UNIT REPORT

Math & Statistical Sci - APR Self-Study Report by Academic Unit/Department

Generated: 3/15/22, 3:35 PM

Program Mission

Department of Mathematics and Statistical Science Mission Statement

Program Mission Statement:

For undergraduates the teaching mission of the Department of Mathematics and Statistical Science is to provide quality major programs and to provide courses that effectively deliver the quantitative, reasoning, and computational skills needed by students from programs all across campus. The success of our lower-division courses is essential to the General Education Requirements of the university. Our calculus, differential equations, linear algebra, and statistical methods courses provide fundamental support to science and engineering programs. Our upper-division course offerings must provide our majors with solid training in the fundamental branches of mathematics and statistics as disciplines, while at the same time giving opportunities for students in the sciences, engineering, and business to develop knowledge and skills relevant to their fields. The training of future mathematics and statistics teachers is also a fundamental aspect of our undergraduate teaching mission. In graduate education, our mission is to provide training in the fundamental areas of advanced mathematics and statistics leading to the MS degrees as well as the only mathematics PhD degree available in the State of Idaho. These programs are integrated with interdisciplinary graduate programs such as Bioinformatics and Computational Biology (BCB) in which our faculty play crucial roles. Finally, our graduate mission includes providing opportunity for in-service training and advancement of mathematics teachers through Master of Arts in Teaching (MAT) degree program available by distance education.

Program Goal (add a minimum of 3 program goal "plan items")

Excellence in Learning across Campus

Goal Statement:

1. To provide appropriate support for underprepared students.
2. To provide courses that effectively deliver skills needed by students from programs all across campus.

Alignment to UI Strategic Plan Goals: Transform (Goal 3): Increase our educational impact.

Indicators/Metrics to Evaluate Progress:

DFWI rates for general education courses (Math 143, Math 144, Math 160, Math 170, Math 175, Math 275, and Stat 251) and service courses (Math 310, Math 330, and Stat 301).

List of Actions the Program Will Take to Achieve Goals :

1. Use technology to enrich the learning experience of students taking general education core courses. Use the Polya Math Leaning Center, the department address the university level concerns over student retention.
2. Deliver high-quality advanced coursework for our own majors as well as majors in the sciences and engineering.

Goal Achievement Level: In Progress

Excellence in Undergraduate Programs

Goal Statement:

To produce professional graduate who will be able to

1. understand and apply fundamental theories in mathematics/statistics.
2. communicate mathematics/statistics ideas orally and in writing.
3. use mathematical/statistical ideas to real world problems.
4. analyze data by using mathematical/statistical computing and modeling skills.

Alignment to UI Strategic Plan Goals: Transform (Goal 3): Increase our educational impact.

Indicators/Metrics to Evaluate Progress:

1. Students' performance on selected homework/exam problems to assess their understanding key concepts, theorem, and results in mathematics/statistics as well as their mastery of computing/modeling skills.
2. Students' performance on presentations and class projects to asses their communication skills.

List of Actions the Program Will Take to Achieve Goals :

Use the assessment results to improve the programs.

Goal Achievement Level: In Progress

Excellence in Graduate Programs

Goal Statement:

To provide

1. training in the fundamental areas of advanced mathematics and statistics leading to the MS degrees as well as the only mathematics PhD degree available in the State of Idaho;
2. opportunity for in-service training and advancement of mathematics teachers through Master of Arts in Teaching (MAT) degree program available by distance education.

Alignment to UI Strategic Plan Goals: Transform (Goal 3): Increase our educational impact.

Indicators/Metrics to Evaluate Progress:

1. The number of graduates in the preceding July 1 and June 30 time period.
2. Students' performance on MS/MAT comprehensive exams.
3. Students' performance on theses and thesis defense presentations.

List of Actions the Program Will Take to Achieve Goals :

1. Offer quality MS and PhD programs in mathematics and statistics, emphasizing training in the core areas of mathematics and statistics.
2. Offer an MAT degree by distance education that provides in-service high school teachers a chance to build their mathematics knowledge base while advancing their careers.

Goal Achievement Level: In Progress

Student Learning Assessment Report (add one "plan item" for each major, degree, and/or certificate offered by dept)

Mathematics B.S. Degree (general, computation, modeling & data science, and math biology)

Assessment Report Contact: Hirotachi Abo

Program Changes in Past Year:

1. Created of two undergraduate courses to strengthen/update the modeling option; Math 183 (Introduction to Data Science in Python) and Math 483 (Foundation of Machine Learning).
2. Changed the title "Quantitative Modeling Option" to "Modeling and Data Science Option" and modified the courses requirements.

Learning Outcomes are Communicated to All Students in Program (check box if true): true

Learning Outcomes are Communicated to All Faculty (check box if true): true

Optional: Framework Alignment:

Import Outcomes Data (from Anthology Outcomes):

Critical Thinking: Students should be able to think critically, apply problem solving strategies, and be able to construct and defend mathematical proofs.

Direct measure: Exam questions from Math 461 and Math 480.
The benchmark is that at least 70% of math majors will demonstrate appropriate critical thinking skills in Math 461 and Math 480. The stretch benchmark is that at least 80% of math majors will demonstrate appropriate critical thinking skills in the aforementioned courses.

- 72% of the math major students in Math 461 received an "above-sufficient" rating.
- 42% of the math major students in Math 480 received an "above-sufficient" rating.
- 64.71% of the math major students in these courses received an "above-sufficient" rating.

Indirect measure: Student self-assessment in exit interviews. The benchmark is that at least 50% of students expressed confidence in attaining the learning outcome in critical thinking. The stretch benchmark is that at least 80% of students expressed confidence in attaining the learning outcome in critical thinking.

- Only two students responded to the exit survey. One of them expressed confidence in attaining the above-mentioned learning outcome.

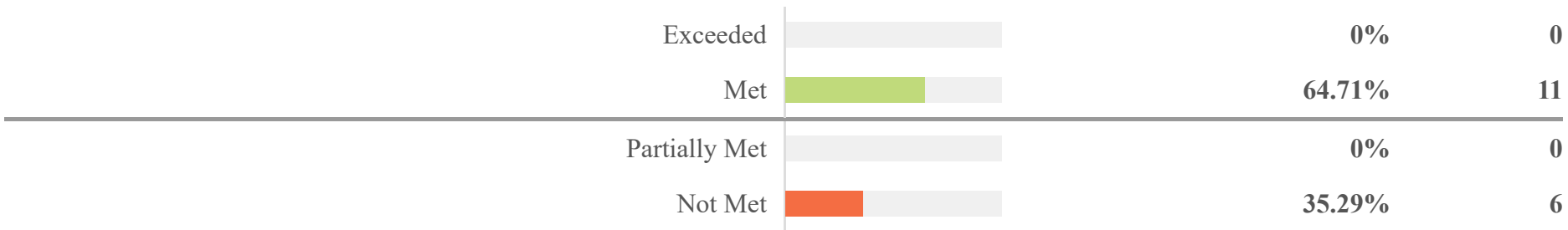
1.

Critical Thinking

University of Idaho Mathematics majors should be able to think critically, apply problem solving strategies, and be able to construct and defend mathematical proofs.

Academic Year 2020-2021: Mathematics - General Option (B.S.)

Term: Overview



Summary of Student Learning:

The ordinary benchmark was not met for the direct, but it was met for thee indirect measures. However, the stretch benchmark was not met for both measures. Based on the last assessment cycle's finding, only 43% of mathematics majors in Math 461 satisfactorily completed the baseline objective. Thus, we see some improvement from last year. Since we just started collecting data from Math 480 this year, we do not have past data on Math 480 students' performance to compare with.

Attached Files

Math480_Sp2021_Final_v2.pdf

MATH 461 Fall 2020 REPORT.doc

Summary of Faculty Discussion:

Exam questions from Math 415 were suggested as a direct measure for the learning outcome in critical thinking because it is a senior experience course and taken by many students in different options.

Summary of Changes/Improvements Being Considered:

- Because of the pandemic of COVID-19, the exit interviews were conducted using Microsoft Forms, which caused a very low response rate. The improvement of student participation in exit interviews is necessary for more meaningful participation.
- In the past several years, we collected data on Math 215 students' performance for the learning outcome in critical thinking. We changed it to Math 480 to assess students' critical thinking skill across the options.

Inter-rater Reliability:

The assessment committee will review and implement changes to procedure for assessment processes.

Closing the Loop:

- Develop at one additional learning outcome for each option.
- Assess the learning outcome on modeling next year.
- Conduct exit interviews in person to increase participation.

Statistics B.S. Degree (general option, actuarial science and finance option)

Assessment Report Contact: Hirotachi Abo

Program Changes in Past Year:

None

Learning Outcomes are Communicated to All Students in Program (check box if true): true

Learning Outcomes are Communicated to All Faculty (check box if true): true

Optional: Framework Alignment:

Import Outcomes Data (from Anthology Outcomes):

Computing Skills: The student can apply statistical computing skills for data analysis and data science.

Direct Measure: Assessment by faculty of a student's statistical software competency based on interaction in and out of courses. The measure is a 4 point ordinal score with the following rubric:

1. deficient. The student often struggles with implementing code, needs repeated assistance on topics.
2. minimally adequate. The student succeeds in writing code with some assistance. They occasionally struggle with adapting example code for their own use.
3. satisfactory. The student has no major problems in using statistical software. They rarely have difficulty adapting example code for their own use.
4. superior. The student learns new code quickly and often finds new example code on their own. This student typically can answer other student's software questions on course assignments.

The benchmark is that at least 90% of students have 3 or better, and the stretched benchmark is that 100% of the students have 3 or better.

- According to the faculty survey, eight out of fourteen students (57.1%) received an "above satisfactory" rating.

Indirect Measure: Student self-assessment in exit interviews. The benchmark is that 80% of students answered yes for the question "Are you confident that you can apply statistical computing skills for data analysis and data science?" The benchmark is that 100% of students answered yes for the above-mentioned question.

- Only two students responded to the exit survey, and both students answered yes for the above-mentioned question.

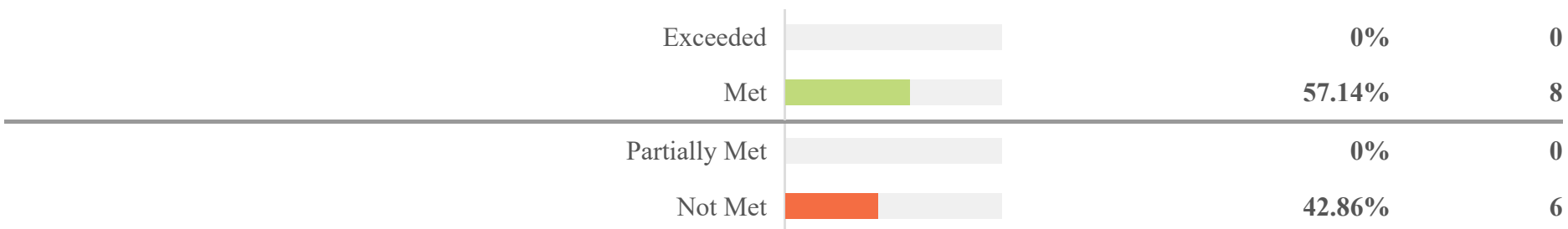
3.

Computing Skills

The student can apply statistical computing skills for data analysis and data science.

Academic Year 2020-2021: Statistics - General Option (B.S.)

Term: Overview



Summary of Student Learning:

- Both the ordinary and stretched benchmarks were not met for the direct measure but they were met for the indirect measure. Based on the finding of the previous assessment by faculty of a student's statistical software competency, 90% of students have 3 or better. The percentages of students with a 3 or better significantly decreased.
- Math 437 and Stat 431 are listed as courses which may have contributed the most for the above-mentioned learning outcome.

Attached Files

STAT Assessment.xlsx

Summary of Faculty Discussion:

Presented in "Summary of Changes" and "Closing the loop."

Summary of Changes/Improvements Being Considered:

Because of the pandemic of COVID-19, the exit interviews were conducted using Microsoft Forms, which caused a very low response rate. The improvement of student participation in exit interviews is necessary for more meaningful participation.

Inter-rater Reliability:

The assessment committee will review and implement changes to procedure for assessment processes.

Closing the Loop:

- Assess the learning outcome on statistical theory and methods next year.
- Conduct exit interviews in person to increase participation.

Master of Arts in Teaching Mathematics

Assessment Report Contact: Hirotachi Abo

Program Changes in Past Year:

None

Learning Outcomes are Communicated to All Students in Program (check box if true): true

Learning Outcomes are Communicated to All Faculty (check box if true): true

Optional: Framework Alignment:

Import Outcomes Data (from Anthology Outcomes):

Knowledge Skills: The student will demonstrate knowledge of intermediate graduate level mathematics.

Direct Measure: MAT comprehensive exam. The benchmark is that at least 80% of students pass the MAT comprehensive exam. The stretch benchmark is that all students pass the MAT comprehensive exam.

- One student took and passed the MAT comprehensive exam.

Indirect Measure:

(a) GPA in MAT program. The benchmark is that at least 80% if students have GPA 3.0 or better. The stretch benchmark is that at least 80% if students have GPA 3.0 or better.

- Only one student responded to the exit survey. He/she expressed confidence in attaining the above-mentioned learning outcomes.

(b) Student satisfaction in exit interviews. The benchmark is that at least 80% of students report satisfaction. The stretch benchmark is that all students report satisfaction.

- The cumulative GPAs of all MAT students are 3.0 or higher.

1.

Knowledge Skills

The student will demonstrate knowledge of intermediate graduate level mathematics.

Academic Year 2020-2021: Mathematics (M.A.T.)

Term: Overview

Exceeded	0%	0
Met	100%	1
Partially Met	0%	0
Not Met	0%	0

Summary of Student Learning:

The stretch benchmark as well as the ordinary benchmark are met for both the direct measure and indirect measure. These results are similar to those in the previous year.

Summary of Faculty Discussion:

Presented in "Summary of Changes" and "Closing the loop."

Summary of Changes/Improvements Being Considered:

Because of the pandemic of COVID-19, the exit interviews were conducted using Microsoft Forms, which caused a very low response rate. The improvement of student participation in exit interviews is necessary for more meaningful participation.

Inter-rater Reliability:

The assessment committee will review and implement changes to procedure for assessment processes.

Closing the Loop:

- Conduct exit interviews in person to increase participation.
- Develop a direct measure and an indirect measure for the learning outcome on education.

Master of Science in Mathematics

Assessment Report Contact: Hirotachi Abo

Program Changes in Past Year:

Created a new graduate course on Fourier Analysis (Math 537)

Learning Outcomes are Communicated to All Students in Program (check box if true): true

Learning Outcomes are Communicated to All Faculty (check box if true): true

Optional: Framework Alignment:

Import Outcomes Data (from Anthology Outcomes):

Mathematics Knowledge: The student can demonstrate knowledge in mathematics that justifies being awarded an M.S. degree and that prepares the student to pursue, should he or she want to do so, a PhD.

Direct measure: MS comprehensive exam. The benchmark is 80% of students pass the MS comprehensive exam. The stretch benchmark is 100% of students pass the MS comprehensive exam.

- One student took and passed the MS comprehensive exam.

Indirect measure: GPA in MS program. The benchmark is 90% of students have GPA 3.0 or higher. The stretch benchmark is 100% of students have GPA 3.0 or higher.

- The cumulative GPAs of all MS students are 3.0 or higher.

3.

Competence

The student can demonstrate knowledge in mathematics that justifies being awarded an MS degree and that prepares the student to pursue, should he or she wants to do so, a PhD.

Academic Year 2020-2021: Mathematics (M.S.)

Term: Overview

Exceeded	0%	0

Met		100%	1
Partially Met		0%	0
Not Met		0%	0

Summary of Student Learning:

The stretch benchmark as well as the ordinary benchmark are met for both the direct measure and indirect measure. These results are similar to those in the previous year.

Summary of Faculty Discussion:

Presented in "Summary of Changes" and "Closing the loop."

Summary of Changes/Improvements Being Considered:

Because of the pandemic of COVID-19, the exit interviews were conducted using Microsoft Forms, which caused a very low response rate. The improvement of student participation in exit interviews is necessary for more meaningful participation.

Inter-rater Reliability:

The assessment committee will review and implement changes to procedure for assessment processes.

Closing the Loop:

- Assess the learning outcome on integrated knowledge next year.
- Create an indirect measure for the learning outcome in integrated knowledge.

Doctor of Philosophy in Mathematics

Assessment Report Contact: Hirotachi Abo

Program Changes in Past Year:

None

Learning Outcomes are Communicated to All Students in Program (check box if true): true

Learning Outcomes are Communicated to All Faculty (check box if true): true

Optional: Framework Alignment:

Import Outcomes Data (from Anthology Outcomes):

Research: The student can conduct research in mathematics.

Direct Measure: Dissertation defense. Both ordinary and stretch benchmarks are that all students pass the dissertation defenses.

- One student defended a thesis during 2020-2022, and the student passed his/her defense.

Summary of Student Learning:

The stretch benchmark as well as the ordinary benchmark are met for the direct measure. This result is similar to that in the previous year.

Summary of Faculty Discussion:

There is no indirect measure to assess this learning outcome.

Summary of Changes/Improvements Being Considered:

Establish an indirect measure for the learning outcome in research.

Inter-rater Reliability:

The assessment committee will review and implement changes to procedure for assessment processes.

Closing the Loop:

Discuss an indirect measure for the learning outcome in research by the next assessment cycle.

Master of Science in Statistical Science

Assessment Report Contact: Hirotachi Abo

Program Changes in Past Year:

None

Learning Outcomes are Communicated to All Students in Program (check box if true): true

Learning Outcomes are Communicated to All Faculty (check box if true): true

Optional: Framework Alignment:

Import Outcomes Data (from Anthology Outcomes):

Computing Skills: The student can apply statistical computing skills for data analysis and data science.

Direct Measure: Assessment by faculty of a student's statistical software competency based on interaction in and out of courses. The measure is a 4

point ordinal score with the following rubric:

1. deficient. The student often struggles with implementing code, needs repeated assistance on topics.
2. minimally adequate. The student succeeds in writing code with some assistance. They occasionally struggle with adapting example code for their own use.
3. satisfactory. The student has no major problems in using statistical software. They rarely have difficulty adapting example code for their own use.
4. superior. The student learns new code quickly and often finds new example code on their own. This student typically can answer other student's software questions on course assignments.

The benchmark is that at least 90% of students have 3 or better, and the stretched benchmark is that 100% of the students have 3 or better.

- According to the faculty survey, eleven out of eleven students received an "above satisfactory" rating.

Indirect Measure: Grades from Math 565. The benchmark is that at least 80% of students with a B or better. The stretch benchmark is that 100% of students with a B or better.

- Eleven of fifteen students (73%) received a B or better.

1.

Statistical Computation

The student will be able to perform common tasks such as reading in data, performing data management, and performing routine statistical analyses using statistical software such as SAS and/or R.

Academic Year 2020-2021: Statistical Science (M.S.)

Term: Overview

Exceeded		0%	0
Met		100%	11
Partially Met		0%	0
Not Met		0%	0

Summary of Student Learning:

Both the ordinary and stretched benchmarks were met for the direct measure. However, the stretched benchmark (and hence the stretched benchmark) was not met for the indirect measure. These results are similar to those in the previous year.

Attached Files

STAT Assessment.xlsx

Summary of Faculty Discussion:

Presented in "Summary of Changes" and "Closing the loop."

Summary of Changes/Improvements Being Considered:

Because of the pandemic of COVID-19, the exit interviews were conducted using Microsoft Forms, which caused a very low response rate. The improvement of student participation in exit interviews is necessary for more meaningful participation.

Inter-rater Reliability:

The assessment committee will review and implement changes to procedure for assessment processes.

Closing the Loop:

- Assess the learning outcome on statistical theory next year.
- Conduct exit interviews in person to increase participation.

Data Science Certificate

Assessment Report Contact: Hirotachi Abo

Program Changes in Past Year:

The name of this certificate was changed from the data analytic certificate to the data science certificate.

Learning Outcomes are Communicated to All Students in Program (check box if true): true

Learning Outcomes are Communicated to All Faculty (check box if true): true

Optional: Framework Alignment:

Import Outcomes Data (from Anthology Outcomes):

Data management: The student will be able to manage (large) data sets.

Direct measure: Course project assessment. The benchmark is that at least 80% of students will demonstrate appropriate data management skills in Stat 517. The stretch benchmark is that at least 100% of students will demonstrate appropriate data management skills in Stat 517.

- Seven of eight students (87.5%) received an "above-sufficient" rating.

Indirect measure: Student self-assessment in exit interviews. The benchmark is that at least 50% of students expressed confidence in attaining the learning outcome in data management. The stretch benchmark is that at least 80% of students expressed confidence in attaining the learning outcome in data management.

- No students responded to the exit survey.

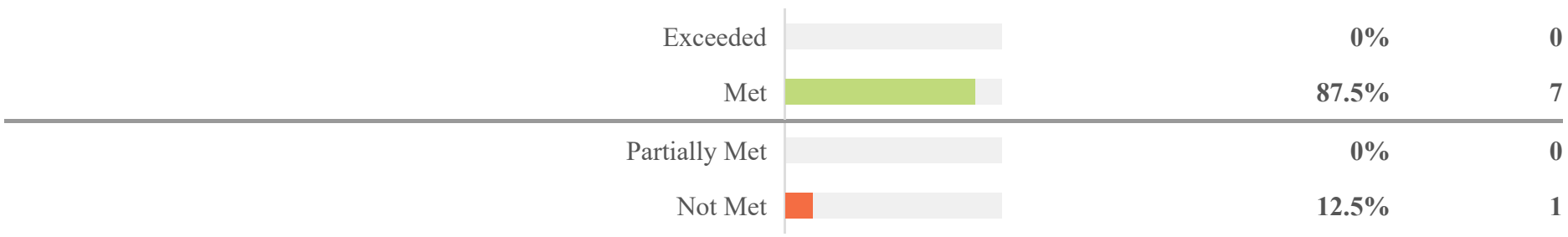
2

Data management

The student will be able to manage (large) data sets.

Academic Year 2020-2021: Data Science (GR Cert)

Term: Overview



Exceeded	0%	0
Met	87.5%	7
Partially Met	0%	0
Not Met	12.5%	1

Summary of Student Learning:

The ordinary benchmark was met for the direct measure. However, the stretched benchmark was not met for the direct measure. We were not able to collect any data for the indirect measure.

Summary of Faculty Discussion:

Since students in this program are able to declare degree complete status whenever they finish their coursework, conducting exit interviews with them is challenging.

Summary of Changes/Improvements Being Considered:

We need to establish effective methods to reach out to students in this program for exit interviews.

Inter-rater Reliability:

The assessment committee will review and implement changes to procedure for assessment processes.

Closing the Loop:

The department works with the registerer office to monitor when students in this program complete the degree to increase participation in exit interviews.

Statistics Certificate

Assessment Report Contact: Hirotachi Abo

Program Changes in Past Year:

None

Learning Outcomes are Communicated to All Students in Program (check box if true): true

Learning Outcomes are Communicated to All Faculty (check box if true): true

Optional: Framework Alignment:

Import Outcomes Data (from Anthology Outcomes):

Statistical methods: The student can clearly explain the results of the statistical analysis and if the statistical method(s) are valid.

Direct measure: Score on a Stat 431 course project. The benchmark is that at least 80% of students in Stat 431 have a score 2 or better. The stretch benchmark is that at least 100% of students in Stat 431 have a score 2 or better.

- Thirty four of thirty eight students (89.5%) had an appropriate score.

Indirect measure: Student self-assessment in exit interviews. The benchmark is that at least 50% of students expressed confidence in attaining the learning outcome in statistical methods. The stretch benchmark is that at least 80% of students expressed confidence in attaining the learning outcome in statistical methods.

- No students responded to the exit survey.

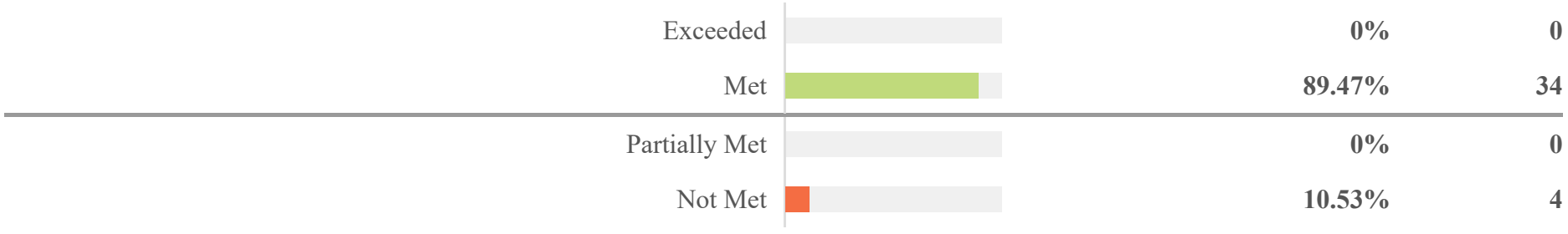
2

Assess assumptions

The student can diagnose whether the assumptions of the chosen statistical method are valid.

Academic Year 2020-2021: Statistics (GR Cert)

Term: Overview



Summary of Student Learning:

The ordinary benchmark was met for the direct measure. However, the stretched benchmark was not met for the direct measure. We were not able to collect any data for the indirect measure. This result is similar to that in the previous year.

Summary of Faculty Discussion:

- Conducting exit interviews with them is challenging because students in this program are able to declare degree complete status whenever they finish their coursework.
- It is a challenge to assess the learning outcomes of the statistics certificate because the students in this program take different courses. Currently, the score on Stat 431 is used as a direct measure for the learning outcome in statistical methods, although this course is a prerequisite for this certificate. While Stat 431 is still considered suitable for a direct measure because the majority of students in this program take Stat 431, it was suggested that further discussions will be necessary to refine the learning outcome review for this program.

Summary of Changes/Improvements Being Considered:

- We need to establish effective methods to reach out to students in this program for exit interviews.

Inter-rater Reliability:

The assessment committee will review and implement changes to procedure for assessment processes.

Closing the Loop:

The department plans to work with the registerer office to monitor when students in this program complete the degree to increase participation in exit interviews.

Student Achievement

Student Achievement

Student Retention:

1. The retention rate is 72.73%.
2. The retention rates of female students and male students are 66.67% and 75% respectively.
3. The retention rate of first generation students is 60%.
4. The retention rates of hispanic/latino, two or more races, and white students are 100%, 100%, and 62.5% respectively.

Student Persistence:

The persistence rate is 82.5%.

Student Completion:

The department uses the data provided by the Office of Internal Research. According their data:

1. The graduation rate is 77.78%.
2. The graduation rates of female and male students are 66.67% and 100% respectively.
3. The graduation rate of first-generation students is 100%.
4. The graduation rates of hispanic/latino, two or more races, unknown, and white students are 100%, 100%, 100%, and 66.67% respectively.

Student Postgraduate Success:

We did not collect data to monitor student postgraduate success.

Identify Equity Gaps:

35.8% of undergraduate mathematics/statistics majors were women. This is lower than the national average of women's representation (over 40%) and needs to be improved.

Effective Learning Environment and Closing Equity Gaps:

The department needs to provide students with a variety of learning models to accommodate diversity of learners.

Demand and Productivity

Demand and Productivity Item

External Demand:

The current enrollment is 106 students. The new enrollment is on an upward trend, while the new enrollment is on a downward trend. The major reason for this downward trend is the decline of the enrollment of instate students.

Internal Demand:

The number of student credit hours is on a downward trend. This is especially true in the student credit hours for lower division courses, which loosely coincides with the downward trend of overall enrollment at the university. On the other hand, the number of the student credit hours for upper division courses does not seem to be strongly affected by the declining trend in the university enrollment.

The students in the online programs need general education mathematics/statistics courses which are available online. As the above-mentioned programs is gaining popularity, the demand for such online is expected to increase.

Credit Productivity:

It is a concerning trend that other programs stop requiring mathematics courses or attempt to create their own statistics courses (due to the lack of non-engineer outreach online statistics courses), which would cause lower student credit hours for mathematics courses.

Financial Health and Resources

Financial Health and Resources Item

Financial Health:

The Polya Mathematics Learning Center operating cost, which includes the costs of an academic specialist, a Polya coordinator, all computers, data management, and up to 30 tutors, is largely covered by Polya Math course fees.

This model works if the number of students in the Polya courses is relatively stable. However, it is vulnerable to the enrollment of the first-year students because about 75% of incoming students UI students take the Polya courses. Thus, the challenge is to establish a financial model, in order to not be affected by the fluctuation of the number of incoming students so that we can ensure a supportive educational environment for a long term.

Efficient Use of Resources:

Ensure effective course scheduling by

1. using enrollment history to predict courses to offer,
2. identifying the courses that students need,
3. managing the schedule with students's need.