SAINT LOUIS UNIVERSITY

Program Assessment: *Annual Report*

Program(s): B.A., B.S., M.A., Ph.D.
Department: Mathematics & Statistics
College/School: Arts & Sciences
Date: June 27, 2019
Primary Assessment Contact: Brody Johnson (Associate Chair)

1. Which program student learning outcomes were assessed in this annual assessment cycle?

Program assessment for the academic year 2017-2018 focused primarily on the following program student learning outcomes for the B.A. and B.S. programs:

- *PLO #1: Demonstrate the ability to solve a variety of mathematical problems;*
- *PLO #4: Demonstrate an ability to apply the methods of direct and indirect proof;*
- *PLO #5: Demonstrate an ability to communicate mathematical ideas and concepts clearly in written problem solutions.*

These PLOs are common to the B.A. and B.S. assessment plans and can be evaluated through student work on final exams in a number of mathematics courses.

2. What data/artifacts of student learning were collected for each assessed outcome? Were Madrid student artifacts included?

The primary source of data for this report consists of student performance on selected problems from the final exam in a range of courses that are part of the B.A. and B.S. programs. Each semester, the instructors for selected courses choose a topic that will be assessed by all instructors of the course on the final exam. The topic is chosen based on the program learning outcome being assessed and often aligns with one of the course learning outcomes.

The courses included in this process are as follows:

- MATH 1510 Calculus 1
- MATH 1520 Calculus 2
- MATH 2530 Calculus 3
- MATH 2660 Principles of Mathematics
- MATH 3120 Introduction to Linear Algebra
- MATH 3550 Differential Equations.

Madrid faculty have been fully engaged in this process since Spring 2017 and participation from the Madrid campus has been excellent.

3.How did you analyze the assessment data? What was the process? Who was involved?
NOTE: If you used rubrics as part of your analysis, please include them in an appendix.

The final exam problems for each section are evaluated by the faculty member responsible for the section and each student is given a score on a 0-3 scale. The typical rubric for this evaluation is given below, although instructors have some flexibility to alter the rubric as necessary.

Rubric for Final Exam Problem Assessment

3 – Student shows a mastery of the relevant material.

2 – Student shows competence, but not complete mastery of the material.

1 – Student shows a limited understanding of the material.

0 – Student shows no understanding of the material.

Students who achieve a "2" or "3" have shown competence for the program learning outcome being assessed with respect to the chosen problem.

Instructors tabulate the scores for their section(s) and complete a form summarizing their findings and providing some background information about the assessment measure used. In most cases, faculty members submit the problem used for the assessment. The completed forms are submitted to the associate chair.

A natural goal for this type of assessment is that scores should fall primarily into the 2 and 3 categories of the rubric. However, the difficulty level of problems in mathematics and statistics can vary substantially even when the core content is identical, so it can also be expected that scores may, at times, fall short of the 2-3 range simply because the chosen problem is somewhat more difficult than many standard problems testing the same skill. This provides some motivation to consider the data in aggregate at the course level with the goal that a high percentage of students who take a given course will receive scores of 2 or 3.

4.What did you learn from the data? Summarize the major findings of your analysis for each assessed outcome.
NOTE: If necessary, include any tables, charts, or graphs in an appendix.

The department has been collecting data on student learning for approximately three academic years and is still in the process of establishing a baseline for expectations. Instructor participation this year was a little less than last year, but still reasonably good. The largest drop in participation was observed in MATH 1510 Calculus 1, so more effort will be made to ensure participation of TA/adjunct instructors for this course. No data was submitted for MATH 2660 Principles of Mathematics for Spring 2019.

Term	Fall 2017	Spring 2018	Fall 2018	Spring 2019
Sections Included	31	29	31	28
Sections Participating	27	25	22	22

The aggregate data for the Fall 2018 and Spring 2019 semesters are presented below. The data for MATH 1510, 1520, 2530, 3120, and 3550 apply to PLOs #1 and #5. Recall that PLO #1 focuses on the development of a body of knowledge in mathematics and material, while PLO #5 deals with the effective communication of mathematical ideas in clearly written problem solutions. The data for MATH 2660 is related to PLO #4, which involves the ability to create and write proofs using a variety of techniques.

Fall 2018

Course	0	1	2	3	Total	2 or 3
1510	19	27	41	92	179	74%
1520	26	4	10	30	70	57%
2530	9	17	11	47	84	69%
2660	0	1	4	15	20	95%
3120	0	1	5	8	14	92%
3550	8	15	17	34	74	68%

Spring 2019

Course	0	1	2	3	Total	2 or 3
1510	6	15	20	66	107	80%
1520	22	21	38	74	155	72%
2530	7	15	27	35	84	73%
3120	8	3	6	2	19	42%
3550	3	16	37	55	111	82%

5. How did your analysis inform meaningful change? How did you *use the analyzed data to make or implement recommendations for change* in pedagogy, curriculum design, or your assessment plan?

Program Learning Outcomes #1, #5:

Overall, 73% of students in 1510, 1520, 2530, 3120, and 3550 achieved a 2 or 3 score, compared to 66% in the AY2017-2018 assessment cycle. Moreover, 49% of these students achieved a 3 score, in comparison with 47% in the previous assessment cycle.

Program Learning Outcome #4:

Participation in assessment of student learning for MATH 2660 Principles of Mathematics was somewhat lacking during the current assessment cycle. Data was received for only one of the four sections taught during the academic year. The data received this year corresponds to 20 students and 19 of these achieved a score of 2 or 3 with 15 receiving a score of 3. The previous assessment cycle involved data from two sections, with 73% of students achieving a score of 2 or 3 and 39% achieving a score of 3. The obvious goal for the next assessment cycle would be to improve participation for this course.

Assessment of student learning through final exam problems has been ongoing for three annual assessment cycles. The data collected is helping to establish reasonable expectations for student learning in key courses that support our B.A. and B.S. programs and the consistency of recent results suggests a possible baseline upon which future results can be interpreted. Although no unusual or unexpected findings have been encountered thus far, it will be important to pay attention to this data as future changes are implemented. In particular, larger sections are expected for some critical courses in Fall 2019 and this baseline will help us determine whether or not student learning is affected by larger class sizes.

The departmental assessment committee engaged in discussions during the current annual assessment cycle over a variety of topics.

- The program learning outcomes at both the undergraduate and graduate level are currently under review. New learning outcomes have been drafted and the departmental assessment committee is in the process of discussing and revising the new learning outcomes. The committee is also reviewing assessment plans and program learning outcomes from mathematics and/or statistics departments at other institutions.
- The idea of one or more assessment tests has been discussed. These tests could be administered at various points in the program to assess students' progress with program learning outcomes as they move through the program.
- The department offered an experimental capstone course for mathematics majors in Spring 2019. Four mathematics majors registered for the course, each in their last semester. The course was structured to support the following program learning outcomes of the major:
    - PLO #2: Demonstrate the ability to recall important mathematical definitions and results (for example, theorems).
    - PLO #3: Demonstrate the ability to apply mathematical reasoning, including formulating definitions.
    - PLO #5: Demonstrate the ability to communicate mathematical ideas and concepts in clearly written problem solutions.
    - PLO #7: Demonstrate an ability to write computer programs to analyze data and perform calculations.

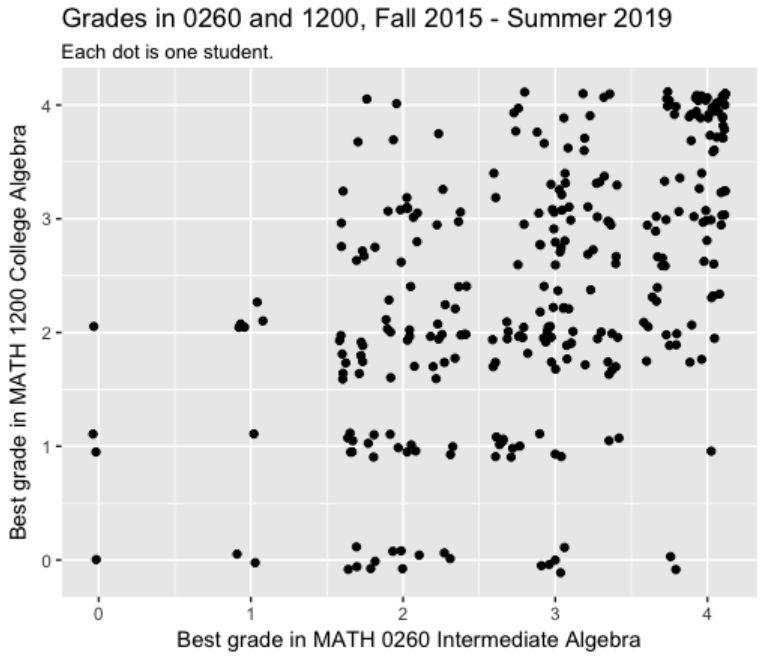
    In particular, each student completed two mathematical projects in the course which required a formal report and presentation. The students submitted draft forms of the reports and presentation slides for feedback prior to the final due date. Two of the students delivered poster presentations in the Senior Legacy Symposium.
- Our graduate committee met multiple times in Fall 2018 to consider changes to the graduate curriculum. Specifically, there was a suggestion in our most recent external review that the course sequence requirements be lessened for the PhD degree. We considered past graduation and placement data, as well as anecdotal evidence from current and recent graduate students. The decision was made to keep the curriculum unchanged.

Discussions will continue during the next annual assessment cycle.

6. Did you follow up ("close the loop") on past assessment work? If so, what did you learn? *(For example, has that curriculum change you made two years ago manifested in improved student learning today, as evidenced in your recent assessment data and analysis?)*

The most significant impact of assessment work on curriculum change during the current assessment cycle involves the adjustment of the recommended Math Index for various introductory math courses. The Math Index is an indirect measure of mathematical preparation that is based on a student's high school grade point average and their math score on either the ACT or SAT. The Math Index is one of the tools advisors use to place incoming freshman in their first mathematics course. Several years ago, the department established baseline Math Index recommendations for most introductory courses using a logistic regression on student data collected over multiple academic years. This analysis was repeated in Fall 2018 using recent data, leading to increases in the recommended Math Index for MATH 1200 College Algebra, MATH 1220 Finite Mathematics, and MATH 1400 Precalculus. This change is expected to improve student success in these courses by ensuring their readiness for their first college course in mathematics.

The department frequently investigates course-to-course grades in an effort to improve student success in introductory mathematics courses. The following graphic compares a student's highest grade in MATH 0260 Intermediate Algebra with their highest grade in MATH 1200 College Algebra. Each dot in the graph represents an individual student.



The data suggests that students often earn a lower grade in MATH 1200 than they had in MATH 0260 and rarely earn a higher grade.

IMPORTANT: Please submit any revised/updated assessment plans to the University Assessment Coordinator along with this report.