SAINT LOUIS UNIVERSITY.

Program-Level Assessment: Annual Report

Program: Mathematics	Department: Mathematics & Statistics
Degree or Certificate Level: BA, BS, MA, PhD	College/School: Arts & Sciences
Date (Month/Year): June/2020	Primary Assessment Contact: Brody Johnson (Assoc. Chair)
In what year was the data upon which this report is based collected? Academic Year 2019-2020	
In what year was the program's assessment plan most recently reviewed/updated? 2015 (BA, BS, MA, PhD)	

1. Student Learning Outcomes

Which of the program's student learning outcomes were assessed in this annual assessment cycle?

Program assessment for the academic year 2019-2020 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. Assessment Methods: Artifacts of Student Learning

Which artifacts of student learning were used to determine if students achieved the outcome(s)? Please identify the course(s) in which these artifacts were collected. Clarify if any such courses were offered a) online, b) at the Madrid campus, or c) at any other off-campus location.

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.

3. Assessment Methods: Evaluation Process

What process was used to evaluate the artifacts of student learning, and by whom? Please identify the tools(s) (e.g., a rubric) used in the process and include them in/with this report.

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. Data/Results

What were the results of the assessment of the learning outcome(s)? Please be specific. Does achievement differ by teaching modality (e.g., online vs. face-to-face) or on-ground location (e.g., STL campus, Madrid campus, other off-campus site)?

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, 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 2019 Data by Course:

Course	0	1	2	3	Pct. of 2/3
MATH 1510	16	32	48	87	73.7%
MATH 1520	5	1	5	24	82.8%
MATH 2530	6	18	20	45	73.0%
MATH 3120	6	2	7	3	55.5%
MATH 3550	5	9	12	19	70.4%

In Fall 2019, 18 of 28 sections (64%) provided assessment data, compared to 22 of 31 (70%) in Fall 2018. One explanation for the drop in participation stems from the closure of campus during final exams as a result of inclement weather. This closure prevented four sections from administering the final exam (one section each from 1510, 1520, 2530, and 3550) on which the assessment was planned.

Spring 2020 Data by Course:

Course	0	1	2	3	Pct. of 2/3
MATH 1510	4	3	15	48	90.0%
MATH 1520	17	21	46	68	75.0%
MATH 2530	17	22	53	90	78.6%
MATH 2660	0	0	0	16	100.0%
MATH 3120	0	0	6	24	80.0%
MATH 3550	11	14	47	39	77.5%

In Spring 2020, 20 of 28 sections (71%) participated in assessment, compared with 22 of 28 (78%) in Spring 2019. As in the previous assessment cycle, it seems that the majority of sections for which no data was submitted corresponded to MATH 1510 Calculus 1. This may be due, in part, to the shift to remote instruction, although efforts were made to remind instructors about assessment as the semester came to a close.

It would be difficult to compare the results between Fall and Spring in order to make any conclusion about how the switch to remote instruction affected student learning. It is worth noting that final examinations during Spring 2020 in Mathematics & Statistics relied heavily on the students to comply with the academic honesty policy. Instructors were encouraged to give exams in a take-home format with a minimum 12-hour window for completion and submission. Most unfortunately, the Department saw a record number of academic dishonesty cases proceed from exams administered during the period of remote instruction along with widespread use of the online homework service Chegg, bypassing the instructions given by instructors. It is likely that this had a detrimental effect on student learning, but there is no clear way to quantify its magnitude.

5. Findings: Interpretations & Conclusions

What have you learned from these results? What does the data tell you?

Program Learning Outcomes #1, #5:

Overall, 77% of students achieved a 2 or 3 score during AY2019-2020, compared to 73% in the AY2018-2019 assessment cycle. Moreover, 49% of these students achieved a score of 3, which is exactly the same result that was observed in the previous assessment cycle.

Program Learning Outcome #4:

Data for MATH 2660 Principles of Mathematics came from just one section out of the four offered during AY2019-2020. The data submitted showed 16 of 16 students achieving a score of 3 on the assessed question. It will be a goal of the assessment committee during the upcoming year to meet with faculty for MATH 2660 to discuss a means of student assessment that will fit the needs of the faculty members, Department, and students. We have capable and

creative faculty members teaching this important course and I am confident that we can find a good way to assess student learning through this course.

Assessment of student learning through final exam problems has been ongoing for four 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, the department has taken strides to implement large sections for a select number of calculus sections and it will be important to compare student assessment in these sections to those with the smaller class sizes. Such projects will no doubt be complicated by variations in format and content delivery related to the ongoing pandemic.

- The departmental assessment committee made progress in developing new assessment plans for the BA and BS programs, including revised program learning outcomes. The shift to remote instruction and working from home created a significant amount of extra work for the faculty in the second half of Spring 2020 and the assessment committee was not able to complete the new plans. The goal for Fall 2020 will be to finalize the new plans and present them to the Department for revision and approval along with a detailed curriculum map for each program.
- Dr. Bart piloted the Department's first "large" section of MATH 1510 Calculus 1 during Spring 2020 with a class size of 50 students as opposed to the usual 30. The standard 30-student class meets with the instructor four times per week for 50 minutes, while the 50-student version involves three 50-minute classes with the instructor as well as one 50-minute recitation with a learning assistant. The students were divided among two recitations in order to better facilitate group work and student-teacher interaction. This course began with 49 students and 5 students withdrew by the end of the semester (4 after March 15). The GPA for the section worked out to 3.31 (very good for this course) and the DFW rate was only 10.2%. Dr. Bart offered a few reflections (below) on this course that should be considered as the Department expands the number of large sections and the variety of courses using large sections. The Department will need to continue to monitor large lectures during the upcoming academic year as multiple sections of MATH 1510 Calculus 1 and one section of MATH 1520 Calculus 2 move to this format.
    - Student Learning Objectives can be covered just as well in a large section as in smaller sections.
    - The large class format reduces interaction with the students. It may be worth considering a flipped classroom model to help counteract this effect.
    - The attendance of recitations was not always good. It would be a good idea to redesign the incentive structure for this component of the course.
    - The large class format makes it easier for students to "check out" of the class. It would be valuable to develop structures that encourage more peer interaction to help keep students engaged.
- Graduating seniors completing a major in Mathematics & Statistics were invited to complete an exit survey through Qualtrics. Some observations from the feedback are summarized below.
    - There were six respondents. Three completed the BS, two completed the BA, and 1 completed the BA with a Concentration in Statistics. Four of the six indicated that Mathematics was their primary major. Four of the six also have another major.
    - Five of the six students indicated that courses related to statistics were the most useful. Several students also indicated that they would like to have taken more courses in this area.
    - Only two of the six students participated in the Math/Stat/CS Club. These two students suggested that professional presentations in the club were beneficial.
    - None of the six students participated in a mathematical competition (the department regularly engages in three separate contests).
    - Four of the six students indicated that they rarely met with their academic mentor. One student was dissatisfied with their mentoring. One comment indicated that the mentoring relationship felt more like a

checklist than a true mentorship. Another student wrote that they contacted professors they knew rather than their assigned mentor.

- Four of the six students chose to apply to a graduate or professional school and all four stated that they had been accepted to such a program. Two of the six have accepted a job. Two of the six stated that they have post-graduation plans other than graduate school or a job.
- One of the six students was dissatisfied with their experience as a Mathematics major, while four of the six were extremely satisfied. Student comments for this question expressed interest in additional focus on post-graduate or career help whether through specific coursework or mentoring.

6. Closing the Loop: Dissemination and Use of Current Assessment Findings

A. When and how did your program faculty share and discuss these results and findings from this cycle of assessment?

Faculty members serving on the departmental assessment committee meet multiple times during each academic year to discuss recent activities, current work, and future goals. All faculty are welcome to attend these meetings as well as review the annual assessment report for the department.

B. How specifically have you decided to use these findings to improve teaching and learning in your program? For example, perhaps you've initiated one or more of the following:

Changes to the Curriculum or Pedagogies	• Course content • Teaching techniques • Improvements in technology • Prerequisites	• Course sequence • New courses • Deletion of courses • Changes in frequency or scheduling of course offerings
Changes to the Assessment Plan	• Student learning outcomes • Artifacts of student learning • Evaluation process	• Evaluation tools (e.g., rubrics) • Data collection methods • Frequency of data collection

Please describe the actions you are taking as a result of these findings.

A few examples are given below.

- Departmental exit surveys with graduating seniors over the last several years have included a number of requests for internship opportunities. This has led the Department to develop internship guidelines and, consequently, more students are pursuing for-credit internships.
- There have been numerous requests to waive the residency requirement for Calculus 3, which requires students majoring in Mathematics to complete MATH 2530 Calculus 3 at SLU. This requirement originated many years ago in response to a significant number of students bringing credit for this course from outside SLU and lacking adequate preparation for subsequent courses in the major. The large number of waivers led to a discussion of the policy on the whole and it was decided that the waivers should be recorded over a period of a few years in order to evaluate the importance of the residency requirement.
- The success of large sections with recitations in Calculus 1 (as discussed above) has prompted the department to introduce additional large sections of Calculus 1 as well as a pilot large section in Calculus 2.

If no changes are being made, please explain why.

7. Closing the Loop: Review of Previous Assessment Findings and Changes

A. What is at least one change your program has implemented in recent years as a result of assessment data?

1) We updated the recommended math index for various courses based on a study of student success.
2) We developed guidelines for internships.
3) We added requirements in statistics and computer programming to the BA in Mathematics in response to exit survey information about the jobs and graduate programs our students were pursuing.

B. How has this change/have these changes been assessed?

1) New data will be gathered over the next few years in order to evaluate the effect of the changes.
2) The internship guidelines are very new, but the department will collect information over a few years on the involvement and success of students taking internships in Mathematics or Statistics.
3) Recent graduates have indicated that statistics courses are among their favorites and that they find them useful. Some students are requesting further additions of statistics courses, especially courses which may be useful in a job setting.

C. What were the findings of the assessment?

See Part B.

D. How do you plan to (continue to) use this information moving forward?

See Part B.

IMPORTANT: Please submit any assessment tools and/or revised/updated assessment plans along with this report.