General Education Assessment Report
2020-2021 Results for Quantitative Reasoning

Executive Summary
In Spring 2021, faculty assessed 1654 students in 67 total sections of MATH 101M, 102M, 103M, 162M and STAT 130 to determine the extent to which they were achieving the specified general education outcomes for Quantitative Reasoning. Overall, test scores for each outcome were close to 70%. The higher rated Quantitative Reasoning outcomes were *computational skills* and *problem solving.* The lower rated outcome were *logical reasoning, quantitative modeling,* and *data interpretation.* Faculty recommended creating and adopting more concept quizzes that are designed to help students develop reasoning beyond computational skills. They also discussed a need for greater collaboration amongst course coordinators and the desire to collect more assessment data to analyze trends over time.

Quantitative Reasoning Assessment Report
As part of Old Dominion University's general education requirements, students must complete three credit hours of Quantitative Reasoning courses, also known as the Mathematical Skills (M), at the lower division level. The lower division Quantitative Reasoning skills are taught in the department of Mathematics and Statistics. The criteria approved by Faculty Senate for M courses includes the following student learning outcomes (SLO):

a. Logical Reasoning: Interpret sentences to contain the logical connectives "and" "or" "some," "all," and "none." They will be able to use deductive reasoning to draw conclusions from a series of statements and to identify appropriate generalizations or trends.

b. Computational Skills: Develop facility in the language and symbols of mathematics and will be able to perform basic calculations and operations related to the application of mathematics or statistics.

c. Data Interpretation: Read and interpret visual displays of quantitative information such as bar graphs, line graphs, pie charts, pictographs, and tables. They will be able to use them to make predictions and draw inferences from the data.

d. Problem Solving: Read a word problem, set up the necessary equations that describe the problem, solve these equations using basic quantitative techniques, and interpret or draw a conclusion from the solution.

e. Quantitative Modeling: Model physical and natural phenomena and assess validity of a model, make predictions from the model, and draw conclusions based on the model.

Methodology
Faculty teaching M courses developed multiple choice tests to assess Quantitative Reasoning. Each of the five student learning outcomes were aligned with specific items on the test. Students in MATH 101M (n=88) were given a 20-question multiple choice assessment. Students in MATH 102M (n=94) and Math 103M (n=513) were given a 20-question multiple choice assessment as a portion of their Final Exam. Students in MATH 162 (n=513) were given a 14-question multiple choice assessment as a portion of their Final Exam. Students in STAT 130M (n=446) were given a 20-question multiple choice assessment. Tests were administered during spring 2021. The questions were graded as correct/incorrect. In most instances, the test was for-

credit and embedded into the grading criteria for the course. Data was collected for online and face-to-face courses; although, many of the courses were taught online due to COVID.

Results
An overview of the findings by SLO is presented in Figure 1. The highest scoring Quantitative Reasoning outcome was *problem solving* (SLO D: 78%). The remaining outcomes, logical reasoning, computational skills, data interpretation, and quantitative modeling, received lower scores (SLO A: 68%, SLO B: 72%, SLO C: 69%, and SLO E: 69%).

Figure 1. Quantitative Reasoning assessment results
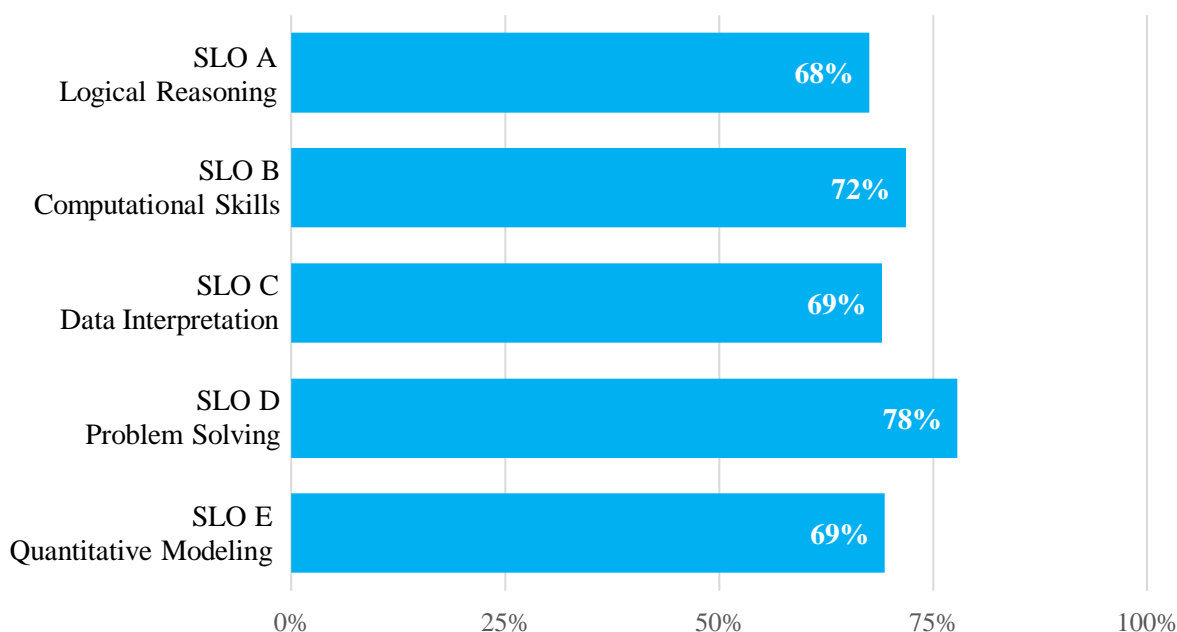
A full description of the results will be made available on the Office of Institutional Effectiveness & Assessment's website: https://tinyurl.com/geneduc

Faculty Rater Discussion and Recommendations

<u>Discussion</u>
In a debrief with course coordinators from the Quantitative Reasonings courses, faculty were asked to reflect upon the strengths and weaknesses of student learning. Students showed strength in their ability to perform basic calculations and operations related to the application of mathematics or statistics (SLO B). Students were also able to read a word problem; however, students struggled with setting up the necessary equations that described the problem (SLO D). Faculty noted that students had difficulty recognizing when to use and combine concepts in real-world applications. Student performance was weaker in their ability to use deductive reasoning to draw conclusions from a series of statements and to identify appropriate generalizations or trends (SLO A). Within this, students were able to understand the logical steps for equations. Overall, faculty noted that the test was a valuable and informative assessment that reflected their course experiences and expectations. Faculty mentioned the potential impact of the COVID

pandemic on the quality of student work. Faculty were pleased that all student learning outcomes scored close to 75% on the test.

<u>Recommendations</u>
Faculty will identify recommendations to improve Quantitative Reasoning outcomes:

Teaching or Assignments
- Create concept questions to help students demonstrate knowledge of the concepts behind each outcome.
- Adopt more concept quizzes that are designed to help students develop reasoning beyond computational skills.
- Revise assignments to clarify the value and use of quantitative modeling and logical reasoning.
- Create more opportunities for faculty and course coordinators to collaborate so that they can learn from each other and adopt best practices.

Assessment Process
- Course coordinators will review and modify individual test questions, based on an item analysis. A review of test items is needed for STAT 130M.
- Faculty aim to administer the assessment tests each semester to evaluate trends in the data. Plans are underway to administer the test in Spring, 2022.
- Faculty want to review and revise the student learning outcomes to ensure that they accurately represent current teaching practices.

Plan to Improve Learning
[to be completed by the department by Spring, 2022]

Faculty Senate Recommendations
[Shared with Committee A in Spring 2022]