End of Year Assessment Report for Programs

Program: Mathematics	Semester/year: Spring 2018
Contact Person: George Peters, Dept. Chair	Submission date:

Program Mission Statement

The principal goals of the mathematics program at Greenville College are to foster students who value mathematics for its own sake and value it as a means of describing God's universe. The program seeks to prepare students for advanced study in mathematics and to perform in the work force. The mathematics program also serves to assist in the preparation of students for advanced work in complementary fields.

Program Objectives

At the close of their degree successful students will be able to:

1. Integrate a variety of mathematical concepts and skills into problem solving.

2. Construct and communicate creative work, including proofs, using the language and symbolism of mathematics.

3. Solve problems using technology.

4. Develop a breadth of knowledge in the applications of mathematics.

Assessment Methods and Benchmarks – SPRING SEMESTER

Program Objective	Introducing	Developing	Mastering
1. Integrate a variety of mathematical concepts and skills into problem solving.	MATH116 Final Exam	Not taught this semester	MATH306 Final Exam
	Benchmark: >=55%	Benchmark: >=75%	Benchmark: >=55%
2. Construct and communicate creative work, including proofs	MATH116 Seq. & Series Exam	MATH312 Final Exam	MATH306 Exam Average
	Benchmark: >=55%	Benchmark: >=60%	Benchmark: >=60%
3. Solve problems using technology.	*Not taught this semester*	*Not taught this semester*	MATH306
	Benchmark: >=75%	Benchmark: >=75%	Benchmark: >=70%
4. Develop a breadth of knowledge in the applications of mathematics.	MATH116 Average of 2 applied exams	*Not taught this semester*	MATH 306 Exam Average
	Benchmark: >=55%	Benchmark: >=75%	Benchmark: >=75%

Assessment Findings – SPRING SEMESTER

PO1.

A. Introducing: MATH116 Final Exam – Some fundamental problem solving happens in Calculus II. From applied integration, to sequences and series, to conics and vectors, problems are solved with newly learned techniques. 65% of students (13 of 20) met the 55% benchmark on the final exam. 67% (2 of 3) currently declared mathematics majors met the benchmark.
B. Developing: Not taught this semester.
C. Mastering: MATH301 Final Exam – The problems of probability and statistics are practical, diverse, and important. 100% of the students (17/17) met the benchmark at the 70% level (although 55% was the actual cutoff)

PO2.

A. Introducing: MATH116 Seq. and Series Exam 1 – Students determine convergence or divergence of sequences and series through appropriate identification and careful application of theorems which is a fundamental building block of proof writing. 14 of 20 students (70%) met the 55% benchmark. 67% (2 of 3) currently declared mathematics majors met the benchmark
B. Developing: MATH312 Final Exam 1 – Students solve problems and write proofs in the area of Linear Algebra. Every solution is communicated through written means. This exam shows if they can construct simple proofs in the area of Linear Alg. 83% (5/6) students met the 60% benchmark.
C. Mastering: MATH306 Exam Average – Students are required to communicate solutions to problems but also identify the strengths and weaknesses of particular numerical techniques. They prove the accuracy of certain techniques using theoretical tools such as Taylor's Theorem. 67% (4/6) students met this benchmark.

PO3.

A. Introducing: Not taught this semester.
B. Developing: Not taught this semester.
C. Mastering: MATH306 (programming) Homework – Students write a good bit of code in this class. The programming homework was not split out from the regular. However, due to the smallness of the class and the proficiency and lack thereof of individual students in the programming assignments I can confidently say 50% (3/6) of the students met this benchmark.

PO4.

A. Introducing: MATH116 Average of Applied Integration Exam & Vectors Exam – There are some important applied techniques in Calculus II. 15 of 20 students (75%) met the 55% benchmark. 100% (3 of 3) currently declared mathematics majors met the benchmark
B. Developing: Not taught this semester.
C. Mastering: MATH306 Exam Average – The problems of Numerical Analysis are very applied (root-finding, solutions of systems of equations, differential equations, etc). 67% (4/6) students met this benchmark.

Analysis of Assessment Findings – SPRING SEMESTER

PO1. Integrate a variety of mathematical concepts and skills into problem solving.
The final exam of Calc. II is a proper place for introductory assessment of this. However, it will always be an exam students struggle with due

to the diverse and non-trivial content. This year's results seem normal. The presence of only 3 mathematics majors in the class is a small number. However, we consider all Calc. II students as potential majors. I think the current assessment practices are reasonable for this objective, although the "Developed" part in MATH217 warrants a little work. See below.

PO2. Construct and communicate creative work, including proofs
The spring is a good time to evaluate this, particularly the introduction and development. Assessing the sequences and series exam is a reasonable start. Many students struggle with it but often rise to the occasion. This semester was no exception. The Linear final is a perfect place to assess students developing some introductory proof-writing skills. All but one of the sophomores did a nice job! Fall, with Advanced Calc. or Abstract Algebra is a better time for this assessment. However, the final in Numerical Analysis showed that the majority of the students carefully communicate important mathematical information, as they understand it.

PO3. Solve problems using technology.
So clearly the MATH306 which was used to assess several things had a higher than desired percentage of students not meeting the benchmark. The class is a difficult one and there were 2 underprepared students in there. A third student was sufficiently prepared but still did not perform well. Several students did **very** well in the class. I think of primary concern from this class was the programming homework. Some students were clearly not ready for the programming and didn't engage in the process sufficiently to meet benchmarks. All students had the prerequisite programming experience but several asked almost no questions in office hours or in class about the coding. Students will need to be supported/encouraged more to take on the programming assignments.

PO4. Develop a breadth of knowledge in the applications of mathematics.
Calc. II is a very reasonable introduction to this. Applied techniques of integration is an obvious important chapter here. See the discussion section below. Applied Mathematics is an excellent course for measuring the mastering of this. The students who did well and fairly well in the class learn a host of different techniques to solve applied problems in more realistic situations. I think the exam average is a reasonable way to assess this as well.

In our introductory majors course MATH116 no major failed to meet the benchmark of more than one objective.

General: We have a problem with a few students who don't stay with the material. They get behind and stop turning in homework. In Numerical Analysis a couple students didn't turn in programming assignments for about 2/3 of the semester. In the Fall in Abstract a couple students worked hard for the first 2 or 3 weeks and then really backed off. They were coming to class but turning in little to no work. I find that I (GRP) have not been very effective in coaxing those students back into engagement. This has been happening more in the last 5 years than in the previous 10.

Sharing and Discussion of Assessment Findings – SPRING SEMESTER

We have an end of year departmental assessment meeting to reflect on the findings. We will have a pre-fall meeting as well to help implement changes in the upcoming semester.
Assessing PO1. We decided that the assessment of the development of this objective in MATH217 would be improved by measuring performance on the last 2 chapter exams (Multiple Integration and Vector Analysis). We will set the benchmark at 60% and will update the alignment table. The final exam was judged to have insufficient depth and contain too many problems that don't measure problem solving well.

Assessing PO3 (in numerical) Programming assignments need to be assessed separately from the written so that we can see the difference in performance. We will do this the next time the class is taught. Students need more exposure to programming as became clear in the Numerical Analysis (MATH306) class. The best students have been able to get by and even do fairly well. The poorer students get crushed. We are developing a new course for the spring of next year that will serve both engineering students and mathematics students. (MATH199 Matrix Algebra and MATLAB) This course is our first experiment with improving our programming. We will strongly advise our freshman majors to take this class at the same time as Calc. II. We will discuss with Physics and Chemistry what it means for their majors.

Discussion of how to handle under-engaged upper-division students: We decided that we should use the early alert system. See if the academic coaching system is available to upper-division students. Consider paying a peer tutor to help in assignment completion. This will need to be done carefully.

Use of Assessment Findings for Program Improvement (Action Plan) – SPRING SEMSTER

PO1 – change assessment (see above)
PO3 – split out Numerical Analysis programming assignments (see above). New programming and Matrix Algebra class for freshman (see above).
Provide more support for under-engaged upper-division students intentionally (see above).

Full Year Reflection – FALL/INTERTERM/SPRING TERMS

After looking back at the fall report and at this report it seems clear the potential value of assembling the report. Everything hangs on examining the report before teaching the classes again and changing the way assessment is done as needed. Reading the fall report showed me that I had already forgotten some of the important details of the struggles from that semester. It will be hugely important to reread it in the fall meeting and as we prepare syllabi for the fall. Examining the individual FCARs will also be very helpful. No classes were taught this spring that were taught last fall so the individual course changes and changes in their methods of assessment will have to wait for this coming fall.

Ongoing consideration of the utilization and training in technology use is something that bridges all semesters. We will be paying close attention to how the Matrix Algebra and MATLAB programming class goes and how that affects students. In our year-end assessment all seniors (and sophomores) are given a score between 0 and 4 in each departmental objective. The scores in technology are lower across the board than the other three areas highlighting our need for work in this area.

The one thing that might have proved more helpful this semester from last semester's report is the following line from that report. "Utilizing a student worker to help motivate students that are not getting their work done can be implemented next semester with initial assessment in May." I'm afraid I did not do it and this semester just gave me more evidence that something should be done. (See above action plan.)

Supporting Documents

All the FCARS from this semester are relevant. The fall end of semester report is also supporting. We use a full-year assessment data spreadsheet as well.