 1060, 1210, 1220, 2210, 2280
Wheeler, Nikki	F	Caucasian	Adjunct	BS	2008	12	1050
Wheeler, Randy	M	Caucasian	Adjunct	BS	2008	12	1050, 1080, 1210

Appendix C: Staff Profile

Name	Gender	Ethnicity	Job Title	Years of Employment	Areas of Expertise
Deborah Larson	F	Caucasian	Administrative Assistant	9	Numerous computer programs Record keeping University policies Department policies Prerequisite Check Navigating QL Communication Flyers News letters Art work for posters Data collection

Appendix D: Financial Analysis Summary
This information is be provided by the Office of Institutional Effectiveness

Mathematics				
Funding	**15-16**	**16-17**	**17-18**	**18-19**
Appropriated Fund	1,486,794	1,561,336	1,726,341	1,868,062
Other: IW Funding from CE	212,165	185,595	170,325	182,330
Special Legislative Appropriation				
Grants or Contracts				
Special Fees/Differential Tuition				
Total	1,698,959	1,746,931	1,896,666	2,050,392

Student FTE Total	591.77	607.73	623.83	632.70
Cost per FTE	$2,871	$2,875	$3,040	$3,241

Appendix E: External Community Involvement Names and Organizations

Name	Organization
Berkenpas, John	ATK-Orbits
Kubica, Kris	JBT AeroTech
Murray, April	Walquist Jr. High
Nowlin, Col Scott	HAFB
Peters, Joyce	HAFB
Redd, Andrew	U of U
Tomalino, Alan	HAFB
Willden, Shawn	Google

Appendix F: Site Visit Team (both internal and external members)

Name	Position	Affiliation
Derek Hein	Associate Professor Mathematics	Southern Utah University
Violeta Vasilevska	Professor Mathematics	Utah Valley University
Peter Alfeld	Professor Mathematics	University of Utah
Hugo Valle	Associate Professor School of Computing	Weber State University

Appendix G: Evidence of Learning Courses within the Major

Course: Math 1210 Semester taught: Fall 2019 Sections included: 7, Total number of students 156

Evidence of Learning: MATH 1210 Calculus I						
Measurable Learning Outcome Students will…	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
1. Basic Abilities a. Evaluate limits using algebraic techniques. b. Find derivative of algebraic and trigonometric functions, defined explicitly or implicitly, using differentiation rules. c. Evaluate definite and indefinite integrals using basic integration techniques, including substitution.	Measure 1: Seven questions on the final exam	Measure 1: 60% of students will score 70% or better	Measure 1: 64% of students scored 70% or better on assessment questions (100 students out of 156)	Measure 1: The target performance has been met	Collect more data	
	Measure 2: Course pass rate	Measure 2: 70% of students will pass the course	Measure 2: 71.83% pass rate	Measure 2: The target performance has been met		
2. Applications a. Find equation of a tangent line, find velocity and acceleration, approximate value of a function, or approximate a zero of a function. b. Graph functions or determine their behavior using first and second derivatives. c. Solve optimization and/or related rates problems. d. Find areas under curves, volume of solids of revolution, or the work done by a variable force.	Measure 1: Seven questions on the final exam	Measure 1: 60% of students will score 65% or better	Measure 1: 60% of students scored 65% or better on assessment questions (93 students out of 156)	Measure 1: The target performance has been met		
	Measure 2: Course pass rate	Measure 2: 70% of students will pass the course	Measure 2: 71.83% pass rate	Measure 2: The target performance has been met		

3. Foundational Deeper Understanding a. Understand the definition of limits, derivatives, or integrals, and/or interpret derivative as the rate of change or definite integral as net area. b. Understand important theorems such as Intermediate Value Theorem, Extreme value Theorem, Rolle's Theorem, Differential or Integral Mean Value Theorems or Fundamental Theorem of Calculus.	Measure 1: Three questions on the final exam	Measure 1: 60% of students will score 60% or better	Measure 1: 64% of students scored 60% or better on assessment questions (100 students out of 156)	Measure 1: The target performance has been met		
	Measure 2: Course pass rate	Measure 2: 70% of students will pass the course	Measure 2: 71.83% pass rate	Measure 2: The target performance has been met		

*Direct and indirect: at least one measure per objective must be a direct measure.
Additional narrative (optional – use as much space as needed):

Course: Math 1220 Semester taught: Fall 2019 Sections included: 5, Total number of students 117

Evidence of Learning: MATH 1220 Calculus II						
Measurable Learning Outcome Students will…	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
1. Basic Abilities a. Evaluate limits using algebraic techniques. b. Find derivative of algebraic and trigonometric functions, defined explicitly or implicitly, using differentiation rules. c. Evaluate definite and indefinite integrals using basic integration techniques, including substitution.	Measure 1: Six questions on the final exam	Measure 1: 60% of students will score 70% or better	Measure 1: 50% of students scored 70% or better on assessment questions (59 students out of 117)	Measure 1: The target performance has not been met	Collect more data, focus on more review	
	Measure 2: Course pass rate	Measure 2: 70% of students will pass the course	Measure 2: 65.93% pass rate	Measure 2: The target performance has not been met	Carefully examine the situation. Look what can be done to improve the pass rate	
2. Applications a. Find equation of a tangent line, find velocity and acceleration, approximate value of a function, or approximate a zero of a function. b. Graph functions or determine their behavior using first and second derivatives. c. Solve optimization and/or related rates problems. d. Find areas under curves, volume of solids of revolution, or the work done by a variable force.	Measure 1: Four questions on the final exam	Measure 1: 60% of students will score 65% or better	Measure 1: 64% of students scored 65% or better on assessment questions (75 students out of 117)	Measure 1: The target performance has been met		
	Measure 2: Course pass rate	Measure 2: 70% of students will pass the course	Measure 2: 65.93% pass rate	Measure 2: See above		

3. Foundational Deeper Understanding a. Understand the definition of limits, derivatives, or integrals, and/or interpret derivative as the rate of change or definite integral as net area. b. Understand important theorems such as Intermediate Value Theorem, Extreme value Theorem, Rolle's Theorem, Differential or Integral Mean Value Theorems or Fundamental Theorem of Calculus.	Measure 1: Eight questions on the final exam	Measure 1: 60% of students will score 60% or better	Measure 1: 65% of students scored 60% or better on assessment questions (76 students out of 117)	Measure 1: The target performance has been met		
	Measure 2: Course pass rate	Measure 2: 70% of students will pass the course	Measure 2: 65.93% pass rate	Measure 2: See above		

*Direct and indirect: at least one measure per objective must be a direct measure.
Additional narrative (optional – use as much space as needed):

Course: Math 2210 Semester taught: Fall 2019 Sections included: 1 section with 29 students

Evidence of Learning: **MATH 2210 Calculus III**						
Measurable Learning Outcome Students will…	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
1. **Basic Abilities** a. Find the derivatives and integrals of vector-valued functions. b. Find partial derivatives of functions of two or more variables. c. Evaluate double and triple integrals in Cartesian, polar, cylindrical, and/or spherical coordinates.	Measure 1: Three questions on the final exam	Measure 1: 70% of students will score 70% or better on three questions	Measure 1: 73% of students scored 70% or better on three questions	Measure 1: Students successfully demonstrated basic abilities	No pedagogical changes are needed at this time	
	Measure 2: Course pass rate	Measure 2: 70% pass rate (W included)	Measure 2: 83% pass rate	Measure 2: The performance target was met		
2. Applications a. Use vectors to solve applied problems and find equations of lines and planes is three dimensions. b. Find arc length or curvature of space curves, or use vector-valued functions to describe motion in space. c. Use partial derivatives to find directional derivatives, equations of a tangent planes or approximate values of functions of two or more variables and solve optimization application problems involving functions of two variables	Measure 1: 5 questions on the final exam	Measure 1: 70% of students will score 70% or better on three questions	Measure 1: 73% of students scored 70% or better on three questions	Measure 1: Students successfully demonstrated knowledge of applications	No pedagogical changes are needed at this time	
	Measure 2: Course pass rate	Measure 2: 70% pass rate (W included)	Measure 2: 83% pass rate	Measure 2 The performance target was met		

3. Foundational Deeper Understanding a. Understand the definition of limits of functions of two variable, partial derivatives, or multiple integrals, and/or interpret directional derivatives, or convert integrals between different coordinate systems. b. Understand vector fields and the Fundamental Theorem of Line Integrals. c. Understand important theorems such as Green's, Stokes', or divergence theorems.	Measure 1: Three questions on the final exam	Measure 1: 70% of students will score 70% or better on three questions	Measure 1: 61% of students scored 70% or better on three questions	Measure 1: The threshold was not met.	Some pedagogical changes are needed	
	Measure 2: Course pass rate	Measure 2: 70% pass rate (W included)	Measure 2: 83% pass rate	Measure 2: The performance target was met		

*Direct and indirect: at least one measure per objective must be a direct measure.

Additional narrative (optional – use as much space as needed):

Course: Math 2270 Semester taught: Fall 2019 Sections included: 1 section with 30 students

Evidence of Learning: **MATH 2270 Elementary Linear Algebra**						
Measurable Learning Outcome Students will…	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
1. Know how to solve systems of linear equations..	Measure 1: Question on Midterm 1	Measure 1: 70% of students (20 out of 28) score 70% or above	Measure 1: 21 out of 28 scored 70% or above	Measure 1: Satisfactory results		
	Measure 2: Question on Midterm 2	Measure 2: 70% of students score 70% or above	Measure 2: 22 out of 28 scored 70% or above	Measure 2: Satisfactory results		
2. Know, understand, and be able to apply the concepts of matrices, matrix algebra, and determinants to solve problems	Measure 1: Question on Midterm 1	Measure 1: Same as outcome 1	Measure 1: 25 out of 28 scored 70% or above	Measure 1: Satisfactory results		
	Measure 2: Question on Midterm 2	Measure 2: Same as outcome 1	Measure 2: 25 out of 28 scored 70% or above	Measure 2: Satisfactory results		
3. Know, understand, and be able to apply the concepts of vector spaces to calculate results, establish basic theorems, and prove conjectures in a clear and mathematically correct way.	Measure 1: Question on Midterm 1	Measure 1: Same as outcome 1	Measure 1: 22 out of 28 scored 70% or above	Measure 1: Satisfactory results		
	Measure 2: Question on final exam	Measure 2: Same as outcome 1	Measure 2: 17 out of 28 scored 70% or above	Measure 2: Question was asked in somewhat abstract form, so students struggled slightly.		

4. Know, understand, and be able to apply the concept of linear transformations to calculate results, establish basic theorems, and prove conjectures in a clear and mathematically correct way.	Measure 1: Question on Midterm 2	Measure 1: Same as outcome 1	Measure 1: 27 out of 28 scored 70% or above	Measure 1: Satisfactory results		
	Measure 2: Question on Midterm 3	Measure 2: Same as outcome 1	Measure 2: 23 out of 28 scored 70% or above	Measure 2: Satisfactory results		
5. Be able to understand and to compute eigenvalues and eigenvectors, and apply these concepts to solving problems.	Measure 1: Question on Midterm 3	Measure 1: Same as outcome 1	Measure 1: 27 out of 28 scored 70% or above	Measure 1: Satisfactory results		
	Measure 2: Question on final exam	Measure 2: Same as outcome 1	Measure 2: 15 out of 28 scored 70% or above	Measure 2: Question addressed diagonalizing a matrix with 0 as an eigenvalue.	Some students simply didn't realize that 0 can be an eigenvalue. I need to emphasize this more in future semesters.	

*Direct and indirect: at least one measure per objective must be a direct measure.

Additional narrative (optional – use as much space as needed):

Course: Math 2280 Semester taught: Fall 2019 Sections included: 1 section

Evidence of Learning: **MATH 2280 Ordinary Differential Equations**						
Measurable Learning Outcome Students will…	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
1. Classify equations as an ordinary differential equation or not. Classify ordinary differential equations by order and linear versus non-linear. Discuss existence and uniqueness of solutions of ordinary differential equations and/or draw and interpret direction fields of the first order ordinary differential equations	Measure 1: Question 5 on the Final Exam	Measure 1: 70% of students will score 70% or better on the question	Measure 1: 75% of students scored 70% or better on the question	Measure 1: Students successfully demonstrated basic abilities	No pedagogical changes are needed at this time	
	Measure 2: Course pass rate	Measure 2: 70% pass rate (W included)	Measure 2: 80 % pass rate	Measure 2: The target performance has been met		
2. Create an ordinary differential equation with initial value(s) to model real life applications, for example, falling bodies, growth and decay, input-output, or position of a mass on a spring. Solve the model and interpret the results.	Measure 1: Question 8 on the Final Exam	Measure 1: 70% of students will score 70% or better on the question	Measure 1: 75% of students scored 70% or better on the question	Measure 1: Students successfully demonstrated basic abilities	No pedagogical changes are needed at this time	
	Measure 2: Course pass rate	Measure 2: 70% pass rate (W included)	Measure 2: 80 % pass rate	Measure 2: The target performance has been met		
3. Solve separable, exact and linear first order ordinary differential equations	Measure 1: Question 1 on the Final Exam	Measure 1: 70% of students will score 70% or better on the question	Measure 1: 100% of students scored 70% or better on the question	Measure 1: Students successfully demonstrated basic abilities	No pedagogical changes are needed at this time	
	Measure 2: Course pass rate	Measure 2: 70% pass rate (W included)	Measure 2: 80 % pass rate	Measure 2: The target performance has been met		

4. Solve second or higher order, homogeneous, linear, constant coefficients ordinary differential equations.	Measure 1: Question 4 on the Final Exam	Measure 1: 70% of students will score 70% or better on the question	Measure 1: 100% of students scored 70 % or better on the question	Measure 1: Students successfully demonstrated basic abilities	No pedagogical changes are needed at this time	
	Measure 2: Course pass rate	Measure 2: 70% pass rate (W included)	Measure 2: 80 % pass rate	Measure 2: The target performance has been met		
5. Solve second or higher order ordinary differential equations using the methods of undetermined coefficient, variation of parameter and reduction of order, as applicable.	Measure 1: Question 5 on the Final Exam	Measure 1: 70% of students will score 70% or better on the question	Measure 1: 75% of students scored 70% or better on the question	Measure 1: Students successfully demonstrated basic abilities	No pedagogical changes are needed at this time	
	Measure 2: Course pass rate	Measure 2: 70% pass rate (W included)	Measure 2: 80 % pass rate	Measure 2: The target performance has been met		
6. Use the Laplace Transform technique to solve second order ordinary differential equations with initial values.	Measure 1: Question 10 on the Final Exam	Measure 1: 70% of students will score 70% or better on the question	Measure 1: 75% of students scored 70% or better on the question	Measure 1: Students successfully demonstrated basic abilities	No pedagogical changes are needed at this time	
	Measure 2: Course pass rate	Measure 2: 70% pass rate (W included)	Measure 2: 80 % pass rate	Measure 2: The target performance has been met		
7. Use the series method to solve second order ordinary differential equations near an ordinary point.	Measure 1: Question 13 on the Final Exam	Measure 1: 70% of students will score 70% or better on the question	Measure 1: 75% of students scored 70% or better on the question	Measure 1: Students successfully demonstrated basic abilities	No pedagogical changes are needed at this time	
	Measure 2: Course pass rate	Measure 2: 70% pass rate (W included)	Measure 2: 80 % pass rate	Measure 2: The target performance has been met		

*Direct and indirect: at least one measure per objective must be a direct measure.

Course: Math 3110 Semester taught: Spring 2020 Sections included: 1 section with 31 students

Evidence of Learning: **MATH 3110 Foundation of Algebra**						
Measurable Learning Outcome Students will…	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
1. Understand basic mathematical logic, both the definitions and applications to mathematical proof.	Measure 1: Question on Ex 1	Measure 1: 70% of students (19 out of 27) earn at least 70% of possible points	Measure 1: 23 students achieved target score	Measure 1: Target met		
	Measure 2: Question on Ex 2	Measure 2: Same as above.	Measure 2: 19 students achieved target score	Measure 2: Target met		
2. Understand the concept of proof and demonstrate proof writing skills.	Measure 1: Question on Ex 1	Measure 1: Same as Outcome 1	Measure 1: 24 students achieved target score	Measure 1: Target met		
	Measure 2: Question on final exam	Measure 2: Same as Outcome 1	Measure 2: 21 students achieved target score	Measure 2: Target met		
3. Write proofs in the areas of basic set theory, number theory, and algebra.	Measure 1: Question on Ex 2	Measure 1: Same as Outcome 1	Measure 1: 15 students achieved target score	Measure 1: Difficult topic. Assess on final exam also.	Will create some video resources on this topic next time I teach the course.	
	Measure 2: Question on final exam	Measure 2: Same as Outcome 1	Measure 2: 22 students achieved target score	Measure 2: Target met		
4. Gain exposure to more advanced topics in algebra such as group theory and ring theory.	Measure 1: Question on Ex 3	Measure 1: Same as Outcome 1	Measure 1: 23 students achieved target score	Measure 1: Target met		

	Measure 2: Question on final exam	Measure 2: Same as Outcome 1	Measure 2: 26 students achieved target score	Measure 2: Target met		
5. Be able to understand abstraction.	Measure 1: Question on Ex 2	Measure 1: Same as Outcome 1	Measure 1: 17 students achieved target score	Measure 1: Abstraction takes time to learn. Assess again later.	This is always a difficult outcome for students. Learning it takes patience / time.	
	Measure 2: Question on final exam	Measure 2: Same as Outcome 1	Measure 2: 23 students achieved target score	Measure 2: Target met		

*Direct and indirect: at least one measure per objective must be a direct measure.

Additional narrative (optional – use as much space as needed):

Course: Math 3160 Semester taught: Spring 2020 Sections included: 1 section with 28 students

Evidence of Learning: **MATH 3160 Number Theory**						
Measurable Learning Outcome Students will…	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
1. Prove an appropriate statement using Mathematical Induction.	Measure 1: 15 minute in-class quiz	Measure 1: 70% of students will score 70% or better on the question	Measure 1: 21 of 28 students scored 70% or better on the question	Measure 1: Satisfactory results		
	Measure 2: Question on final exam	Measure 2: 70% of students will score 70% or better on the question	Measure 2: 26 of 28 students scored 70% or better on the question	Measure 2: Satisfactory results		
2. Solve a linear Diophantine and congruence equation.	Measure 1: 15 minute in-class exam	Measure 1: 70% of students will score 70% or better on the question	Measure 1: 23 of 28 students scored 70% or better on the question	Measure 1: Satisfactory results		
	Measure 2: Question on final exam	Measure 2: 70% of students will score 70% or better on the question	Measure 2: 25 of 28 students scored 70% or better on the question	Measure 2: Satisfactory results		
3. Be familiar with the Fundamental Theorem of Arithmetic, the Chinese Remainder Theorem, and Euler's Theorem, and be able to use those results to prove and/or calculate a posed theoretical or applied problem in a clear and mathematically correct way.	Measure 1: 15 minute in-class exam	Measure 1: 70% of students will score 70% or better on the question	Measure 1: 24 of 28 students scored 70% or better on the question	Measure 1: Satisfactory results		
	Measure 2: Question on mid-term exam	Measure 2: 70% of students will score 70% or better on the question	Measure 2: 27 of 28 students scored 70% or better on the question	Measure 2: Satisfactory results		

4. Be familiar with multiplicative functions, the Euler Phi-function, Mobius inversion, and be able to use those results to prove and/or calculate a posed theoretical or applied problem.	Measure 1: Question on mid-term exam	Measure 1: 70% of students will score 70% or better on the question	Measure 1: 26 of 28 students scored 70% or better on the question	Measure 1: Satisfactory results		
	Measure 2: Question on final exam	Measure 2: 70% of students will score 70% or better on the question	Measure 2: 23 of 28 students scored 70% or better on the question	Measure 2: Satisfactory results		
5. Be familiar with primitive roots and be able to use this concept to prove and/or calculate a posed theoretical or applied problem.	Measure 1: Question on final exam	Measure 1: 70% of students will score 70% or better on the question	Measure 1: 22 of 28 students scored 70% or better on the question	Measure 1: Satisfactory results		
	Measure 2: Course pass rate	Measure 2: 70% of students will pass the course	Measure 2: 26 of 28 students passed the course with a C or better	Measure 2: Satisfactory results		

*Direct and indirect: at least one measure per objective must be a direct measure.

Course: Math 3410 Semester taught: Fall 2019 Sections included: 1 with 30 students

Evidence of Learning: **MATH 3410 Probability and Statistics I**						
Measurable Learning Outcome Students will…	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
1. Be able to compute continuous and discrete probabilities.	Measure 1: Exam problem #5	Measure 1: 70%	Measure 1: 77%	Measure 1: Good performance	This measure has shown good learning outcome measure.	
	Measure 2: Exam problem #10	Measure 2: 70%	Measure 2: 73%	Measure 2: satisfactory performance	Perhaps a more straight-forward problem should be used to assess this outcome	
2. Be able to effectively analyze data.	Measure 1: Exam problem #1	Measure 1: 70%	Measure 1: 85%	Measure 1: Good performance	This measure has shown good learning outcome measure.	
	Measure 2: Exam problem #2	Measure 2: 70%	Measure 2: 70%	Measure 2: satisfactory performance	Place slightly more emphasis on this topic.	
3. Be able to construct a confidence interval.	Measure 1: Exam problem #2	Measure 1: 70%	Measure 1: 70%	Measure 1: satisfactory performance	Place slightly more emphasis on this topic.	
	Measure 2: Course pass rate	Measure 2: 70% pass rate (W included)	Measure 2: 84% pass rate	Measure 2: Good performance	This measure has shown good learning outcome measure.	

4. Be able to construct and test a hypothesis.	Measure 1: Exam problem #1	Measure 1: 70%	Measure 1: 85%	Measure 1: Good performance	This measure has shown good learning outcome measure.	
	Measure 2: Course pass rate	Measure 2: 70% pass rate (W included)	Measure 2: 84% pass rate	Measure 1: Good performance	This measure has shown good learning outcome measure.	

Course: Math 3420 Semester taught: Spring 2020 Sections included: 1 section with 16 students

Evidence of Learning: **MATH 3420 Probability and Statistics II**						
Measurable Learning Outcome Students will…	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
2. Be able to effectively analyze data.	Measure 1: Test 2	Measure 1: 70%	Measure 1: 85.6%	Measure 1: Good success	This measure has shown good learning outcome measure.	
	Measure 2: Test 3	Measure 2: 70%	Measure 2: 87%	Measure 2: Good success	This measure has shown good learning outcome measure.	
3. Be able to construct a confidence interval.	Measure 1: Test 1 Question 8	Measure 1: 70%	Measure 1: 82.8%	Measure 1: Good success	This measure has shown good learning outcome measure.	
	Measure 2: Test 1 Question 11	Measure 2: 70%	Measure 2: 85.6%	Measure 2: Good success	This measure has shown good learning outcome measure.	
4. Be able to construct and test a hypothesis.	Measure 1: Test 2	Measure 1: 70%	Measure 1: 85.6%	Measure 1: Good success	This measure has shown good learning outcome measure.	
	Measure 2: Test 3	Measure 2: 70%	Measure 2: 87%	Measure 2: Good success	This measure has shown good learning outcome measure.	
5. Be familiar with regression.	Measure 1: HW 7	Measure 1: 70%	Measure 1: 89.1%	Measure 1: Good success	This measure has shown good learning outcome measure.	
	Measure 2: Test 2	Measure 2: 70%	Measure 2: 85.6%	Measure 2: Good success	This measure has shown good learning outcome measure.	

6. Be introduced to analysis of variance, and related topics.	Measure 1: HW 8	Measure 1: 70%	Measure 1: 90.0%	Measure 1: Good success	This measure has shown good learning outcome measure.	
	Measure 2: Test 3	Measure 2: 70%	Measure 2: 87.0%	Measure 2: Good success	This measure has shown good learning outcome measure.	

*Direct and indirect: at least one measure per objective must be a direct measure.

Additional narrative (optional – use as much space as needed):

Course: Math 3450 Semester taught: Spring 2020 Sections included: 1 section with 21 students

Evidence of Learning: **MATH 3450 Advanced Statistical Methods**						
Measurable Learning Outcome Students will…	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
1. Evaluate the design of scientific studies to assess the scope of inference and the strengths and weaknesses of the dataset for addressing the questions posed.	Measure 1: Homework #1	Measure 1: 70%	Measure 1: 79.7%	Measure 1: Good		
	Measure 2: Course pass rate	Measure 2: 70% of students will pass the course	Measure 2: 80% of students passed the course	Measure 2: Good		
2. Use graphical displays and interpret scientific data.	Measure 1: Homework #3	Measure 1: 70%	Measure 1: 81.1%	Measure 1: Good		
	Measure 2: Course pass rate	Measure 2: 70% of students will pass the course	Measure 2: 80% of students passed the course	Measure 2: Good		
3. Apply techniques for different types of data sets such as ANOVA, regression, T-tests, be able to choose an appropriate technique, and implement the technique using software such as R.	Measure 1: Homework #11	Measure 1: 70%	Measure 1: 83.5%	Measure 1: Good		
	Measure 2: Course pass rate	Measure 2: 70% of students will pass the course	Measure 2: 80% of students passed the course	Measure 2: Good		
4. Interpret statistical analyses to answer scientific questions, appropriately considering the scope of inference and weight of evidence.	Measure 1: Homework #6	Measure 1: 70%	Measure 1: 86.8%	Measure 1: Good		
	Measure 2: Course pass rate	Measure 2: 70% of students will pass the course	Measure 2: 80% of students passed the course	Measure 2: Good		

*Direct and indirect: at least one measure per objective must be a direct measure.

Course: Math 3610 Semester taught: Fall 2019 Sections included: 1 section with 13 students

Evidence of Learning: **MATH 3610 Graph Theory**						
Measurable Learning Outcome Students will…	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
1. Explain basic definitions and properties associated with simple planar graphs, including isomorphism, connectivity, and Euler's formula, and describe the difference between Eulerian and Hamiltonian graphs.	Measure 1: HW4	Measure 1: 70%	Measure 1: 77%	Measure 1: Good success	Many new definitions make the beginning of this class overwhelming. I need to do a better job interweaving definitions with proof techniques	
	Measure 2: Questions on Final	Measure 2: 70%	Measure 2: 92%	Measure 2: Great success	By the end of the semester, the students were 'getting it'	
2. Describe and implement some of the graph algorithms, including finding a minimum weight spanning tree in a connected graph, finding a maximum matching and a maximum weight matching in a bipartite graph, and finding a Euler trail in a graph or digraph.	Measure 1: HW8	Measure 1: 70%	Measure 1: 88%	Measure 1: Good success		
	Measure 2: Questions on Final	Measure 2: 70%	Measure 2: 89%	Measure 2: Good success		
3. Understand and apply some of the classical theorems of graph theory, including Kuratowski's theorem, Konig's theorem, Hall's theorem, Four Color theorem, Ramsey's theorem, and Tutte's theorem.	Measure 1: HW10	Measure 1: 70%	Measure 1: 95%	Measure 1: Great success	By the end of the semester, the students were 'getting it'	
	Measure 2: Questions on Final	Measure 2: 70%	Measure 2: 82%	Measure 2: Good success		
4. Formulate short proofs using the following methods: direct proof, indirect proof, proof by contradiction, and case analysis.	Measure 1: HW3	Measure 1: 70%	Measure 1: 83%	Measure 1: Good success		
	Measure 2: Questions on Final	Measure 2: 70%	Measure 2: 69%	Measure 2: Some improvement needed	Proofs are hard in a testing environment - this measure is appropriate, and I will give more practice on proofs, starting earlier	

Course: Math 3620 Semester taught: Spring 2020 Sections included: 1 section with 9 students

Evidence of Learning: **MATH 3620 Enumeration**						
Measurable Learning Outcome Students will…	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
1. Find recurrence relations for some sequences, and be able to apply generating-function methods to solve combinatorial problems.	Measure 1: Final Exam problem 5	Measure 1: 70%	Measure 1: 92%	Measure 1: Pass		
	Measure 2: Course pass rate	Measure 2: 80%	Measure 2: 100%	Measure 2: Pass		
2. Apply the Inclusion-Exclusion Principle to a variety of problems.	Measure 1: Final Exam problem 2	Measure 1: 70%	Measure 1: 90%	Measure 1: Pass		
	Measure 2: Course pass rate	Measure 2: 80%	Measure 2: 100%	Measure 2: Pass		
3. Advance their ability in reading and constructing proofs by using combinatorial methods.	Measure 1: Exam 2 problem 9	Measure 1: 70%	Measure 1: 88%	Measure 1: Pass		
	Measure 2: Course pass rate	Measure 2: 80%	Measure 2: 100%	Measure 2: Pass		

*Direct and indirect: at least one measure per objective must be a direct measure.

Additional narrative (optional – use as much space as needed):

Course: Math 3710 Semester taught: Fall 2019 Sections included: 1 section with 15 students

Evidence of Learning: **MATH 3710 Boundary Value Problems**						
Measurable Learning Outcome Students will…	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
1. Classify equations as partial differential equations or not. Classify partial differential equations by order and linear versus non-linear. Recognize heat, wave or potential equations and boundary conditions of the first kind (Dirichlet B.C.'s), second kind (Neumann B.C.'s) or third kind (Robin B.C.'s).	Measure 1: a set of homework questions	Measure 1: 70% of students will score 90% or better	Measure 1: more than 90% of students scored 95% or better on assignment questions	Measure 1: Far above the threshold level of 70%		
	Measure 2: Course pass rate	Measure 2: 70% pass rate (W included)	Measure 2: 86% pass rate	Measure 2: The target performance has been met		
2. Create a partial differential equation with auxiliary conditions (boundary conditions and initial values) to model real life applications, for example, heat conduction or wave propagation, or their related time-independent states. Solve the model and interpret the results.	Measure 1: results of question 1 in the final exam	Measure 1: Average score is 70% or above	Measure 1: the average score of question 1 in the final exam is 81%	Measure 1: due to the lack of necessary basic background knowledge in a certain field, it's challenging for students to translate the information into mathematical expressions.	offer more group projects related to real world problems	
	Measure 2: group projects	Measure 2: Students will be able to use PDE models to solve real world problems	Measure 2: all three groups show moderate abilities to use the PDE models to solve real world problems	Measure 2: Students' feedback: hard to define the meaning of variables. It is challenging to choose variables in different relationships.		
3. Compute Fourier series, Fourier sine series or Fourier cosine series of simple functions. Use differentiation, integration, combination and/or evaluation of known Fourier series to build Fourier series for other functions or to find the sum of certain series, for example,.	Measure 1: A set of Homework questions in individual Assignment 1.	Measure 1: 70% of students will score 90% or above	Measure 1: all students scored 90% or above on those questions in assignment 1	Measure 1: Far above the threshold level of 70%		

	Measure 2: results of questions 1 and 2 in the midterm exam	Measure 2: 70% of students will score 90% or above	Measure 2: all students scored 90% or higher on those questions in the midterm exam	Measure 2: Far above the threshold level of 70%		
4. Find eigenvalues and eigenfunctions of simple Sturm-Liouville eigenvalue problems and/or derivation of some formulas for or results of simple Sturm-Liouville eigenvalue problems, for example, Lagrange's identity, Greens' formula, or Rayleigh quotient.	Measure 1: A set of Homework questions in individual Assignment 2	Measure 1: 50% of students need to refresh their ODE knowledge and get 80% or better on assignment 2	Measure 1: 73% students scored 80% or better on assignment 2.	Measure 1: The target performance has been met		
	Measure 2: In-class quiz	Measure 2: 70% of students will score 90%	Measure 2: more than 85% of students scored 90% or higher on in-class quiz	Measure 2: The target performance has been met		
5. Apply the method of separation of variables to solve one dimensional heat or wave equations in bounded domains.	Measure 1: Homework questions in individual assignments 2 and 3.	Measure 1: Students will be able to apply method of seperation	Measure 1: Most students successfully apply the method of separation of variables to solve 1-D equations	Measure 1: A few students lack fundamental algebraic skills in expanding a series.	Reviewed the topics on series in classes and offered more practice problems.	
	Measure 2: Results of question 7 in the midterm exam	Measure 2: The average score 70%	Measure 2: The average score is 89% on that question	Measure 2: The target performance has been met		
6. Apply the method of separation of variables to solve two or higher dimensional heat, wave or potential equations in bounded domains.	Measure 1: Three questions from individual assignment 4.	Measure 1: The average score 70%	Measure 1: The average score of those questions is 13.4 out of 15 points, Which is 90%	Measure 1: The target performance has been met.		

	Measure 2: Course pass rate	Measure 2: 70% pass rate (W included)	Measure 2: 86% pass rate	Measure 2: The target performance has been met.		
7. Solve heat, wave or potential equations using the eigenfunction expansion technique and/or in domains requiring the use of special functions, for example, Legendre polynomials or Bessel's functions.	Measure 1: Homework questions in individual assignments 1 and 2 and the results of question 7 of midterm exam	Measure 1: 70% of student will be able to solve the problems	Only a few students are able to solve the related first order ODE using the integrating factor.	Measure 1: Most students need to refresh their ODE knowledge.	gave students more chances to use eigenfunction expansion technique	
	Measure 2: Make-up/Extra assignment questions	Measure 2:	Measure 2: Data was not collected	Measure 2: more than 85% students grasped the eigenfunction expansion technique		
8. Solve all three heat, wave and potential equations in bounded domains.	Measure 1: The individual assignment 5	Measure 1: The average score is 70%	Measure 1: The average score of assignment 5 is 26.5 out of 30 points, which is 88%	Measure 1: The target performance has been met.		
	Measure 2: The results of question 4 and 5 in the final exam	Measure 2: The average score is 70%	Measure 2: The average score of those questions is 81%	Measure 2: The target performance has been met.		

*Direct and indirect: at least one measure per objective must be a direct measure.

Additional narrative (optional – use as much space as needed):

Course: Math 3810 Semester taught: Fall 2019 Sections included: 1 section with 6 students (one was retired senior seeking knowledge)

Evidence of Learning: **MATH 3810 Complex Variables**						
Measurable Learning Outcome Students will…	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
1. Know, understand, and be able to apply the algebra and geometry of complex numbers.	Measure 1: Questions on Exam 1	Measure 1: 70%	Measure 1:88%	Measure 1:Two students misunderstood the geometry	Class discussion of the test questions	Students corrected adjusted their view
	Measure 2: Course pass rate	Measure 2: 60% pass rate (W included)	Measure 2: 100% pass rate	Measure 2: Excellent	None needed	Gold stars awarded
2. Demonstrate ability to understand and perform complex differentiation.	Measure 1:Questions on Exam 1	Measure 1: 70%	Measure 1:93%	Measure 1:Two students made a few basic calculation errors	This was prerequisite skills and errors some time happen	Students corrected their calculations
	Measure 2: Course pass rate	Measure 2: 60% pass rate (W included)	Measure 2: 100% pass rate	Measure 2: Excellent	None needed	Gold stars awarded
3. Demonstrate ability to understand and calculate path integrals and use the Cauchy integral formula.	Measure 1:Questions on Exam2	Measure 1: 70%	Measure 1:100%	Measure 1: Excellent	None needed	Gold stars awarded
	Measure 2: Course pass rate	Measure 2: 60% pass rate (W included)	Measure 2: 100% pass rate	Measure 2: Excellent	None needed	Gold stars awarded
4. Know, understand, and be able to apply the concepts of series.	Measure 1:Questions on Exam3	Measure 1: 70%	Measure 1:95%	Measure 1: Excellent	None needed	Gold stars awarded

	Measure 2: Course pass rate	Measure 2: 60% pass rate (W included)	Measure 2: 100% pass rate	Measure 2: Excellent	None needed	Gold stars awarded
5. Know, understand, and be able to apply the concepts of residues and poles.	Measure 1:Questions on Exam3	Measure 1: 70%	Measure 1:95%	Measure 1: Excellent	None needed	Gold stars awarded
	Measure 2: Course pass rate	Measure 2: 60% pass rate (W included)	Measure 2: 100% pass rate	Measure 2: Excellent	None needed	Gold stars awarded

*Direct and indirect: at least one measure per objective must be a direct measure.

Course: Math 4110 Semester taught: Fall 2019 Sections included: 1 section with 9 students

Evidence of Learning: **MATH 4110 Modern Algebra I**						
Measurable Learning Outcome Students will…	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
1. Clearly state and use definitions pertaining to group theory, ring theory, and field theory.	Measure 1: Average student percentage on Exam 1: prob 8, 9, 11 Exam 2: prob 11, 12 Exam 3: prob 11, 2 TH Final: prob 16, 2 TH	Measure 1: Average >= 70%	Measure 1: 82%	Measure 1: Success		
	Measure 2: Course pass rate	Measure 2: 70% pass rate (W included)	Measure 2: 100% pass rate	Measure 2: Success		
2. Write proofs of basic abstract facts regarding group theory, ring theory, and field theory.	Measure 1: Average percentage on Exam 1 prob: 6, 12 Exam 2 prob: 15, 1 TH Exam 3 prob: 7, 9 Final prob: 17, 19	Measure 1: Average >= 70%	Measure 1: 84%	Measure 1: Success		
	Measure 2: Course pass rate	Measure 2: 70% pass rate (W included)	Measure 2: 100% pass rate	Measure 2: Success		
3. Write mathematical solutions and proofs in a clear and concise manner.	Measure 1: Average percentage on Exam 1 prob: 7 Exam 2 prob: 14 Exam 3 prob: 8 Final prob: 6 TH	Measure 1: Average >= 70%	Measure 1: 82%	Measure 1: Success		
	Measure 2: Course pass rate	Measure 2: 70% pass rate (W included)	Measure 2: 100% pass rate	Measure 2: Success		

4. Think critically and form conjectures related to group theory, ring theory, and field theory.	Measure 1: Average percentage on Exam 1 prob: 13 Exam 2 prob: 4 TH Final Exam prob: 9, 14	Measure 1: Average >= 70%	Measure 1: 73%	Measure 1: Success		
	Measure 2: Course pass rate	Measure 2: 70% pass rate (W included)	Measure 2: 100% pass rate	Measure 2: Success		
5. Use the fundamental theorems from group theory, ring theory, and field theory to prove additional theorems and better understand examples.	Measure 1: Average percentage on Exam 2 prob: 13, 2 TH Exam 3 prob: 1 TH Final Exam prob: 18	Measure 1: Average >= 70%	Measure 1: 72%	Measure 1: Success		
	Measure 2: Course pass rate	Measure 2: 70% pass rate (W included)	Measure 2: 100% pass rate	Measure 2: Success		

*Direct and indirect: at least one measure per objective must be a direct measure.

Additional narrative (optional – use as much space as needed):

Course: Math 4120 Semester taught: Spring 2020 Sections included: 1 section with 6 students

Evidence of Learning: **MATH 4120 Modern Algebra II**						
Measurable Learning Outcome Students will…	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
1. Clearly state and use definitions pertaining to group theory, ring theory, and field theory.	Measure 1: Exam 1 TH problem 2	Measure 1: 70%	Measure 1: 73%	Measure 1: Pass		
	Measure 2: Course pass rate	Measure 2: 80%	Measure 2: 100%	Measure 2: Pass		
2. Write proofs of basic abstract facts regarding group theory, ring theory, and field theory.	Measure 1: Final Exam problem 2	Measure 1: 70%	Measure 1: 78%	Measure 1: Pass		
	Measure 2: Course pass rate	Measure 2: 80%	Measure 2: 100%	Measure 2: Pass		
3. Write mathematical solutions and proofs in a clear and concise manner.	Measure 1: Final Exam problem 1	Measure 1: 70%	Measure 1: 87%	Measure 1: Pass		
	Measure 2: Course pass rate	Measure 2: 80%	Measure 2: 100%	Measure 2: Pass		
4. Think critically and form conjectures related to group theory, ring theory, and field theory.	Measure 1: Exam 1 TC problem 5	Measure 1: 70%	Measure 1: 75%	Measure 1: Pass		
	Measure 2: Course pass rate	Measure 2: 80%	Measure 2: 100%	Measure 2: Pass		
5. Use the fundamental theorems from group theory, ring theory, and field theory to prove additional theorems and better understand examples.	Measure 1: Final Exam problem 7	Measure 1: 70%	Measure 1: 78%	Measure 1: Pass		
	Measure 2: Course pass rate	Measure 2: 80%	Measure 2: 100%	Measure 2: Pass		

*Direct and indirect: at least one measure per objective must be a direct measure.
Additional narrative (optional – use as much space as needed):

Course: Math 4210 Semester taught: Fall 2019 Sections included: 1 section with 10 students

Evidence of Learning: **MATH 4210 Introductory Real Analysis I**						
Measurable Learning Outcome Students will…	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	“Closing the Loop”
1. Effectively write mathematical solutions and proofs in a clear and concise manner.	Measure 1: Final Exam Problem #1	Measure 1: 70%	Measure 1: 87%	Measure 1: Good		
	Measure 2: Course pass rate	Measure 2: 70% pass rate (W included)	Measure 2: 90% pass rate	Measure 2: Good		
2. Know, understand, and be able to apply basic results from set theory and point-set topology to establish theorems and prove conjectures in a clear and mathematically correct way.	Measure 1: Final Exam Problem #3	Measure 1: 70%	Measure 1: 93%	Measure 1: Great		
	Measure 2: Course pass rate	Measure 2: 70% pass rate (W included)	Measure 2: 90% pass rate	Measure 2: Good		
3. Demonstrate ability to think critically by proving mathematical conjectures and establishing theorems from calculus.	Measure 1: Final Exam Problem #11	Measure 1: 70%	Measure 1: 44%	Measure 1: Needs work	Focus more on conjectures	
	Measure 2: Course pass rate	Measure 2: 70% pass rate (W included)	Measure 2: 90% pass rate	Measure 2: Good		
4. Demonstrate an intuitive and computational understanding of continuity, differentiation, and integration through calculations and solving application problems.	Measure 1: Final Exam Problem #12	Measure 1: 70%	Measure 1: 71%	Measure 1: Satisfactory	Do more concrete examples of calculation based proofs	
	Measure 2: Course pass rate	Measure 2: 70% pass rate (W included)	Measure 2: 90% pass rate	Measure 2: Good		

5. Know, understand, and be able to apply the concepts of metric spaces to establish theorems and prove conjectures in a clear and mathematically correct way.	Measure 1: Final Exam Problem #7	Measure 1: 70%	Measure 1: 67%	Measure 1: Needs work	Work more on Problems that motivate an abstract definition	
	Measure 2: Course pass rate	Measure 2: 70% pass rate (W included)	Measure 2: 90% pass rate	Measure 2: Good		
6. Know, understand, and be able to apply the concepts of sequences and functions to establish theorems and prove conjectures in a clear and mathematically correct way.	Measure 1: Final Exam Problem #8	Measure 1: 70%	Measure 1: 84%	Measure 1: Good		
	Measure 2: Course pass rate	Measure 2: 70% pass rate (W included)	Measure 2: 90% pass rate	Measure 2: Good		

*Direct and indirect: at least one measure per objective must be a direct measure.

Additional narrative (optional – use as much space as needed):

Course: Math 4400 Semester taught: Fall 2019 Sections included: 1 section with 15 students

Evidence of Learning: **MATH 4400 Statistical Analysis of Big and Small Data**						
Measurable Learning Outcome Students will…	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
1. Use software to retrieve and prepare data for analysis.	Measure 1: In class exam 1	Measure 1: 70%	Measure 1: 86%	Measure 1: Students have demonstrated this ability.	Continue to maintain this outcome.	
	Measure 2: Course pass rate	Measure 2: 60% pass rate (W included)	Measure 2: 78% pass rate	Measure 2:Students have demonstrated this ability.	Continue to maintain this outcome.	
2. Explore big data techniques such as data mining and predictive analytics.	Measure 1: This was the hack-a-thon which counted as the applied portion of the final exam	Measure 1: 70%	Measure 1: 83%	Measure 1: Students have met this standard	Continue to maintain this outcome.	
	Measure 2: Course pass rate	Measure 2: 60% pass rate (W included)	Measure 2: 78% pass rate	Measure 2: Students have demonstrated this ability.	Continue to maintain this outcome.	
3. Explore small data techniques such as non-parametric statistics and resampling.	Measure 1: This was a group project.	Measure 1: 70%	Measure 1: 91%	Measure 1: Students have met this standard.	Continue to maintain this outcome.	
	Measure 2: Course pass rate	Measure 2: 60% pass rate (W included)	Measure 2: 78% pass rate	Measure 2:Students have demonstrated this ability.	Continue to maintain this outcome.	
4. Understand the theoretical underpinnings of big and small data.	Measure 1: Exam 2	Measure 1: 70%	Measure 1: 86%	Measure 1: Students have met this standard	Continue to maintain this outcome.	
	Measure 2: Course pass rate	Measure 2: 60% pass rate (W included)	Measure 2: 78% pass rate	Measure 2:Students have demonstrated this ability.	Continue to maintain this outcome.	

Course: MTHE 2120 Semester taught: Fall 2019 Sections included: 1 section with 12 students

Evidence of Learning: **MTHE 2120 Euclidean Geometry**						
Measurable Learning Outcome Students will…	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
1. Demonstrate thorough understanding of Euclidean geometry concepts related to secondary geometry standards, particularly in the following areas: a. Congruence b. Similarity, right triangles, trigonometry c. Polygons and circles d. Expressing geometric properties with equations e. Volume and area f. Writing formal arguments through the use of an axiomatic system	Measure 1: Quest #6 on Exam 1. Proving using incidence axioms	Measure 1: 70% of students earn at least 70% of points.	Measure 1: 8 of 12 students earned at least 70% of points (in fact, 8 of 12 earned at least 80%).	Measure 1: Abstract/difficult topic. They did better on other similar questions.		
	Measure 2: Quest #5 on Exam 2. Use similarity to reason about trapezoids.	70% of students earn at least 70% of points.	9 of 12 students earned at least 70% of points.	Measure 2: Success		
	Measure 3:: Quest #3 on Exam 2. Use triangle congruence to prove about quadrilaterals.	Measure 3: 70% of students earn at least 70% of points.	Measure 3: 9 of 12 students earned at least 70%.	Measure 3: Success		
2. Demonstrate use of effective strategies for teaching high school geometry.	Measure 1: Paper asking students to simulate a teaching situation (on rigid motions)..	Measure 1: 70% of students earn at least 70% of points.	Measure 1: 12 of 12 students earned at least 70% of points.	Measure 1: Success		
	Measure 2: Computer labs using dynamic geometry software.	Measure 2: 70% of students earn at least 70% of points	Measure 2: 12 of 12 students earned at least 70% of points.	Measure 2: Success		

*Direct and indirect: at least one measure per objective must be a direct measure.
Additional narrative (optional – use as much space as needed):

Course: MTHE 3010 Semester taught: Spring 2020 Sections included: 1 section with 12 students

Evidence of Learning: **MTHE 3010 Methods and Technology for Teaching Secondary Mathematics**						
Measurable Learning Outcome Students will…	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
1. Students will learn several methods of teaching mathematics such as: discovery learning, cooperative learning, and direct instruction.	Measure 1: Three essay questions across the midterm and final, each scored on a 2, 1, 0 rubric (see additional comments below for specific questions and rubrics for each question).	Measure 1: 75% of students will have an average of 75% or better across the three questions.	Measure 1: 75% of students (9 out of 12) earned an average of 75% or better.	Measure 1: While the target was met, this could have been higher. I gave students the opportunity to revise their midterm, but only two did. Also, one student did not take the final.	I will emphasize revisions in the future as a way of trying to better capture if students are meeting this LO.	
	Measure 2:Students were expected to give two presentations throughout the semester. These presentations focused on course readings and unpacked important practices related to various methods of teaching.	Measure 2: 100% of students will earn credit on both presentations.	Measure 2: 100% of students (12 out of 12) earned credit on both presentations.	Measure 2: The presentations were straightforward, and students either earned credit or didn't. These presentations were required for passing, so it isn't surprising to see this threshold met.	I will continue to use the presentations, but I think my grading or expectations might need to be revised to make sure I'm accurately capturing learning.	
2. Students will understand the capabilities and sound pedagogical uses of current technological tools (e.g. graphing calculators or computer software).	Measure 1: One essay question on the midterm scored on a 2, 1, 0 rubric (see additional comments below for the specific question and its rubric).	Measure 1: 75% of students will have an average of 75% or better on the question.	Measure 1: 91.6% of students (11 out of 12) earned a 75% or better.	Measure 1: One student did not meet expectations for the essay on the midterm.	I think I need to include additional components of technology to other midterm and final items	
	Measure 2: Students needed to include specific strategies for incorporating technology into their classroom for their final lesson plan (see additional	Measure 2: 100% of students will meet expectations for this part of the second	Measure 2: 91.6% of students (11 out of 12) met expectations for	Measure 2: My assessment of this LO is thin, I realize in hindsight. Consequently I do not	The week on technology could come earlier in the course so that students would	

	comments for the expectations for the assignment)	lesson plan.	this part of the second lesson plan.	really know the degree to which students met this learning outcome.	have to include it in the first lesson plan as well. I will implement this next time.	
3. Students will be able to create lesson plans and assessment that are logical and mathematically well organized.	Measure 1: Four essay questions across the midterm and final, each scored on a 2, 1, 0 rubric (see additional comments below for specific questions and rubrics for each question).	Measure 1: 75% of students will have an average of 75% or better on the across the four questions.	Measure 1: 83.3% of students (10 out of 12) earned	Measure 1: I think this measure accurately reflects students' learning.	I will use this measure again the next time I teach the course and reassess afterwards.	
	Measure 2: Students are expected to complete two in-depth lesson plans that show mastery of all phases of lesson planning.	Measure 2: 100% of students will meet expectations for all parts of both lesson plans.	Measure 2: 91.6% of students (11 out of 12) meet expectations for all parts of both lesson plans.	Measure 2: Completing both lesson plans is a requirement for passing the course, so the high threshold is indicating I *expect* all students to pass. One student stopped attending class and turning in assignments (but did not officially drop) after the COVID-19 shutdown	I will use this measure again the next time I teach the course and reassess afterwards.	

*Direct and indirect: at least one measure per objective must be a direct measure.
Additional narrative (optional – use as much space as needed):

Below you will find (organized by Learning Outcome) the assessments I used for each of the measures.

Learning Outcome 1; Measure 1:

1. Suppose you've recently started your first job teaching mathematics at a middle school or high school. While enjoying your lunch in the teachers' lounge, you overhear some teachers who have been at the school for many years complaining about the "new math" and its emphasis on using tasks. You catch some of their conversation, which includes phrases like "not enough time," "my students get frustrated and give up," and "not real math." Write an essay that demonstrates your understanding of tasks and that addresses each of the comments you overheard in the teachers' lounge. (MIDTERM #2)

RUBRIC

Meets Expectations	Approaches Expectations	Needs Revisions
2	1	0
The essay is described by all of the following:	The essay is described by all of the following (and/or any from the "Meets Expectations" column):	The essay is described by any of the following:
● Demonstrates understanding of the key features of tasks. ● Demonstrates understanding of challenges of implementing tasks. ● Demonstrates understanding of the benefits of implementing tasks. ● Responds to each of the three phrases overheard in the teachers' lounge ● Includes appropriate citations from both Principles to Actions and Enhancing Classroom Practice.	● Demonstrates understanding of tasks, but misses some of the key features. ● Demonstrates some understanding of the challenges of implementing tasks, but overlooks or dismisses some of them. ● Demonstrates some understanding of the benefits of implementing tasks, but overlooks or dismisses some of them. ● Responds to some, but not all, of the phrases overheard in the teachers' lounge. ● Includes appropriate citations from both Principles to Actions and Enhancing Classroom Practice.	● Demonstrates little or no understanding of tasks. ● Demonstrates little or no understanding of the challenges of implementing tasks. ● Demonstrates little or no understanding of the benefits of implementing tasks. ● Does not respond to (or dismisses) the phrases overheard in the teachers' lounge. ● Citations from either Principles to Actions or Enhancing Classroom Practice are missing.

2. Define productive struggle. Explain different ways you might support students during class so that their struggle remains productive. Argue for how purposeful questions can act as tools for supporting productive struggle. (MIDTERM #5)

RUBRIC

Meets Expectations	Approaches Expectations	Needs Revisions
2	1	0
The essay is described by all of the following:	The essay is described by all of the following (and/or any from the "Meets Expectations" column):	The essay is described by any of the following:
● Thoroughly defines productive struggle. ● Describes multiple ways to support students during class so that their struggle remains productive. ● Provides convincing argument that demonstrates understanding of purposeful questions and how they can be used to support productive struggle. ● Includes appropriate citations from both Principles to Actions and Enhancing Classroom Practice.	● Defines productive struggle but misses one or more key ideas. ● Describes one way to support students during class so that their struggle remains productive (or mentions, but does not thoroughly describe multiple ways). ● Provides weak or unconvincing argument that purposeful questions can be used to support productive struggle. ● Understanding of purposeful questions is thorough. ● Includes appropriate citations from both Principles to Actions and Enhancing Classroom	● Does not define productive struggle or definition is weak or limited. ● Does not describe in detail any ways to support students during class so their struggle remains productive. ● No argument is made about using purposeful questions to support productive struggle. ● Understanding of purposeful questions is weak or limited. ● Citations from either Principles to Actions or Enhancing Classroom Practice are missing.

	Practice.	

3. Suppose you've been teaching for a few years when a colleague approaches you to ask you about your classroom. They say "You know, I've had students of yours that talk about how much talking they do in class, both in groups and doing presentations. I'd like to try that. Can you tell me where to begin?" Write an essay that answers your colleague's question by exploring the practice *Facilitate Meaningful Mathematical Discourse* through the lens of the 5 Practices for Orchestrating Productive Mathematical Discussions. See the rubric for details on what to include. (FINAL #2)

RUBRIC

Meets Expectations	Approaches Expectations	Needs Revisions
2	1	0
The essay is described by all of the following:	The essay is described by all of the following (and/or any from the "Meets Expectations" column):	The essay is described by any of the following:
• Demonstrates understanding of each of the 5 practices: Anticipating, Monitoring, Selecting, Sequencing, and Connecting. • Thoroughly describes the process of anticipating and monitoring. • Thoroughly describes different rationales for sequencing. • Convincingly argues about the importance of connecting. • Includes appropriate citations from all of Principles to Actions, Enhancing Classroom Practice, and 5 Practices for Orchestrating Productive Mathematical Discussions.	• Demonstrates understanding of each of the 5 practices: Anticipating, Monitoring, Selecting, Sequencing, and Connecting. • Description of the process of anticipating and monitoring is thin. • Description of different rationales for sequencing is thin. • Argument that connecting is important is weak. • Includes appropriate citations from all of Principles to Actions, Enhancing Classroom Practice, and 5 Practices for Orchestrating Productive Mathematical Discussions.	• Demonstrates limited or no understanding of any of the 5 practices. • Description of the process of anticipating and monitoring is missing. • Description of different rationales for sequencing is missing. • Argument that connecting is important is missing. • Citations from any of Principles to Actions, Enhancing Classroom Practice, and 5 Practices for Orchestrating Productive Mathematical Discussions are missing.

Learning Outcome 1; Measure 2:
Two presentations - Expectations for Students:
You should meet as a group (virtually or in person) to plan out your presentation. Before meeting, be sure to read and summarize the assigned sections of the reading. As a group, decide how you will tackle the following components. Each presentation should include:

1. A handout that:
    a. has the theme for the week (see the calendar) at the top
    b. has a "created by:" with the group members' names
    c. summarizes key ideas from the readings
2. The handout may also include any or all of the following:
    a. couple of quotes that resonated with the group and might be used as a conversation starter,
    b. highlights other main ideas from the readings
    c. tables, diagrams, etc. that distill main ideas or key points
    d. other elements I haven't thought about (be creative if you'd like :))
3. An in-class presentation that includes:

a. High level discussion of the main points from the readings
b. Opportunities for the students interact with one another
c. Specific discussion that links the theme to a specific task we have already done as a class

Plan for the presentation to take around 25-35 minutes. The handout should be one page (front and back is fine)

Learning Outcome 2; Measure 1:
Questions assessed:
1. Technology, the big debate! Write an essay that establishes your position about technology usage in the classroom. First, describe how technology can be used to enhance students' mathematical learning. Then – with supporting evidence – argue either for how such use would help your students or argue for limiting technology in the classroom. (MIDTERM #4)

RUBRIC

Meets Expectations	Approaches Expectations	Needs Revisions
2	1	0
The essay is described by all of the following:	The essay is described by all of the following (and/or any from the "Meets Expectations" column):	The essay is described by any of the following:
● Describes (with appropriate examples) multiple ways technology can be used in the classroom ● Argues (with supporting evidence) for how such use would help students. Or, provides a compelling argument (with supporting evidence) for limiting the use of technology in the classroom ● Includes appropriate citations from both Principles to Actions and Enhancing Classroom Practice.	● Describes (with an appropriate example) one way technology can be used in the classroom ● Argues (with minimal/no supporting evidence) for how such use would help students Or, provides an argument (with minimal/no supporting evidence) for limiting the use of technology in the classroom ● Includes appropriate citations from both Principles to Actions and Enhancing Classroom Practice.	● Demonstrates limited or no understanding of any of the 5 practices. ● Description of the process of anticipating and monitoring is missing. ● Description of different rationales for sequencing is missing. ● Argument that connecting is important is missing. ● Citations from any of Principles to Actions, Enhancing Classroom Practice, and 5 Practices for Orchestrating Productive Mathematical Discussions are missing.

Learning Outcome 2; Measure 2:

Specific expectations for earning credit on one lesson plan assignment:

Includes a technological tool in your lesson. This could be the use of graphing calculators in an innovative or rich manner, the use of technology for formative assessment, or some other student-centered use of technology. This means things such as online grade books, projecting a powerpoint, or some other teacher-centered use of technology will not be sufficient.

Learning Outcome 3; Measure 1:

Questions Assessed:

1. Distinguish between *learning goals* and *doing goals*. Craft an argument for why it is important that teachers of mathematics focus on learning goals as a foundation for successful mathematics lessons that engage all students. (MIDTERM #1)

RUBRIC

Meets Expectations	Approaches Expectations	Needs Revisions
2	1	0
The essay is described by all of the following:	The essay is described by all of the following (and/or any from the "Meets Expectations" column):	The essay is described by any of the following:
• Clearly articulates the difference between learning goals and doing goals. • A strong case is made for focusing on learning goals, and it includes multiple arguments. • Argument makes clear the link between learning goals and successful mathematics lessons that engage all students, and it is supported by the literature. • Includes appropriate citations from both Principles to Actions and Enhancing Classroom Practice.	• Clearly articulates the difference between learning goals and doing goals. • A case is made for focusing on learning goals, and it includes at least one argument. • Argument attempts to link learning goals to successful mathematics lessons that engage all students, but the argument may be weak or unsupported by the literature. • Includes appropriate citations from both Principles to Actions and Enhancing Classroom Practice.	• The difference between learning and doing goals is not clearly articulated. • No argument for focusing on learning goals is provided. • The argument to link learning goals to successful mathematics lessons that engage all students is missing. • Citations from either Principles to Actions or Enhancing Classroom Practice are missing.

2. The teaching practices outlined in *Principles to Actions* (and unpacked in much greater detail in *Enhancing Classroom Practice*) are worded carefully and with the intent that the practices are things the *teacher* must do. Consider the two practices "Use & Connect Mathematical Representations" and "Build Procedural Fluency From Conceptual Understanding." Reflect on these practices by describing what you believe the practices are obligating YOU, as a teacher, to do. In your essay, use specific mathematical examples to help the reader understand your perspective. (MIDTERM #3)

RUBRIC

Meets Expectations	Approaches Expectations	Needs Revisions
2	1	0
The essay is described by all of the following:	The essay is described by all of the following (and/or any from the "Meets Expectations" column):	The essay is described by any of the following:
• Clearly articulates the difference between learning goals and doing goals. • A strong case is made for focusing on learning goals, and it includes multiple arguments. • Argument makes clear the link between learning goals and successful mathematics lessons that engage all students, and it is supported by the literature. • Includes appropriate citations from both	• Clearly articulates the difference between learning goals and doing goals. • A case is made for focusing on learning goals, and it includes at least one argument. • Argument attempts to link learning goals to successful mathematics lessons that engage all students, but the argument may be weak or unsupported by the literature. • Includes appropriate citations from both	• The difference between learning and doing goals is not clearly articulated. • No argument for focusing on learning goals is provided. • The argument to link learning goals to successful mathematics lessons that engage all students is missing. • Citations from either Principles to Actions or Enhancing Classroom Practice are

Principles to Actions and Enhancing Classroom Practice.	Principles to Actions and Enhancing Classroom Practice.	missing.

3. Compare and contrast formative assessments and summative assessments. As part of your response, describe two different formative assessment techniques and illustrate how they are formative assessment. Do the same for summative assessments. Explain how you can use formative assessments to *Elicit and Use Evidence of Student Thinking.* (FINAL #3)

RUBRIC

Meets Expectations	Approaches Expectations	Needs Revisions
2	1	0
The essay is described by all of the following:	The essay is described by all of the following (and/or any from the “Meets Expectations” column):	The essay is described by any of the following:
● Clearly describes formative assessments and uses two examples to help illustrate points. ● Clearly describes summative assessments and uses two examples to help illustrate points. ● Summarizes key differences between the two assessment processes. ● Essay demonstrates understanding of the practice Elicit and Use Evidence of Student Thinking. ● Includes appropriate citations from both Principles to Actions and Enhancing Classroom Practice.	● Description of formative assessments is not clear, or uses fewer than two examples. ● Description of summative assessments is not clear, or uses fewer than two examples. ● Summarizes key differences between the two assessment processes. ● Essay demonstrates understanding of the practice Elicit and Use Evidence of Student Thinking. ● Includes appropriate citations from both Principles to Actions and Enhancing Classroom Practice.	● Does not describe formative assessments in a coherent way. ● Does not describe summative assessments in a coherent way. ● Key differences between the two assessment processes are not summarized or clear. ● Essay demonstrates limited understanding of the practice Elicit and Use Evidence of Student Thinking. ● Citations from either Principles to Actions or Enhancing Classroom Practice are missing.

4. What is curriculum? What does it mean to understand the curriculum both horizontally and vertically? Pick a mathematics topic and describe, in broad terms, what curriculum around that topic looks like – both horizontally and vertically. (FINAL #4)

RUBRIC

Meets Expectations	Approaches Expectations	Needs Revisions
2	1	0
The essay is described by all of the following:	The essay is described by all of the following (and/or any from the “Meets Expectations” column):	The essay is described by any of the following:
● Demonstrates understanding of what curriculum is. ● Thoroughly and completely describes what it means to understand the curriculum horizontally and vertically.	● Demonstrates understanding of what curriculum is. ● Description of what it means to understand the curriculum horizontally and vertically is present, but thin.	● Demonstrates limited understanding of what curriculum is. ● Description of what it means to understand the curriculum horizontally and vertically is not present.

• Includes a rich example of a math topic and curriculum around that topic, both horizontally and vertically. • Includes appropriate citations from both Principles to Actions and Enhancing Classroom Practice.	• Example of a math topic and curriculum around that topic, both horizontally and vertically is present, but thin. • Includes appropriate citations from both Principles to Actions and Enhancing Classroom Practice.	• Example of a math topic and curriculum around that topic, both horizontally and vertically is not present. • Citations from either Principles to Actions or Enhancing Classroom Practice are missing.

Learning Outcome 3; Measure 2:
Two in-depth lesson plans addressing over-arching course themes. The first lesson plan addressed themes 1–4. The second lesson plan addressed all 10 themes. The expectations for the lesson plans are below.

• Includes resources for the lesson (e.g., will students need compasses? calculators? graph paper? Do you need supplies for a demonstration? Computers? Manipulatives?)
Integrates Theme 1 – Establish Math Goals to Focus Learning
• Includes at least one *learning goal* for the lesson and any associated *doing goals*.
• Includes grade-specific or course-specific *content standards* (all that apply) from the Common Core State Standards that align with your goals. Briefly explain how the standards align with your goals.
• Includes two *Standards for Mathematical Practice* (SMPs) that align with your goals. Briefly explain how the standards align with your goals.
Integrates Theme 2 – Pose Purposeful Questions
• Includes at least four purposeful questions you could pose to students as they work on the task. ○ At least two questions must be in the form of "If a student does this, I will ask this." In other words, you must anticipate student actions and describe questions to address those actions. Explicitly state what you anticipate the student would do (or say), and then state the question. ○ You must *include* (and clearly label) **both** Assessing and Advancing question types.
Integrates Theme 3 – Implement Tasks That Promote Reasoning & Problem Solving
• Includes one low-floor, high-level cognitive demand task that serves as the foundation for your lesson. ○ The task should align with descriptions of good tasks to use that are found in the *5 Practices*, *Principles to Actions*, and *Enhancing Classroom Practice*.
• Links the task to your learning goal and the CCSS standards. ○ "Linking" does not mean stating the standards. I know them. You will too. Linking means explicating how the task addresses specific aspects of your learning goal and the CCSS standards. For example, if the task provides opportunities for students to attend to precision, you should state that and briefly detail how it does so.
Integrates Theme 4 – Use & Connect Mathematical Representations

● Identifies at least TWO different authentic representations (from Physical, Verbal, Visual, Contextual, and Symbolic) for the main mathematical content for the lesson. Describe the affordances and constraints of each representation. Briefly describe the conventions for each representation. Write a few words about why you would use each representation, then a few more words about why you might not use it, or switch from it.
Integrates Theme 5 – Tools & Technology
● Includes a technological tool in your lesson. This could be the use of graphing calculators in an innovative or rich manner, the use of technology for formative assessment, or some other student-centered use of technology. This means things such as online grade books, projecting a powerpoint, or some other teacher-centered use of technology will not be sufficient.
Integrates Theme 6 – Support Productive Struggle in Learning Mathematics
● Includes a brief rationale that demonstrates how you've thought about supporting students' productive struggle on the task and throughout your lesson. Pay attention to opportunities to "rescue" and what you should do instead. Touch on some of the ideas mentioned in the reading from *Enhancing Classroom Practice...* You might consider framing this rationale with the challenges you outlined above. For example, how might you help students overcome the challenges you listed without taking away their *productive* struggle?
Integrates Theme 7 – Build Procedural Fluency from Conceptual Understanding
● Includes a description of the procedures that students will need or learn, and what fluency with those procedures looks like
● Includes a thorough description of the conceptual understanding students need to develop procedural fluency with the procedures described above.
Integrates Theme 8 – Equity & Access
● Includes strategies, teacher tools, or expectations for students that foster equitable access to mathematics during your lesson. This should be a brief discussion that illustrates how you have thought about these issues and are planning to address them in your own teaching practice.
Integrates Theme 9 – Facilitate Meaningful Mathematical Discourse
● Includes a plan for leading a productive mathematical conversation as described in the book *5 Practices for Orchestrating*... This means you describe the five practices from this book with specific details pertaining to your lesson plan. The purpose of this part of this assignment is to help me assess the degree to which you engaged with this book. Be sure to describe how you *Anticipate* student approaches/solutions to your task; describe a plan for *Monitoring* your class as they work on the task; describe your method and rationale for *Selecting* and *Sequencing* student presentations; and finally explain fully the *Connections* you will want students to make between the solutions/presentations.
Integrates Theme 10 – Elicit Evidence of Student Thinking & Assessment
● Includes one tool for formative assessment. If this is a written or produced tool, include it (attached to your lesson plan). If it is a digital tool, include the URL.

- Includes a brief discussion for each of the following: What learning are you assessing? How will you do that? How will results inform your next instructional steps?

Course: MTHE 3060 Semester taught: Spring 2020 Sections included: 1 section with 22 students

Evidence of Learning: **MTHE 3060 Probability and Statistics from a Teaching Perspective**						
Measurable Learning Outcome Students will…	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
1. Solve basic probability problems where the experiment involves both simple and compound events.	Measure 1: Unit 6 Exam	Measure 1: 75% pass rate	Measure 1: 94% pass rate	Measure 1: the target performance has been met		
	Measure 2: Course pass rate (W counted as a fail) Course C or better rate (W counted as a fail)	Measure 2: Course pass rate = 80% or better Course C or better rate = 80% or better	Measure 2: Course pass rate = 92% Course C or better rate = 83%	Measure 2: Two students dropped the course prior to the Covid-19 shutdown due to personal reasons. Another student was never engaged in the course due to personal reasons. The final student became disengaged in the course with the Covid-19 shutdown.	The course is very passable for those that attend regularly and complete all assignments. Reach out to disengaged students early and often to figure out how to better serve them.	
2. Know permutations, combinations, mixed counting principles, and be able to use them in problem solving.	Measure 1: Unit 6 Exam #7	Measure 1: 75% pass rate	Measure 1: 74% pass rate	Measure 1: Covid-19 cut out some classes dedicated to this outcome	Need more time spent on this topic next year	
	Measure 2: Course pass rate (W counted as a fail) Course C or better rate (W counted as a fail)	Measure 2: Course pass rate = 80% or better Course C or better rate = 80% or better	Measure 2: Course pass rate = 92% Course C or better rate = 83%	Measure 2: See above		
3. Compute, understand and use measures of	Measure 1: Unit 3 Exam	Measure 1: 75% pass rate	Measure 1: 79% pass rate	Measure 1: Students need more work with understanding mean conceptually	Spend more time with the learning goals for this unit next year	

center and measures to analyze single variable data.	Measure 2: Course pass rate (W counted as a fail) Course C or better rate (W counted as a fail)	Measure 2: Course pass rate = 80% or better Course C or better rate = 80% or better	Measure 2: Course pass rate = 92% Course C or better rate = 83%	Measure 2: See above		
4. Collect, display and analyze data using a variety of techniques.	Measure 1: Unit 2 Exam	Measure 1: 75% pass rate	Measure 1: 79% pass rate	Measure 1: The most difficult piece here was boxplots	Change treatment of box plots next year.	
	Measure 2: Course pass rate (W counted as a fail) Course C or better rate (W counted as a fail)	Measure 2: Course pass rate = 80% or better Course C or better rate = 80% or better	Measure 2: Course pass rate = 92% Course C or better rate = 83%	Measure 2: See above.		
5. Understand and be able to use random variables and various distributions to model and analyze data.	Measure 1: Unit 4 Exam	Measure 1: 75% pass rate	Measure 1: 76% pass rate	Measure 1: Students struggled to understand the process of inference used to infer the shape and spread of the underlying distribution given information about the sample.	Break this unit into two smaller units next year.	
	Measure 2: Course pass rate (W counted as a fail) Course C or better rate (W counted as a fail)	Measure 2: Course pass rate = 80% or better Course C or better rate = 80% or better	Measure 2: Course pass rate = 92% Course C or better rate = 83%	Measure 2: See above		

*Direct and indirect: at least one measure per objective must be a direct measure.

Additional narrative (optional – use as much space as needed):

Course: MTHE 4110 Semester taught: Fall 2019 Sections included: 1 section with 8 students

Evidence of Learning: **MTHE 4110 Algebra from a Teaching Perspective**						
Measurable Learning Outcome Students will…	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	“Closing the Loop”
1. Demonstrate thorough understanding of algebraic concepts related to secondary standards, particularly in the following areas: a. Seeing structure in expressions b. Arithmetic with polynomials and rational expressions c. Creating and reasoning with equations and inequalities d. Interpreting and building functions	Measure 1: Unit 2 exam questions 2-5	Measure 1: 80%	Measure 1: 81.0%	Measure 1: Goal met	Continue to offer opportunities to practice with these objectives	
	Measure 2: Unit 3 exam question 4	Measure 2: 80%	Measure 2: 78.91%	Measure 2: Slightly under goal	Continue to offer opportunities to practice with these objectives	
2. Demonstrate use of effective strategies for teaching algebraic concepts at the secondary level.	Measure 1: Unit 2 exam question 7	Measure 1: 80%	Measure 1: 84.6%	Measure 1: Goal met	Continue to offer opportunities to demonstrate effective strategies for teaching algebraic concepts at the secondary level	
	Measure 2: Unit 3 exam question 3	Measure 2: 80%	Measure 2: 96.9%	Measure 2: excellent		

*Direct and indirect: at least one measure per objective must be a direct measure.

Additional narrative (optional – use as much space as needed):

Course: Math 3550 Semester taught: Fall 2019 Sections included: 1 section with 21 students

Evidence of Learning: MATH 3550 Introduction to Mathematical Modeling

There are 5 learning outcomes for Math 3550, Introduction to Mathematical Modeling

1. Be able to construct or work with analytical models (using physical laws).
2. Be able to fit data to develop empirical models.
3. Be able to construct or work with a simulation, queuing, probabilistic, or decision tree model.
4. Be able to construct or work with a differential equation or discrete dynamical system model.
5. Understand the philosophy and the process of mathematical modeling and construct a model application in business or in the biological, physical, or social sciences.

Learning Outcome	Direct Measure 1*	Direct Measure 2	Indirect Measure**
1	Homework 3	Problem 3 on the Final Exam	Passing Rate
2	Homework 4 and 5	Problems 4 and 5 on the Final Exam	Passing Rate
3	Homework 6 and 7	Problems 6, 7 and 8 on the Final Exam	Passing Rate
4	Homework 2 and 8	Problems 1 and 2 on the Final Exam	Passing Rate
5	Individual Projects	Group Projects	Passing Rate

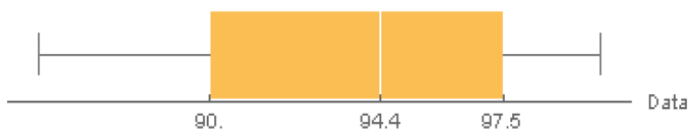
* Each homework consisted of 8 to 10 problems.

** Passing rate = (# of students with a course grade of "C" or better) / (# of students who completed the course)

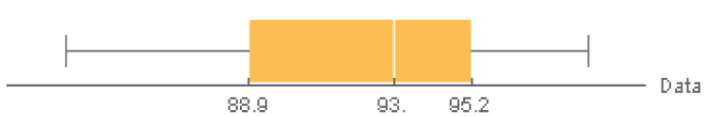
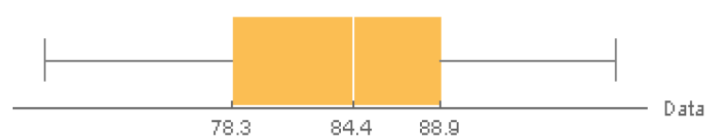
Learning Outcome	Direct Measure 1	Direct Measure 2	Indirect Measure
1 - Threshold Level	75%	70%	75%
2 - Threshold Level	75%	70%	75%
3 - Threshold Level	75%	70%	75%
4 - Threshold Level	75%	70%	75%
5 - Threshold Level	70%***	70%	75%

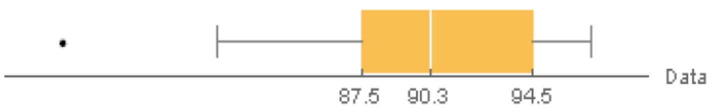
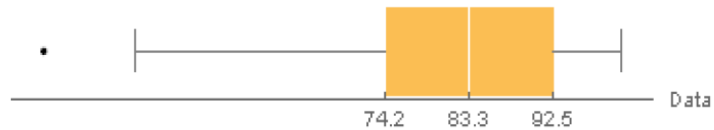
*** A lower threshold level is used since Learning Outcome 5 indicates the highest level of achievement in the course and the Individual Projects is completed before 50% of the course is completed.

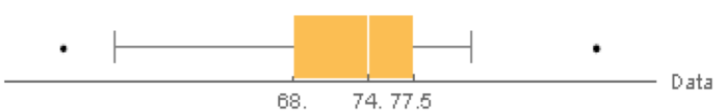
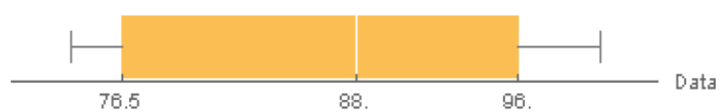
Summary of Learning Outcomes: This course has maintained a very high standards and, overall, has fully achieved them. In addition, some students in this class have competed in the 2020 international Mathematical Contest in Modeling (MCM). MCM is a highly prestigious contest. In spring 2019 MCM, 14108 teams participated with only 270 teams from US. This course is an example of what can be achieved with careful planning and effective teaching/learning methods.

<table>
<tr><td colspan="3">Leaning Outcome 1 – Math 3550 – Fall 2019</td></tr>
<tr><td>Direct Measure 1</td><td>Direct Measure 2</td><td>Indirect Measure</td></tr>
<tr><td>Data</td><td>Data</td><td>Data</td></tr>
<tr><td>
</td><td>
</td><td>100%</td></tr>
<tr><td>Q1 = 90, Q2 = 94.4, Q3 = 97.5, Mean = 93.8</td><td>Q1 = 35, Q2 = 73.3, Q3 = 97.5, Mean = 64.2</td><td></td></tr>
<tr><td>Interpretation of Data</td><td>Interpretation of Data</td><td>Interpretation of Data</td></tr>
<tr><td>75% of students scored 90% or better, far exceeding the threshold level score of 75%.</td><td>50% of students scored 73.3% or better. The data is skewed left; the mean is below the threshold level score of 70%, while the median is above it. This is probably due to just having one problem of this type on the final exam.</td><td>No improvement can be made in this area.</td></tr>
<tr><td colspan="3">Result</td></tr>
<tr><td colspan="3">Although the Learning Outcome 1 has been achieved, additional emphasis should be placed on this learning outcome and a problem in this category should be added to the final exam.</td></tr>
</table>

Leaning Outcome 2 – Math 3550 – Fall 2019		
Direct Measure 1	Direct Measure 2	Indirect Measure
Data	Data	Data
		100%
Q1 = 80, Q2 = 91.6, Q3 = 96.4, Mean = 87.9	Q1 = 69.2, Q2 = 83.3, Q3 = 99.2, Mean = 82.8	
Interpretation of Data	Interpretation of Data	Interpretation of Data
75% of students scored 80% or better, far exceeding the threshold level score of 75%.	75% of students scored 69.1% or better. 50% of students scored 83.3% or better. The mean is far above the threshold level score of 70%.	No improvement can be made in this area.
Result		
The Learning Outcome 2 has been fully achieved.		

Leaning Outcome 3 – Math 3550 – Fall 2019		
Direct Measure 1	Direct Measure 2	Indirect Measure
Data	Data	Data
		100%
Q1 = 88.9, Q2 = 93, Q3 = 95.2, Mean = 92	Q1 = 78.3, Q2 = 84.4, Q3 = 88.9, Mean = 83.2	
Interpretation of Data	Interpretation of Data	Interpretation of Data
75% of students scored 88.9% or better, far exceeding the threshold level score of 75%.	75% of students scored 84.4% or better, far exceeding the threshold level score of 70%.	No improvement can be made in this area.
Result		
The Learning Outcome 3 has been fully achieved.		

Leaning Outcome 4 – Math 3550 – Fall 2019		
Direct Measure 1	Direct Measure 2	Indirect Measure
Data	Data	Data
		100%
Q1 = 87.5, Q2 = 90.3, Q3 = 94.5, Mean = 89.7	Q1 = 74.2, Q2 = 83.3, Q3 = 92.5, Mean = 79.5	
Interpretation of Data	Interpretation of Data	Interpretation of Data
75% of students scored 87.5% or better, far exceeding the threshold level score of 75%.	75% of students scored 74.2% or better, far exceeding the threshold level score of 70%.	No improvement can be made in this area.
Result		
The Learning Outcome 4 has been fully achieved.		

Leaning Outcome 5 – Math 3550 – Fall 2019		
Direct Measure 1	Direct Measure 2	Indirect Measure
Data	Data	Data
		100%
Q1 = 68, Q2 = 74, Q3 = 77.5, Mean = 72	Q1 = 76.5, Q2 = 88, Q3 = 96, Mean = 87.2	
Interpretation of Data	Interpretation of Data	Interpretation of Data
50% of students scored 74% or better, exceeding the threshold level score of 70%.	75% of students scored 76.5% or better, exceeding the threshold level score of 70%.	No improvement can be made in this area.
Result		
The Learning Outcome 5 has been achieved.		

Evidence of Learning: General Education Courses

Course: Math 1030 Semester taught: Fall 2019 Sections included: 8 sections with total from 230 to 262 students (students who took the exams)

Evidence of Learning: **MATH 1030 Contemporary Math**						
Measurable Learning Outcome Students will…	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
1. Interpret mathematical models such as formulas, graphs, tables and schematics and draw inferences from them.	Measure 1: Two questions with multiple components on midterm exams	Measure 1: 70% of students will score 70% or better	Measure 1: 71% of students scored 70% or better on assessment questions (186 students out of 261)	Measure 1: The target performance was met	We will collect more data	
	Measure 2: Course pass rate	Measure 2: 70% of students will pass the course	Measure 2: Actual passing rate is 82.89%	Measure 2: Far above the threshold level of 70%		
2. Represent mathematical information symbolically, visually, numerically, and verbally.	Measure 1: Two questions on midterm exams with multiple components	Measure 1: 70% of students will score 60% or better	Measure 1: 75% of students scored 60% or better (196 students out of 262)	Measure 1: The target performance was met	We plan to collect more data and re-evaluate the threshold level	
	Measure 2: Course pass rate	Measure 2: 70% of students will pass the course	Measure 2: Passing rate is 82.89%	Measure 2: Far above the threshold level of 70%		
3.Use arithmetical, algebraic, geometric, and statistical methods to solve problems.	Measure 1: Two questions on midterm exams with multiple components	Measure 1: 60% of students will score 65% or better	Measure 1: 64% of students scored 65% or better (164 students out of 258)	Measure 1: The target performance was met	We plan to collect more data and re-evaluate the threshold level	
	Measure 2: Course pass rate	Measure 2: 70% of students will pass the course	Measure 2: Passing rate is 82.89%	Measure 2: As above		

4. Estimate and check answers to mathematical problems in order to determine reasonableness, identify alternatives and select optimal results.	Measure 1: Two questions on midterm exams with multiple components	Measure 1: 70% of students will score 60% or better	Measure 1: 72% of students scored 60% or better (166 students out of 230)	Measure 1: The target performance was met		
	Measure 2: Course pass rate	Measure 2: 70% of students will pass the course	Measure 2: Passing rate is 82.89%	Measure 2: Far above the threshold level of 70%		
5. Recognize that mathematical and statistical methods have limits.	Measure 1 One question on the final exam and one question on a midterm exam, with multiple components	Measure 1: 70% of students will score 60% or better	Measure 1: 88% of students scored 60% or better (228 students out of 259)	Measure 1: The target performance was met		
	Measure 2: Course pass rate	Measure 2: 70% of students will pass the course	Measure 2: 82.89%	Measure 2: Far above the threshold level of 70%		

*Direct and indirect: at least one measure per objective must be a direct measure.

Additional narrative (optional – use as much space as needed):

1. Course pass rate: passing grade C or better / all grades excluding W
2. There is a different threshold set up for different learning outcomes because some learning outcomes are basic skills that the majority of students should have and other outcomes require a deeper understanding that we expect a lower percentage of students to achieve.

Course: Math 1040 Semester taught: Fall 2019 Sections included: 6 sections with total from 165 to 170 students (students who took the exams)

Evidence of Learning: **MATH 1040 Introduction to Statistics**						
Measurable Learning Outcome Students will…	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
1. Interpret mathematical models such as formulas, graphs, tables and schematics and draw inferences from them.	Measure 1: One question with multiple components on a midterm exam	Measure 1: 70% of students will score 70% or better	Measure 1: 82% of students scored 70% or better on assessment questions (140 students out of 170)	Measure 1: Far above the threshold level of 70%		
	Measure 2: Course pass rate	Measure 2: 70% of students will pass the course	Measure 2: Actual passing rate is 68.56%	Measure 2: The target performance was not met. Half of the sections were taught by adjuncts.	Carefully examine the situation. Look at the pass rate of individual instructors.	
2. Represent mathematical information symbolically, visually, numerically, and verbally.	Measure 1: Two questions on midterm exams with multiple components	Measure 1: 70% of students will score 65% or better	Measure 1: 81% of students scored 65% or better (137 students out of 170)	Measure 1: Far above the threshold level of 70%		
	Measure 2: Course pass rate	Measure 2: 70% of students will pass the course	Measure 2: Pass rate is 68.56%	Measure 2: See above		
3.Use arithmetical, algebraic, geometric, and statistical methods to solve problems.	Measure 1: Two questions on the final exam and a midterm exam	Measure 1: 60% of students will score 60% or better	Measure 1: 65% of students scored 60% or better (109 students out of 167)	Measure 1: The target performance was met.	Collect more data and re-evaluate the threshold level	

	Measure 2: Course pass rate	Measure 2: 70% of students will pass the course	Measure 2: Pass rate is 68.56%	Measure 2: See above		
4. Estimate and check answers to mathematical problems in order to determine reasonableness, identify alternatives and select optimal results.	Measure 1: One question on a midterm exam with multiple components	Measure 1: 70% of students will score 70% or better	Measure 1: 78% of students scored 70% or better (132 students out of 170)	Measure 1: The target performance was met.		
	Measure 2: Course pass rate	Measure 2: 70% of students will pass the course	Measure 2: Pass rate is 68.56%	Measure 2: See above		
5. Recognize that mathematical and statistical methods have limits.	Measure 1 One question on the final exam with multiple components	Measure 1: 70% of students will score 70% or better	Measure 1: 76% of students scored 70% or better (126 students out of 165)	Measure 1: The target performance was met.		
	Measure 2: Course pass rate	Measure 2: 70% of students will pass the course	Measure 2: Pass rate is 68.56%	Measure 2: See above		

*Direct and indirect: at least one measure per objective must be a direct measure.

Additional narrative (optional – use as much space as needed):

1. Course pass rate: passing grade C or better / all grades excluding W
2. There is a different threshold set up for different learning outcomes because some learning outcomes are basic skills that the majority of students should have and other outcomes require a deeper understanding that we expect a lower percentage of students to achieve.

Course: Math 1050 Semester taught: Fall 2019 Sections included: 13 sections with total from 307 to 349 students (students who took the exams)

Evidence of Learning: **MATH 1050 College Algebra**

Measurable Learning Outcome Students will…	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
1. Interpret mathematical models such as formulas, graphs, tables and schematics and draw inferences from them.	Measure 1: Two questions with multiple components on midterm exams	Measure 1: 60% of students will score 65% or better	Measure 1: 63% of students scored 65% or better on assessment questions (219 students out of 349)	Measure 1: The target performance was met.	Collect more data and re-evaluate the threshold level	
	Measure 2: Course pass rate	Measure 2: 70% of students will pass the course	Measure 2: Passing rate is 74.44%	Measure 2: The target performance was met.		
2. Represent mathematical information symbolically, visually, numerically, and verbally.	Measure 1: One problem on the final exam with five questions	Measure 1: 60% of students will score 70% or better	Measure 1: 64% of students scored 70% or better (216 students out of 335)	Measure 1: The target performance was met.	Collect more data and re-evaluate the threshold level	
	Measure 2: Course pass rate	Measure 2: 70% of students will pass the course	Measure 2: Passing rate is 74.44%	Measure 2: The target performance was met.		
3.Use arithmetical, algebraic, geometric, and statistical methods to solve problems.	Measure 1: Three questions on midterm exams	Measure 1: 60% of students will score 65% or better	Measure 1: 52% of students scored 65% or better (170 students out of 330)	Measure 1: Students performed lower than expected	Collect more data, focus on more review	
	Measure 2: Course pass rate	Measure 2: 70% of students will pass the course	Measure 2: Passing rate is 74.44%	Measure 2: The target performance was met.		

4. Estimate and check answers to mathematical problems in order to determine reasonableness, identify alternatives and select optimal results.	Measure 1: One problem on a midterm exam with three questions	Measure 1: 60% of students will score 60% or better	Measure 1: 75% of students scored 60% or better (256 students out of 340)	Measure 1: The target performance was met.	Collect more data and re-evaluate the threshold level	
	Measure 2: Course pass rate	Measure 2:	Measure 2: 74.44%	Measure 2: The target performance was met.		
5. Recognize that mathematical and statistical methods have limits.	Measure 1 Two questions on midterm exams	Measure 1: 60% of students will score 60% or better	Measure 1: 76% of students scored 60% or better (232 students out of 307)	Measure 1: The target performance was met.	Collect more data and re-evaluate the threshold level	
	Measure 2: Course pass rate	Measure 2: 70% of students will pass the course	Measure 2: Passing rate is 74.44%	Measure 2: The target performance was met.		

*Direct and indirect: at least one measure per objective must be a direct measure.

Additional narrative (optional – use as much space as needed):

1. Course pass rate: passing grade C or better / all grades excluding W
2. There is a different threshold set up for different learning outcomes because some learning outcomes are basic skills that the majority of students should have and other outcomes require a deeper understanding that we expect a lower percentage of students to achieve.

Course: Math 1080 Semester taught: Fall 2019 Sections included: 4 sections with total from 104 to 129 students (students who took the exams)

Evidence of Learning: **MATH 1080 PreCalculus**

Measurable Learning Outcome Students will…	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
1. Interpret mathematical models such as formulas, graphs, tables and schematics and draw inferences from them.	Measure 1: Two questions with multiple components on midterm exams	Measure 1: 60% of students will score 65% or better	Measure 1: 57% of students scored 65% or better on assessment questions (69 students out of 122)	Measure 1: The target performance was not met.	Collect more data. Focus more on review problems.	
	Measure 2: Course pass rate	Measure 2: 70% of students will pass the course	Measure 2: Pass rate is 67.33%	Measure 2: The target performance was not met. This course is a fast-pace course that weaker students struggle	Carefully examine the situation. Look what can be done to improve the pass rate	
2. Represent mathematical information symbolically, visually, numerically, and verbally.	Measure 1: One question on a midterm exam with five components	Measure 1: 70% of students will score 65% or better	Measure 1: 70% of students scored 65% or better (88 students out of 126)	Measure 1: The performance target was met		
	Measure 2: Course pass rate	Measure 2: 70% of students will pass the course	Measure 2: Pass rate is 67.33%	Measure 2: See above		
3.Use arithmetical, algebraic, geometric, and statistical methods to solve problems.	Measure 1: One question on the final exam and two questions on midterm exams	Measure 1: 70% of students will score 65% or better	Measure 1: 80% of students scored 65% or better (80 students out of 104)	Measure 1: Far above the threshold level	Collect more data. Re-evaluate the threshold level.	
	Measure 2: Course pass rate	Measure 2: 70% of students will pass the course	Measure 2: Pass rate is 67.33%	Measure 2: See above		

4. Estimate and check answers to mathematical problems in order to determine reasonableness, identify alternatives and select optimal results.	Measure 1: One question on a midterm exam and one question on the final exam	Measure 1: 60% of students will score 60% or better	Measure 1: 66% of students scored 60% or better (69 students out of 104)	Measure 1: The performance target was met		
	Measure 2: Course pass rate	Measure 2: 70% of students will pass the course	Measure 2: Pass rate is 67.33%	Measure 2: See above		
5. Recognize that mathematical and statistical methods have limits.	Measure 1 Two questions on midterm exams with multiple components	Measure 1: 60% of students will score 60% or better	Measure 1: 67% of students scored 60% or better (87 students out of 129)	Measure 1: The performance target was met		
	Measure 2: Course pass rate	Measure 2: 70% of students will pass the course	Measure 2: Pass rate is 67.33%	Measure 2: See above		

*Direct and indirect: at least one measure per objective must be a direct measure.

Additional narrative (optional – use as much space as needed):

1. Course pass rate: passing grade C or better / all grades excluding W
2. There is a different threshold set up for different learning outcomes because some learning outcomes are basic skills that the majority of students should have and other outcomes require a deeper understanding that we expect a lower percentage of students to achieve.

Course: Math 2020 Semester taught: Fall 2019 Sections included: 1 with 12 students

Evidence of Learning: **MATH 2020 Mathematics for Elementary Teachers II**

Measurable Learning Outcome Students will...	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
1. Interpret mathematical models such as formulas, graphs, tables and schematics and draw inferences from them.	Measure 1: Three items (#10a, b, and c) on the final exam asking for the derivation for the formula of angles in a polygon, a 2D geometric shape, and a 3D geometric shape from a list of options.	Measure 1: 80% of the students will score 75% or better on the three items. (9 points total)	Measure 1: 83% of the students scored 75% or better on the three items. (24 out of 29 students scored 6.75 points or above)	Measure 1: The percent of students who were proficient on the items is good, target met, but improvement is possible. This is up from 63% on the last report.	Include additional items on the homework and focus on these topics specifically on review day.	Conduct another "Evidence of Learning" assessment next year.
	Measure 2: Course pass rate	Measure 2: 80% of the students pass with a C or better.	Measure 2: 97% of the students passed with a C or better. (28 out of 29 students passed)	Measure 2: Most students successfully demonstrated proficiency in the course objectives. This is up from 92% on the last report. Target met.	No action plan needed at this time.	
2. Represent mathematical information symbolically, visually, numerically, and verbally.	Measure 1: Two items (#7a and b) on the final exam asking for the area and perimeter of a composite 2D figure given the diagram.	Measure 1: 80% of the students will score 75% or better on the two items. (9 points total)	Measure 1: 83% of the students scored 75% or better on the three items. (24 out of 29 students scored 6.75 points or above)	Measure 1: The percent of students who were proficient on the items is good, target met, but improvement is possible. This is up	Include additional items on the homework and focus on these topics specifically on review day.	Conduct another "Evidence of Learning" assessment next year.

				from 63% on the last report.		
	Measure 2: Course pass rate	Measure 2: [see Learning Outcome 1]	Measure 2: [see Learning Outcome 1]	Measure 2: [see Learning Outcome 1]		
3.Use arithmetical, algebraic, geometric, and statistical methods to solve problems.	Measure 1: Two proof items (#4 and 5) on the final exam that uses geometric, algebraic, and arithmetical methods to solve it.	Measure 1: 80% of the students will score 75% or better on the two items. (8 points total)	Measure 1: 76% of the students scored 75% or better on the item. (22 out of 29 students scored 6 points or above)	Measure 1: About ¾ of the students were proficient. This is a big improvement from last report. About half were proficient then. Close to target!	Include additional items on the homework and focus on these topics specifically on review day.	Conduct another “Evidence of Learning” assessment next year.
	Measure 2: Course pass rate	Measure 2: [see Learning Outcome 1]	Measure 2: [see Learning Outcome 1]	Measure 2: [see Learning Outcome 1]		
4. Estimate and check answers to mathematical problems in order to determine reasonableness, identify alternatives and select optimal results.	Measure 1: One item (#9) on the final exam that uses estimation and reasonableness of the height and volume of an object using standard units.	Measure 1: 80% of the students will score 75% or better on the item. (8 points total)	Measure 1: 86% of the students scored 75% or better on the item. (25 out of 29 students scored 6 points or above)	Measure 1: The percent of students who were proficient on the items is good, target met, but improvement is possible. This is slightly up from 80% on the last report.	Include additional items on the homework and focus on these topics specifically on review day.	Conduct another “Evidence of Learning” assessment next year.
	Measure 2: Course pass rate	Measure 2: [see Learning Outcome 1]	Measure 2: [see Learning Outcome 1]	Measure 2: [see Learning Outcome 1]		

5. Recognize that mathematical and statistical methods have limits.	Measure 1: A set of questions on a homework assignment assessing the limits of mathematical methods to find the area of a rectangle.	Measure 1: 80% of the students will score 75% or better on the item. (10 points total)	Measure 1: 73% of the students scored 75% or better on the assignment. (20 out of 30 students scored 7.5 points or above. One student dropped since this assignment before the final.)	Measure 1: The results were below our goal. This was also from the homework and not very accurate because students could work together. Improvement is needed. Target is not quite met. This learning outcome is down from 97% from last report, but it is a different item.	Need to find better questions and assess this outcome on the final exam.	Conduct another “Evidence of Learning” assessment next year.
	Measure 2: Course pass rate	Measure 2: [see Learning Outcome 1]	Measure 2: [see Learning Outcome 1]	Measure 2: [see Learning Outcome 1]		

*Direct and indirect: at least one measure per objective must be a direct measure.
Additional narrative (optional – use as much space as needed):

Concurrent Enrollment

Course: CE Math 1030 Semester taught: Fall 2019 Sections included: 6 sections with total 89 students (students who took the final exam)
A random sample of 12 students is analyzed

Evidence of Learning: **CE MATH 1030 Contemporary Mathematics**						
Measurable Learning Outcome Students will…	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
1. Interpret mathematical models such as formulas, graphs, tables and schematics and draw inferences from them.	Measure 1: Two questions with multiple parts, one on a midterm exam, one on the final exam	Measure 1: 60% of students will score 70% or better	Measure 1: 58% of students scored 70% or better on assessment questions (7 students out of 12)	Measure 1: The target performance has been met	Collect more data, focus on more review	
	Measure 2: Course pass rate	Measure 2: 70% of students will pass the course	Measure 2: Passing rate is 80%	Measure 2: The target performance has been met		
2. Represent mathematical information symbolically, visually, numerically, and verbally.	Measure 1: One question with multiple parts on the final exam	Measure 1: 60% of students will score 60% or better	Measure 1: 75% of students scored 60% or better (9 students out of 12)	Measure 1: The target performance has been met		
	Measure 2: Course pass rate	Measure 2: 70% of students will pass the course	Measure 2: Passing rate is 80%	Measure 2: The target performance has been met		
3.Use arithmetical, algebraic, geometric, and statistical methods to solve problems.	Measure 1: Two questions with multiple parts, one a midterm exam and one on the final exam	Measure 1: 60% of students will score 65% or better	Measure 1: 58% of students scored 65% or better (7 students out of 12)	Measure 1: Students performed lower than expected	Collect more data, focus on more review	
	Measure 2: Course pass rate	Measure 2: 70% of students will pass the course	Measure 2: Passing rate is 80%	Measure 2: The target performance has been met		

4. Estimate and check answers to mathematical problems in order to determine reasonableness, identify alternatives and select optimal results.	Measure 1: Two questions multiple parts on the final exam	Measure 1: 60% of students will score 60% or better	Measure 1: 67% of students scored 60% or better (8 students out of 12)	Measure 1: The target performance has been met		
	Measure 2: Course pass rate	Measure 2:	Measure 2: Passing rate is 80%	Measure 2: The target performance has been met		
5. Recognize that mathematical and statistical methods have limits.	Measure 1 One question with multiple parts on the final exam	Measure 1: 60% of students will score 60% or better	Measure 1: 83% of students scored 60% or better (10 students out of 12)	Measure 1: Far above the threshold level	Collect more data and re-evaluate the threshold level	
	Measure 2: Course pass rate	Measure 2: 70% of students will pass the course	Measure 2: Passing rate is 80%	Measure 2: The target performance has been met		

*Direct and indirect: at least one measure per objective must be a direct measure.

Additional narrative (optional – use as much space as needed):

1. Course pass rate: passing grade C or better / all grades excluding W
2. There is a different threshold set up for different learning outcomes because some learning outcomes are basic skills that the majority of students should have and other outcomes require a deeper understanding that we expect a lower percentage of students to achieve.

Concurrent Enrollment

Course: CE Math 1050   Semester taught: Fall 2019   Sections included: 16 sections with total 379 students (students who took the final exam)
A random sample of 48 students is analyzed

Evidence of Learning: **CE MATH 1050 College Algebra**						
Measurable Learning Outcome Students will…	Method of Measurement*	Target Performance	Actual Performance	Interpretation of Findings	Action Plan/Use of Results	"Closing the Loop"
1. Interpret mathematical models such as formulas, graphs, tables and schematics and draw inferences from them.	Measure 1: Four questions on the final exam	Measure 1: 60% of students will score 65% or better	Measure 1: 89% of students scored 65% or better on assessment questions (43 students out of 48)	Measure 1: Far above the threshold level	Collect more data and re-evaluate the threshold level	
	Measure 2: Course pass rate	Measure 2: 70% of students will pass the course	Measure 2: Passing rate is 92.8%	Measure 2: Far above the threshold level		
2. Represent mathematical information symbolically, visually, numerically, and verbally.	Measure 1: Six questions on the final exam	Measure 1: 60% of students will score 70% or better	Measure 1: 95% of students scored 70% or better (46 students out of 48)	Measure 1: Far above the threshold level		
	Measure 2: Course pass rate	Measure 2: 70% of students will pass the course	Measure 2: Passing rate is 92.8%	Measure 2: Far above the threshold level		
3.Use arithmetical, algebraic, geometric, and statistical methods to solve problems.	Measure 1: Three questions on the final exam	Measure 1: 60% of students will score 65% or better	Measure 1: 79% of students scored 65% or better (38 students out of 48)	Measure 1: The target performance has been met		
	Measure 2: Course pass rate	Measure 2: 70% of students will pass the course	Measure 2: Passing rate is 92.8%	Measure 2: Far above the threshold level		

4. Estimate and check answers to mathematical problems in order to determine reasonableness, identify alternatives and select optimal results.	Measure 1: Two questions on the final exam	Measure 1: 60% of students will score 60% or better	Measure 1: 73% of students scored 60% or better (35 students out of 48)	Measure 1: The performance target has been met		
	Measure 2: Course pass rate	Measure 2: 70% of students will pass the course	Measure 2: Passing rate is 92.8%	Measure 2: Far above the threshold level		
5. Recognize that mathematical and statistical methods have limits.	Measure 1 Three questions on the final exam	Measure 1: 60% of students will score 60% or better	Measure 1: 54% of students scored 60% or better (26 students out of 48	Measure 1: The target performance was not met	Collect more data, focus on more review	
	Measure 2: Course pass rate	Measure 2: 70% of students will pass the course	Measure 2: Passing rate is 92.8%	Measure 2: Far above the threshold level		

*Direct and indirect: at least one measure per objective must be a direct measure.

Additional narrative (optional – use as much space as needed):

1. Course pass rate: passing grade C or better / all grades excluding W
2. There is a different threshold set up for different learning outcomes because some learning outcomes are basic skills that the majority of students should have and other outcomes require a deeper understanding that we expect a lower percentage of students to achieve.

APPENDIX H

Examples of Signature Assignment

Big Question: How can mathematics help me in my life?

Signature Assignment for Math 1050 or 1080

Write a persuasive paper that answers all the questions.

Assume that you won $150,000 and you want to spend half of the money and save the rest.

You need to make a decision on how to save the money and you need to persuade your partner (or parents) that you made the right choice.

(a) List four financial institution and their terms and conditions (interest rate, how the interest is calculated, minimum balance, etc..)

(b) Calculate what your savings would be in 10 years in each institution that you listed in part (a)? Justify your answer (that is show your work).

(c) What financial institution would you choose? And why?

(d) Reflect, why it is important (or not) to study mathematics and how mathematics can help you in your life. Provide at least two examples to support your opinion.

Big Question: How is mathematics used in every-day life?

Signature Assignment for Math 1080 or Math 1050

In Math 1080 and 1050 we encounter new mathematical ideas and objects (such as trigonometric functions, polar coordinates, vectors and matrices) that most students have only been briefly introduced to, if at all. In particular, students often ask, "What are matrices used for?" The answer is that matrices have many applications, including but not limited to: computer graphics programming, storing statistical data, and encryption, just to name a few. Here is a link to a short article with more information which you may find interesting: https://www.slideshare.net/moneebakhtar50/application-of-matrices-in-real-life . This assignment will explore only one possible use for matrices: Cryptography!

<u>Project Description:</u>

Systems of Equations, Matrices and Cryptography

When banks and other money institutions send information about accounts they send it through an encrypted message. For example, when you enter your PIN number at an ATM they will encrypt the PIN so that if it is intercepted then the decryption process would be needed to figure out the PIN. I may input a PIN of 1234, and the receiving end gets the PIN 5678 based on the encryption process.

The encryption can be based on a system of equations. Suppose a bank has a system of equations of:

$$\begin{cases} x + y + z + w = a \\ 2x + y + 2z + w = b \\ x + 7y + 3z + 2w = c \\ 10x - 3y + 7z - 2w = d \end{cases}$$

Your four digit PIN would then be the matrix $= \begin{bmatrix} x \\ y \\ z \\ w \end{bmatrix}$. The encrypted message would be the matrix

$$B = \begin{bmatrix} a \\ b \\ c \\ d \end{bmatrix}.$$

Let's say my PIN is 1234 with the above system. Then the receiver would get the PIN as the encrypted matrix $B = \begin{bmatrix} 10 \\ 14 \\ 32 \\ 17 \end{bmatrix}$. The receiver must then multiply the encrypted matrix B by a key matrix, call it K, which will decrypt the message to get back the PIN of 1234 and thus enable the system to work with the corresponding account.

As a group, create a system of equations with which you can encrypt a PIN (the PIN should be at least 4 digits). Choose a PIN and then find the corresponding encrypted PIN. Find the key matrix you would need to give to the receiver so that they could decipher the encrypted PIN. Using this matrix the receiver should be able to take an encrypted PIN and find the original PIN. *Remember, not all square matrices have inverses, so if you cannot find an inverse matrix for your system this means that your system is singular. Try again!

Espionage!

Suppose a hacker found a way to gain access to encrypted PINs and they steal the deciphering (key) matrix. They would then be able to discover the original PINs for different accounts using matrices!

Once your system, PIN, encrypted PIN, and deciphering matrix are created, then steal an encrypted PIN and deciphering matrix from another group! With the stolen PIN and matrix, find the system that the other group created and the original PIN they used in their system.

<u>Instructions:</u> Please write a paper thoroughly detailing your project, the process(es) you went through to create your system, PIN, key matrix, etc. including any problems you encountered. Also include your process of stealing and decoding another group's PIN. Your audience is the students in our class. That means that they already understand the basic ideas behind systems of equations, matrices and matrix algebra. However, make sure that you clearly explain your process so that someone else reading your paper could re-create it. You should also include the following:

a) Your system, your original PIN, the encrypted PIN, and the deciphering matrix for your system.
b) The stolen encrypted PIN, the stolen deciphering matrix, the successfully (or not!) decrypted PIN, and original system.
c) Clearly explain the process you went through for both parts (a) and (b) above.
d) At least one paragraph on why it is important (or not) to study mathematics and how mathematics (specifically matrices is fine) is used in everyday life. Provide at least two examples to support your opinion.
e) Please upload your project to Canvas under the Signature Assignment. Also please submit a paper copy to me in person.

Please only turn in <u>one project</u> (paper) for your group. Make sure all names of group members are on the project. Please examine the rubric at the end of this document to ensure that you have completed and included all the necessary parts and have met expectations. **Each** group member should put their name at the top of a rubric and turn it in along with the project for scoring purposes. Additionally, **each** group member should fill out and turn in a Peer Evaluation Form, which can also be found at the end of this document.