Annual Departmental Report

2021-2022

Program Information

Program/Department: Mathematics
Department Chair: Peter Staab
Department Assessment Committee Contact: Amy Wehe

This document is to be kept in the department and an electronic file is due to the AVP of Institutional Research & Planning by June 1, 2022.

A. Departmental Special Section for AY21-22

Department Lessons Learned and Accomplishments

This was another trying year for the Mathematics Department mainly due to personnel. We had two faculty members (Sarah Wright and Rachael Norton) go on leave toward the end of the Fall semester and throughout the spring semester. Ben Levy took a ¾ leave to do research at NOAA, Nermin Bayazit was on a full-year sabbatical, and jenn berg decided not to return to FSU. For most of the year, we were down 5 faculty members from the 2019 academic year and only had seven tenured/tenure-track members. Thus, we were spread quite thin. We realized how important having a bigger set of faculty is needed to get everything accomplished that we needed.

Also, due to the lack of tenure/tenure-track faculty, we had a much larger percentage of classes taught by adjunct faculty. We have an impressive number of adjuncts that regularly teach Mathematics classes, however, it is clearly not the same as tenure/tenure-track faculty. However, I will add that two of them (Michael Stassen and Lori Leonard, who had a full-time position this year) helped out the Department in terms of service. Lori chaired the assessment committee and Michael sat on the curriculum committee.

Despite the lack of faculty, we had plenty of accomplishments this year. To begin with we hosted the 41st Elizabeth Haskins Mathematics Contest for about 60 regional high school students here on campus. Although the total number of contestants were down compared to the 2019 contest, the last year it was on campus, the enthusiasm by the students, their teachers and the Fitchburg State faculty were high, resulting in a nice contest. This is clearly an important event for us to build community with local high schools, but additionally with math majors and minors that often help out during the contest for proctoring and giving talks.

Another case of things returning in person was our seminar series. We had 6 speakers (2 in the fall and 4 in the spring), with 4 of those speakers from off campus and most of these were held in person. However, our ability to have virtual talks has expanded geographically the speakers that we can have for our students. One such example was Emily Norton, our colleague Rachael's twin sister, who lives in Seattle, Washington delivered a nice virtual talk on Statistics in Oceanography.

We had many faculty accomplishments this academic year. First of all, Ben Levy was granted tenure and Catherine Buell was promoted to professor. Additionally, Amy Wehe and Mary Ann Barbato worked on a project about alternative assessments to the MTEL test for students in Elementary Education. Rachael Norton and Peter Staab received a ROTEL grant to rewrite WeBWorK problems to improve the DEI of relevant Statistics problems that will be used in the Math 1700 course in the future. Finally, Nermin Bayazit completed a sabbatical project. (give short description of this)

The Mathematics Department Curriculum Committee submitted a few AUC proposals that were all passed. The courses Math 1250 and 1300 both received QR designation and Math 4000 now has the new name of Real Analysis, a more common name for this course across the nation. In addition, we continued to discuss how the Math 1300, Precalculus course can be redesigned to better fit the mathematics needed for all of the majors that require it. This will continue next academic year.

A small event was the pi-day event on March 14. Like the mathematics contest, it was a community building event for students and faculty.

B. Program Learning Outcomes (PLOs) (Educational Objectives)

I. List of PLOs and the timeline for assessment.

PLO #	PLO – Stated in assessable terms	Where are the learning outcomes for this level/program published?	Timing of assessment (annual,	When was the last assessment of the PLO completed?

		(please specify) Include URLs where appropriate	**semester, bi-annual, etc.)**	
1.	Students should develop effective thinking and communication skills. a) state problems carefully, articulate assumptions, understand the importance of precise definition, and reason logically to conclusions; b) identify and model essential features of a complex situation, modify models as necessary for tractability, and draw useful conclusions; c) deduce general principles from particular instances; d) use and compare analytical, visual, and numerical perspectives in exploring mathematics; e) assess the correctness of solutions, create and explore examples, carry out mathematical experiments, and devise and test conjectures;	https://www.fitchburgstate.edu/academics/programs/mathematics-babs	(a)(c)(f)(h) – every other year (b)(d)(e)(g) - every other year (i)(j) – every 3 years (with PLO 4)	

	f) recognize and make mathematically rigorous arguments g) read mathematics with understanding; h) communicate mathematical ideas clearly and coherently both verbally and in writing to audiences of varying mathematical sophistication; i) approach mathematical problems with curiosity and creativity and persist in the face of difficulties; j) work creatively and self-sufficiently with mathematics.			
2.	Students should learn to link applications and theory. a) Mathematics students should encounter a range of contemporary applications that motivate and illustrate the ideas they are studying b) learn to apply mathematical ideas to problems in those areas.	https://www.fitchburgstate.edu/academics/programs/mathematics-babs	Every three years	

	c) Students should come to see mathematical theory as useful and enlightening in both pure and applied contexts.			
3.	Students should learn to use technological tools. a) Mathematical sciences major programs should teach students to use technology effectively, both as a tool for solving problems b) Mathematical sciences major programs should teach students to use technology effectively, as an aid to exploring mathematical ideas. c) Use of technology should occur with increasing sophistication throughout a major curriculum.	https://www.fitchburgstate.edu/academics/programs/mathematics-babs	Every three years	
4.	Students should develop mathematical independence and experience open-ended inquiry. a) A mathematical sciences major should be structured to move students beyond the carefully	https://www.fitchburgstate.edu/academics/programs/mathematics-babs	Every three years	

	choreographed mathematical experiences of the classroom. b) A major curriculum should gradually prepare students to pursue open-ended questions c) to speak and write about mathematics with increasing depth and sophistication.			

II. PLO Assessment (Please report on the PLOs assessed and/or reviewed this year. Programs should be assessing at least one each year.)

Using the table below, list and briefly describe the **direct method(s)** used to collect information assessing whether students are learning the core sets of knowledge (K), skills (S) and attitudes (A) identified as essential.

PLO # (from above)	**Assessment description (exam, observation, national standardized exam, oral presentation with rubric, etc.)**	**When assessment was administered in student program (internship, 4th year, 1st year, etc.)**	**To which students were assessments administered (all, only a sample, etc.)**	**What is the target set for the PLO? (criteria for success)**	**Reflection on the results: How was the "loop closed"?**
1a	Written assignment				
1c	Written assignment				
1f	Written assignment				
1h	Survey of faculty and written papers	3rd year			
2	Survey of students	1st and 4th year students	Most completed the survey		

You may use this comment box to provide any additional information, if applicable:

This year, the Assessment Committee assessed Goal 1(a),(c), (f), (h) and Goal 2.

We did not previously have a tool to use to assess Goal 2. This year, we created a survey for students to take to help us assess whether were learning to link applications and theory in their courses. The survey asked students the following questions:

What is/are your major(s)?
How many math classes have you taken? (Include the courses you are currently taking.)
In which course are you currently taking this survey?
Did you find material in this course useful to other courses in your major?
Does this course increase your interest in the field of mathematics?
Does this course give you new mathematical ideas?
Have you demonstrated the knowledge you have learned in this course in any projects or discussions?
Do you see how to apply knowledge learned in this course to real life?
How often did you contact your instructor this semester because the topics in this course motivated you?
Please share any other information here to show how this course was useful to you.

Ten students took the "Assessment Goal Survey" to assess Goal 2. All but 2 of the students who took the survey were Mathematics majors at the time they took the survey. The number of mathematics classes student had taken ranged from 2 to 14. Three of the students were taking the survey for Numerical Analysis, four for Multivariate Calculus, and three for Freshman Seminar. Most students (7 out of 10) found the material they learned in their course helpful to other courses in their major. All (10 out of 10) students said the course increased their interest in the field of mathematics and gave them new mathematical ideas. Half (5 out of 10) of the students said they demonstrated the knowledge they have learned in the course in projects and discussions. Additionally, 8 out of 10 of the students said they could see how they could apply the knowledge learned in the course to real life. Finally, 4 out of 10 of the students said they sought out discussions with their professor during the semester because the topics in the course motivated them. Of those, two students said they contacted their instructor weekly. The other two said they contacted their professor "not often" or "probably 2 or 3 times."

Several students taking the survey also included further comments about their course. Below I have included comments that are relevant to assessing Goal 2:

"Each speaker brought new information useful to me as a freshman especially the applied career information to see where I might want to use math post-graduation, the non-applied speakers were still cool to see for things like research and theoretical math."

"As this is the highest difficulty math course I have taken in terms of concepts I haven't yet been able to build off this knowledge for higher level courses, but I will hopefully going forward."

"It is one of the highest level math courses. That is why I have not used information in this course in others."

"This course provided a much more in depth explanation of topics I have only touched on in the past. One of the most enjoyable, challenging, and thought provoking math classes I have taken."

In order to assess Goal 1(h), the Assessment Committee created a survey for faculty this semester and then asked faculty to complete the survey. We asked faculty to only respond to the survey regarding courses they taught in AY 2021-22 that were at the Calculus I level or above. Seven faculty members responded to the survey. Of those, 100% responded that they asked their students to communicate mathematical ideas verbally this academic year. When asked in which courses they required students to engage in this activity, the following courses were listed: Introduction to Mathematical Thought, History of Mathematics, Math 3003, Abstract Algebra, Geometry (Math 3000), Probability and Statistics I, Math Practicum (Math 4020/4030, 4860/4870), Math 3010 (Methods I pre-prac), Math 2400, Math 1850, and Math 4400. In other words, students are asked to communicate verbally in many courses throughout the mathematics curriculum.

When asked if they required students to communicate mathematics in writing this year, 100% of the faculty responding said that they indeed require students to communicate mathematics in writing. They responded that they specifically asked students to respond in writing in the following classes at or above the level of Calculus I: Introduction to Mathematical Thought, History of Mathematics, Math 2600, Math 3003, Math

2550, Abstract Algebra, Geometry (Math 3000), Probability and Statistics, Math Practicum (Math 4020/4030, 4860/4870), Math 3010 (Methods I pre-prac), Math 2400, Math 1850, Math 4400 and Math 3500.

Faculty were asked if their students were asked to communicate mathematical ideas to audiences of varying sophistication this semester. Just over half (57.1%) said they had asked students to communicate mathematical ideas to audiences of varying sophistication. The courses in which faculty asked their students to practice this skill were: Introduction to Mathematical Thought, Math 3003, Math Practicum (Math 4020/4030, 4860/4870), and Math 3010 (methods I pre-prac). An additional faculty member stated that they had told their students that their main audience was each other/themselves.

When asked if their students had communicated mathematics in a manner appropriate to their audience, all participating faculty members responded in the affirmative. They said their students communicated with their audience successfully in Introduction to Mathematical Thought, History of Mathematics, Math 3003, Math Practicum (Math 4020/4030, 4860/4870), Math 3010 (Methods I pre-prac), Math 3500 and Math 4400.

In addition, we used a previously created rubric to assess Goal 1(h) for students taking History of Mathematics in Fall 2021 through the two of the three papers they wrote for that class. We read 15 papers. Of those, 9 of them were of the quality we would hope graduates of mathematics would write. They were well written papers with appropriate “works cited” pages, good transitions, informative introductions and conclusions, and accurately explained mathematics. The authors of three of the papers were developing their writing skills. They attained most of the goals in writing their paper, but their paper was not quite yet what we would hope graduates of mathematics would demonstrate. Most often, there was a lack in the transitions or a sudden ending to the paper. Three of the submitted assignments were not developed into full papers. They were lacking in transitions or information, had abrupt endings, and/or did not explain the mathematics in their paper well. All students wrote papers that minimally achieved the assignment goals.

Summary of Findings: Briefly summarize the results of the PLO assessments reported in Section II above combined with other relevant evidence gathered and show how these are being reviewed/discussed. How are you "closing the loop"?

Reflection Prompt	Narrative Response
Other than GPA, what data/ evidence is used to determine that graduates have achieved the stated outcomes for the degree? (e.g., capstone course, portfolio review, licensure examination)	For students in the middle & secondary education concentrations, there is a licensure option. For students in applied mathematics, Math 4600 is a capstone course where a substantial paper (10-20 pages) is written on a topic of the student's choice with research done. There is also a capstone course for students who are mathematics majors and are not in a specific mathematics track, Math 3900.
Who interprets the evidence? **What is the process?** **(e.g. annually by the curriculum committee)**	Annually, the Assessment Committee assessed the PLOs that we decided to cover this academic year in consultation with the Chair. This committee also performs all of the assessment.

What changes have been made as a result of using the data/evidence? (close the loop)	The department has been thinking about how to make sure students engage in all of the important aspects of mathematics. It is, for instance, possible for some students to graduate without taking a course in statistics or in math modeling. There are discussions about what all students need to experience and what can be entirely elective for students who are interested in that field of mathematics.

C. Assessment Plan for Program/Department

I. Insert the program or department Assessment Plan
(see section BI above)

II. Explain any changes in the assessment plan including new or revised PLOs, new assessments that the program/department plans to implement and new targets or goals set for student success.
Nothing in particular has changed in the Department's assessment plan.

III. If you do not have a plan, would you like help in developing one?

We have one, but could use some ideas on refining and working on the process of performing the annual assessment.

D. Program Review Action Plan or External Accreditation Action Letter/Report

Annual Reflection/Follow-up on Action Plan from last Program Review or external accreditation (only complete the table that is appropriate for your program)

I. Programs that fall under Program Review:

i. Date of most recent Review: *May 2017*

ii. Insert the Action Plan table from your last Program Review and give any progress towards completing the tasks or achieving targets set forth in the plan.

Specific area where improvement is needed	**Evidence to support the recommended change**	**Person(s) Responsible for implementing the change**	**Timeline for implementation**	**Resources needed**	**Assessment Plan**	**Progress made this year**
STEM resource center (math and science)	Additional support needed for students in science courses, who often face mathematical difficulties in their courses.	Dean of HNS John Schaumloffel will coordinate efforts in collaboration with representatives from STEM departments	Discussed in fall 2018.	Space, computer, staff.	TBD	NA
Math Center	The Math Center often seems disjoint from the department. It is located in a different building and although there is some collaboration between the two, there should be more.	Department chair will maintain ties and perhaps appoint a Math Center Liaison from the department. Math Support Specialist will also collaborate with center	Fall 2018 and ongoing			

Careers	We are unsure what skills are most important in securing and succeeding in a math related position in industry and are understaffed in the areas of applied mathematics and statistics. We have limited information on local internship and job opportunities to help students find such opportunities.	The department is submitting corresponding tenure track requests. Mary Ann Barbato, as part of her sabbatical, collected and shared information on internship & job opportunities, corresponding companies and curricular pathways.	Spring 2017 and ongoing.	New FT faculty members in applied mathematics and statistics	Student surveys & alumni data	continued working on examining our statistics offerings in the Department especially with discussion surrounding a Data Science major.
Dev. Math Coordinator	We have had a one year temp. serving in this role for the past 4 years.	The Mathematics Department is in the process of a corresponding search for an FT staff member to fulfill this role	Spring 2018 -	Staff position which has already been granted	Position will be reviewed after the first year.	Math Support Specialist is now fully a member of the Department and making significant contributions.
Assessment Plans	Our current assessment plan is very dated and	The department Assessment Committee is working on a new plan.	Fall 2017 -		Assessment data will be collected by dept.	Developed career competencies and action plan via Davis grant activities from the previous year is being

	needs to be revised.					integrated into both assessment and advising
Math Software	We have some new faculty who use different software and would also like to expand our software exposure to our students.	An ad hoc dept. committee will evaluate what software we would like to retain and which we would like to remove/ replace/add.	Fall 2017. Revisit in Fall 2018		TBD	
QR requirement	Quantitative reasoning is gaining attention nationwide as a more appropriate math experience for certain majors and our faculty see it as a desirable option for students at Fitchburg State who do not have a prescribed mathematics requirement.	Members of the Math dept. in collaboration with appropriate departments are developing a QR course titled Math in Society which has already been approved by AUC and is on the schedule for next AY.	Spring 2018 –	Additional faculty support	Collect & analyze performance and retention data after first year.	

Co-requisite instruction	There is a statewide push toward real time remediation as it expedites students' path through developmental mathematics. In our initial pilot it showed to improve retention rates.	The department is continuing to use co-requisite instruction in math 1700, has expanded to math 1250 and 1800 and in fall 2018 will expand to the new QR course and math 1500.	Fall 2017 -	Additional faculty support	Collect & analyze performance and retention data.	continued corequisite instruction in nearly all gateway math courses
BHE plans for developmental math	There is a statewide initiative piloting the use of HS GPA to place students into college level mathematics	The Math dept. has participated in the pilot and is expanding this alternate form of placement to several math courses.	expansion began in Fall 2017 and will continue into AY 18/19.		Collect & analyze performance and retention data	Implemented new policy incorporating hs gpa into prerequisites of nearly all gateway math courses
Graduate programs in STEM Ed.	The numbers in our graduate programs for teachers are low by department and streamlining into a joint program may solve this problem and enable us to better serve	Dean of Education, Bruno Hicks in collaboration with representatives from STEM departments	Explore options and check demand in Fall 2018		TBD	NA

	teachers in these fields.					
Statistics	Although some faculty in the department have taken statistics classes, we do not currently have a statistician on the faculty in this department. Since statistics is an area of math that is highly useful in industry and otherwise, we will be looking for ways to strengthen our department in that area.	Mathematics department	Fall 2017 -	Tenure track faculty member (statistics focus)		As mentioned above, the statistic program is on firmer ground with a hire of Jessica Oehrlein and especially around the discussions of a Data Science major.
Collaboration w. other depts.	One way to improve our students' educational experience in STEM is to make more connections between our mathematics	The Mathematics department has been in collaboration with several departments including: Bio/Chem, EGS, Comm. Media, Education,	Fall 2017 -			Collaborated with other departments on new LA&S designations

	service courses and other courses.					
Collaboration w. MWCC	Mass Transfer and Math Pathways statewide efforts for ease of transfer	Since Fall 2015, several members of the Math dept. have represented Fitchburg State on statewide committees related to these efforts and worked with MWCC among other statewide institutions to align courses and curriculum. These efforts will continue.	Fall 2017 -			During the previous AY, we worked with STEM faculty to establish a pathway for licensure track students. This is nearly finished.

iii. If you do not have an action plan, would you like help in developing one based on your last program review and needs of the program?

☐ Yes

II. Programs with external Accreditation:

i. Professional, specialized, State, or programmatic accreditations currently held by the program/department.
ii. Date of most recent accreditation action by each listed agency.
iii. Date and nature of next review and type of review.

List key issues for continuing accreditation identified in accreditation action letter or report.	Key performance indicators as required by agency or selected by program (licensure, board or bar pass rates; employment rates, etc.)(If required.)	Update on fulfilling the action letter/report or on meeting the key performance indicators.

E. Departmental Strategic Initiatives

Accomplished Initiatives AY 21-22 Add more rows as needed	Corresponding Strategic Plan Goal & Strategy Goal # followed by Strategy # ex: 1.3	Indicate if a Diversity, Equity and Inclusiveness (DEI) Goal
Finalize action plan for math major via Davis grant	2.1: Achieve a cultural shift around how we advise, mentor, and teach all students, especially traditionally underrepresented and underserved students, so that we meet them where they are	☐
Collaboration with other departments on research and curriculum (e.g. CS on Data Science minor)	1.3: Promote greater interdisciplinary teaching and develop innovative combinations across academic departments.	☐

Collaborate with MWCC on curriculum and transfers	2.4: Ensure all processes and support services are adequate to meet the unique needs of transfer students, non-traditional students, online learners, and graduate students. 5.7: Remain affordable and accessible to all prospective and incoming students.	
Expansion of OER use	2.1 Achieve a cultural shift around how we advise, mentor, and teach all students, especially traditionally underrepresented and underserved students, so that we meet them where they are.	**Yes**

Planned Initiatives for AY 22-23 **Add more rows as needed**	**Associated Strategic Plan Goal & Strategy** **Goal # followed by Strategy # ex: 1.3**	**Indicate if a Diversity, Equity and Inclusiveness (DEI) Goal**
Propose a Data Science major	1.3: Promote greater interdisciplinary teaching and develop innovative combinations across academic departments. 1.4: Leverage existing curricular strengths to develop new programs that meet demand and	

	forge deeper connections between our curriculum and community needs.	
Develop an internship program	1.2: Establish a learning environment in which academic and co-curricular programs work in synergy to offer applied learning experiences that prepare students for purposeful personal and professional lives.	
Continued discussion around Precalculus	1.1: Fortify and promote the distinct role of the general education curriculum that provides every undergraduate student a relevant and challenging liberal arts foundation. 1.2: Establish a learning environment in which academic and co-curricular programs work in synergy to offer applied learning experiences that prepare students for purposeful personal and professional lives.	
Formalize math career advising	2.5: Integrate career services into departments and curriculum, and build more consistent career advising across	

	campus, especially for first-year students and sophomores.	
Gather ideas from PD Institute on Racial Equity in Pedagogy and Practice	2.3: Provide faculty and staff training around equity and inclusiveness both in and out of the classroom.	**yes**
Have department representative participate in Faculty Academy	2.3: Provide faculty and staff training around equity and inclusiveness both in and out of the classroom.	**yes**
Increase enrollment in math major and minor via active recruitment	2.6: Adopt an integrated approach to enrollment management to achieve more systemic and centralized coordination of student recruitment and retention efforts.	**yes**
Expansion of OER use	2.1 Achieve a cultural shift around how we advise, mentor, and teach all students, especially traditionally underrepresented and underserved students, so that we meet them where they are.	**Yes**
Open lab hours for introductory level math classes	2.4: Ensure all processes and support services are adequate to meet the unique needs of	

(could help pave the way for STEM resource center)	transfer students, non-traditional students, online learners, and graduate students.	
Expand collaborate with Math Center	2.4: Ensure all processes and support services are adequate to meet the unique needs of transfer students, non-traditional students, online learners, and graduate students.	**yes**

F. Departmental Reflection:

Take this section to reflect on--

1) *Initiatives that you may be considering for 22-23 academic year that you did not already capture above.*

2) *Any other thoughts or information that you would like to share.*

There was continued discussion this year between the Computer Science and Earth and Geographical Sciences Departments in forming a Data Science interdisciplinary major. There were some discrepancies between the Departments involved on what would be best and we ran out of time to complete the work this year. Recently, some new ideas about the major were discussed and we are optimistic that we can get work on this in the coming year.

The Mathematics Department has had just a few students who have done internships over the years. However, for many students this would be a valuable experience and we hope to formalize the process and put this in place. Our Department along with Biology/Chemistry and Earth and Geographic Sciences have proposed a collaborative process in this place.

Many of next academic year's initiatives are from this current year that are still in progress. This lack of current initiatives not finished is mostly due to the lack of tenure/tenure-track faculty availability this current year. Additionally, these are still high priorities for the Department.

Although we accomplished quite a bit on the OER front this academic year, it remains an important initiative into the future. This coming year, we hope to complete a text for Math 1600: Informal Mathematical Modeling, which will then put all 3 Elementary education classes (Math 1500, 1600, 2000) written by FSU faculty with 2 of the 3 OER.

G. Other Department Accomplishments