SAINT LOUIS UNIVERSITY.

Program-Level Assessment: Annual Report

Program Name (no acronyms): Data Science	Department: Mathematics and Statistics
Degree or Certificate Level:Undergraduate	College/School: Arts and Sciences
Date (Month/Year): September/2023	Assessment Contact: Darrin Speegle

In what year was the data upon which this report is based collected? AY 2022-2023

In what year was the program's assessment plan most recently reviewed/updated? AY 2019-2020

Is this program accredited by an external program/disciplinary/specialized accrediting organization or subject to state/licensure requirements? No

If yes, please share how this affects the program's assessment process (e.g., number of learning outcomes assessed, mandated exams or other assessment methods, schedule or timing of assessment, etc.):

1. Student Learning Outcomes

Which of the program's student learning outcomes were assessed in this annual assessment cycle? (Please provide the complete list of the program's learning outcome statements and **bold** the SLOs assessed in this cycle.)

SLO 2: Students will apply statistics to analyze data sets.

2. Assessment Methods: Artifacts of Student Learning

Which artifacts of student learning were used to determine if students achieved the outcome(s)? Please describe the artifacts in detail, identify the course(s) in which they were collected, and if they are from program majors/graduates and/or other students. Clarify if any such courses were offered a) online, b) at the Madrid campus, or c) at any other off-campus location.

Homework problems in STAT 4850 which directly assessed SLO 2 were collected throughout Spring, 2023. STAT 4850 was an in person course offered in St Louis.

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 document** (please do not just refer to the assessment plan).

The rubric used to assess the artifacts is given below:

0: Student shows little or no understanding of the concept(s)
1: Student shows a limited understanding of the concept(s)
2: Student shows competence, but not complete mastery of the concept(s)
4: Student shows mastery of the relevant concept(s)

The artifact was assessed by the course instructor, with a subset of problems to be re-assessed by another instructor to check for intra-rater reliability. (Note: this part of the assessment method was forgotten until writing of this report, and I will try to get this done and provide an updated analysis which includes an intra-rater reliability measure. I recognize that having multiple assessors is important for reliability.)

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)?

Please see attached notes

5. Findings: Interpretations & Conclusions

What have you learned from these results? What does the data tell you? Address both a) learning gaps and possible curricular or pedagogical remedies, and b) strengths of curriculum and pedagogy.

While the overall scores were encouraging, the student level scores were less so. One of the seven students scored "1" on half of the assessment problems in a senior level course. This type of issue with Learning Outcomes had been hidden from our previous assessment efforts.

To be honest, I am not sure how to remedy this. Since 6 of the 7 students did well on the assessment, it seems that the program is making it possible to achieve the SLO's at an appropriate level. We will need to think carefully about how to help students who are struggling more. One thing I did notice is that the student who did not do as well had grades in previous courses which are consistent with struggling to master SLO 2.

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

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

The results were shared with the department in an email on September 21.

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.

I am going to recommend to mentors that they monitor student progress. If they notice a student struggling in courses that are heavy in a particular SLO, they should make appropriate recommendations to the student. Possibilities might include choosing a career path which minimizes the necessity of that SLO, re-taking courses, or taking additional coursework to shore up that SLO.

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 previous assessment data**?

The program has removed the requirement of CSCI 2300 for data science degree, and replaced it with an elective course.

B. How has the change/have these changes identified in 7A been assessed?

It is too early to formally assess these changes. The possible changes would be in upper level courses which have a large computing component. When students who were not required to take CSCI 2300 are in upper level courses (next year), we will assess SLO 1 (Graduates will use programming and other computer science skills to analyze and interact with data). SLO 1 is the learning outcome most impacted by CSCI 2300, based on the Curriculum mapping.

However, we have collected anecdotal evidence via exit interviews and conversations with faculty.

C. What were the findings of the assessment?

There is anecdotal evidence that the changes have allowed valued flexibility in the program without negatively impacting SLO 1.

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

We will compare results from assessments to ensure that SLO 1 is still being adequately covered in the data science program.

IMPORTANT: Please submit any assessment tools (e.g., artifact prompts, rubrics) with this report as separate attachments or copied and pasted/appended into this Word document. Please do not just refer to the assessment plan; the report should serve as a stand-alone document. Thank you.

Supplement to Program Level Assessment Report

Data was collected from the course STAT 4850. The instructor assigned scores of 0, 1, 2, or 3 based on performance on homework problems throughout the semester which assessed the SLO *Students will apply statistics to analyze data sets.* In previous years, the following data collection procedures were observed:

1. Students across multiple classes were asked one question. The questions were not the same across the classes, though the SLO measured was the same.
2. Students *at different levels* who were in the same class were asked the same question.

Method 1 has the advantage of getting a lot of data about a lot of different things. It has the downside of being hard to interpret, as the difficulty of questions is not consistent across the courses. Method 2 has the advantage of directly assessing whether more advanced students in the program have better mastery of the SLO.

However, both methods share a common disadvantage. It is impossible to understand the *within student* variation of skill in an SLO. By repeated measurement on the same student, we can begin to understand the variance in outcome scores that students have. For example, before this survey, we would not have known whether each individual student would have a distribution similar to that of all the students, or whether students each have their own distribution. It seems more likely that each student would have their own distribution, and this instrument can allow us to see what those distributions look like.

We start with the overall distribution of scores.

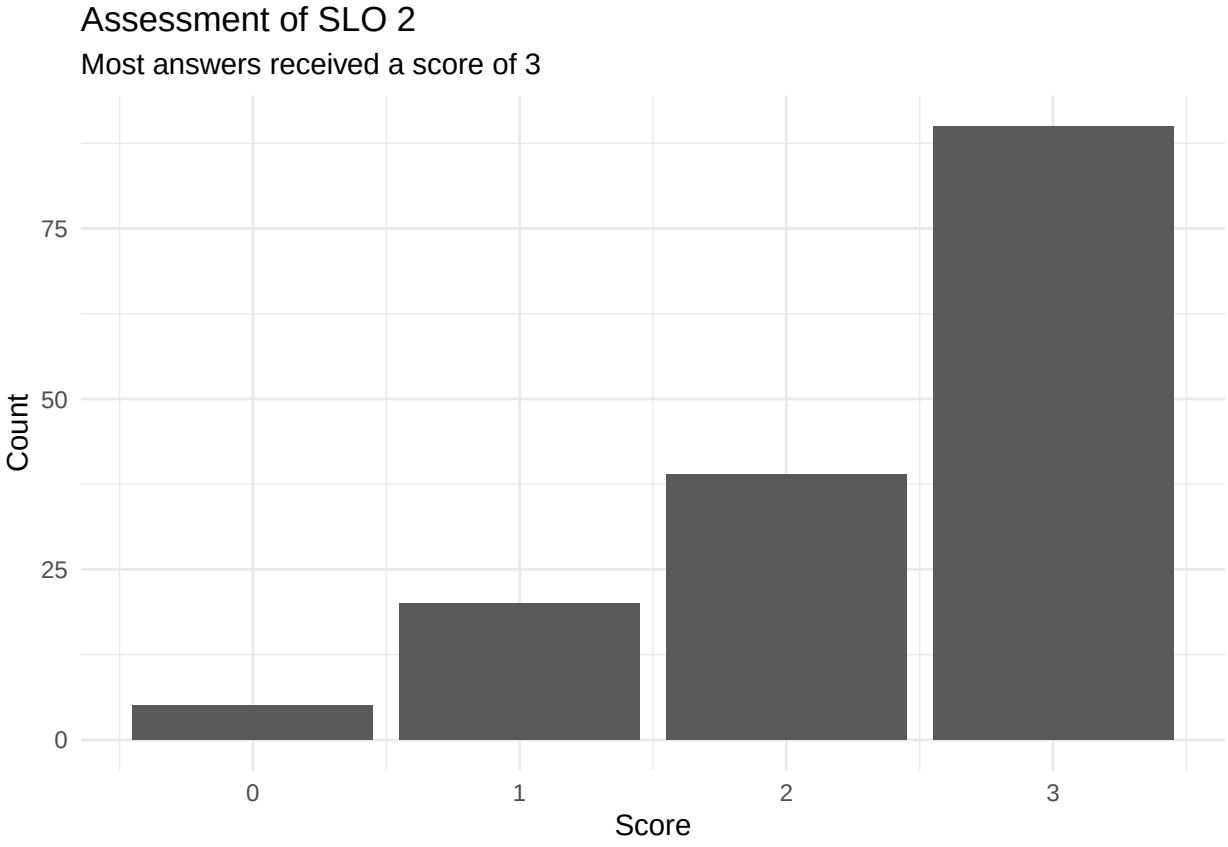
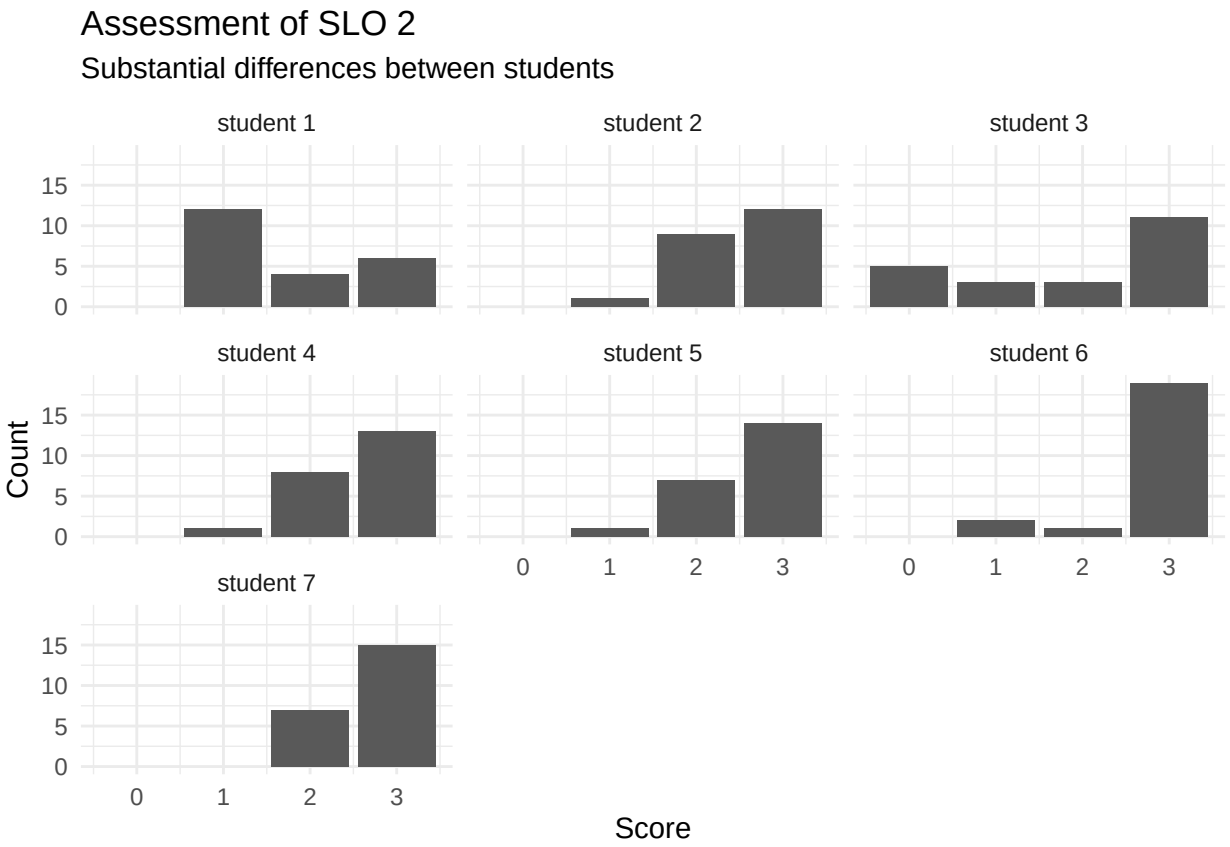


Table 1: Table of Scores on SLO 2

score	count
0	5
1	20
2	39
3	90

Now, we break it out by student:



We see that three of the students (2, 4, and 5) roughly follow the overall trend, while the other four students seem to be different. Students 6 and 7 both have a higher proportion of 2's and 3's overall, and Student 3 had all of the 0's[1]. Student 1 had most of the scores of 1. This plot paints a different picture than the first one. It seems that most students are getting the SLO, but Student 1 and perhaps Student 3 need help.

We also present the same data in table form.

Table 2: Table of Scores on SLO 2 by Student

student	zero	one	two	three
student 1	0	12	4	6
student 2	0	1	9	12
student 3	5	3	3	11
student 4	0	1	8	13

[1]Student 1 did not turn in any work for those 5 problems, despite being given unlimited time to finish. It is not clear whether the student was unable to do the problem at all, or whether there was a different reason the work was not submitted.

student	zero	one	two	three
student 5	0	1	7	14
student 6	0	2	1	19
student 7	0	0	7	15

Though it seems pretty clear that the distributions of the students are different, we also performed a χ^2 test of homogeneity with simulated p-values both with and without the 5 zero scores. In each case, we conclude ($p < .0005$) that the distributions of the scores depend on the student.