

## Hunter College Mathematics & Quantitative Reasoning Assessment 2022-2023

### Summary Report, August 2023

By Joel Bloom, Ph.D., Director of Assessment

Introduction. The Hunter College Faculty Senate first passed its institutional General Education Assessment Plan in April 2018, and then updated it for another five-year cycle in May 2022. The Hunter Senate's Joint Committee on General Education Assessment (comprised of members of the Committee of General Education Requirements and the Committee on Academic Assessment & Evaluation), in cooperation with the Assessment Office and the Provost's Office, planned and implemented student learning outcome assessments in the Mathematical and Quantitative Reasoning required common core category.

Methodology. Because student learning outcomes (SLOs) in Mathematical and Quantitative Reasoning (MQR) were assessed successfully in 2018-2019, we were able to use the same rubric for the six SLOs as in the previous cycle. The box below details the selection of courses and sections, the types of student work assessed, and the method of that assessment.

Math 102 Four standard sections were chosen and asked to use 12 common questions on their Final Exam that were aligned with the MQR General Education learning outcomes. Each outcome was linked to two of these questions. The questions were scored as follows: 2 Points = Fully Correct (No Errors), 1 = Partially Correct, 0 = Blank or No Progress Toward Correct Answer. Each student's scores on each pair of questions tied to a learning outcome were summed. The student was then ranked as follows according to this sum: 4 = Exceeds Expectations, 3 = Meets Expectations, 2 = Approaches Expectations, 0-1 = Does Not Meet Expectations.

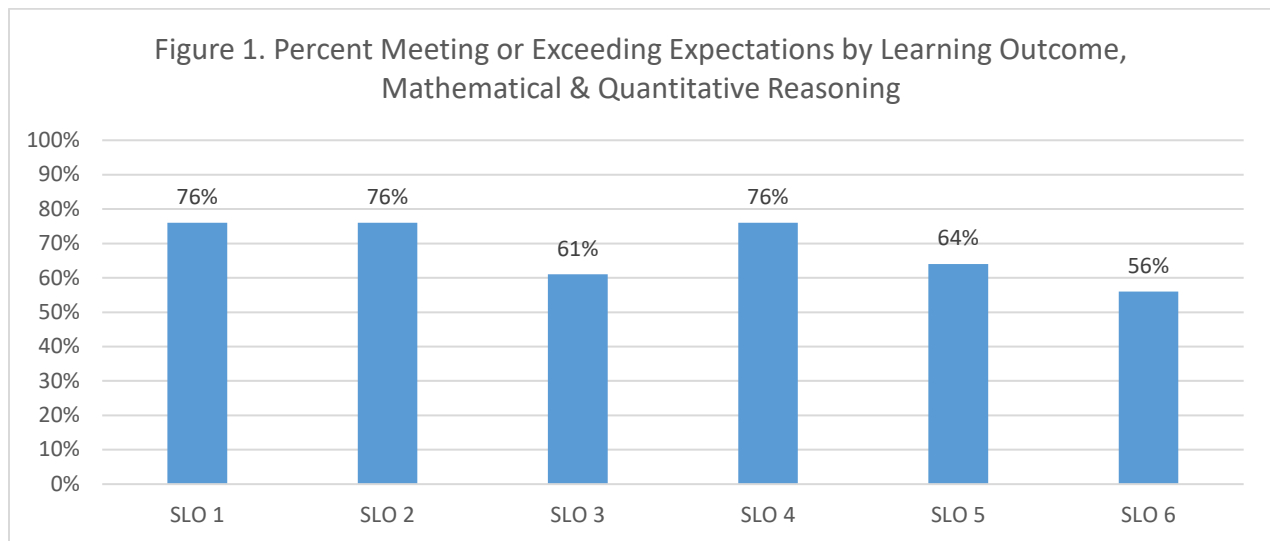
Math 150. One large section (capped at 100 students) and one standard section (capped at 35 students) were chosen. These sections agreed to include 10 questions on their Final Exam aligned with four of the MQR outcomes. A method similar to the above was used; however, most of the questions chosen were multiple choice. Multiple Choice were scored as follows: 2 = Correct Answer, 1 = Second-Best Answer, 0 = Any Other Answer / Blank. For outcomes #1, #3, and #6, two questions were tied to each. Students' scores on both were summed, and the following ranking was then used: 4 = Exceeds Expectations, 3 = Meets Expectations, 2 = Approaches Expectations, 0-1 = Does Not Meet Expectations. For outcome #2, four questions were used. Students were ranked by their total score on all four questions as follows: 7-8 = Exceeds Expectations, 5-6 = Meets Expectations, 3-4 = Approaches Expectations, 0-2 = Does Not Meet Expectations.

Working with the Joint Committee and the Director of Assessment, Mathematics and Statistics Department's Assessment Coordinator selected sections and assessment methods, and conducted the assessments. Student work for this assessment was collected in Fall 2022, and analyzed in winter and early Spring 2023. Overall, 122 pieces of student work were assessed from MATH 102 and another 98 were assessed from MATH 150, for a total of 220. On completion of the assessment activities, the results were compiled and analyzed, and presented in this report to the Committees on General Education Requirements and Academic Assessment & Evaluation.

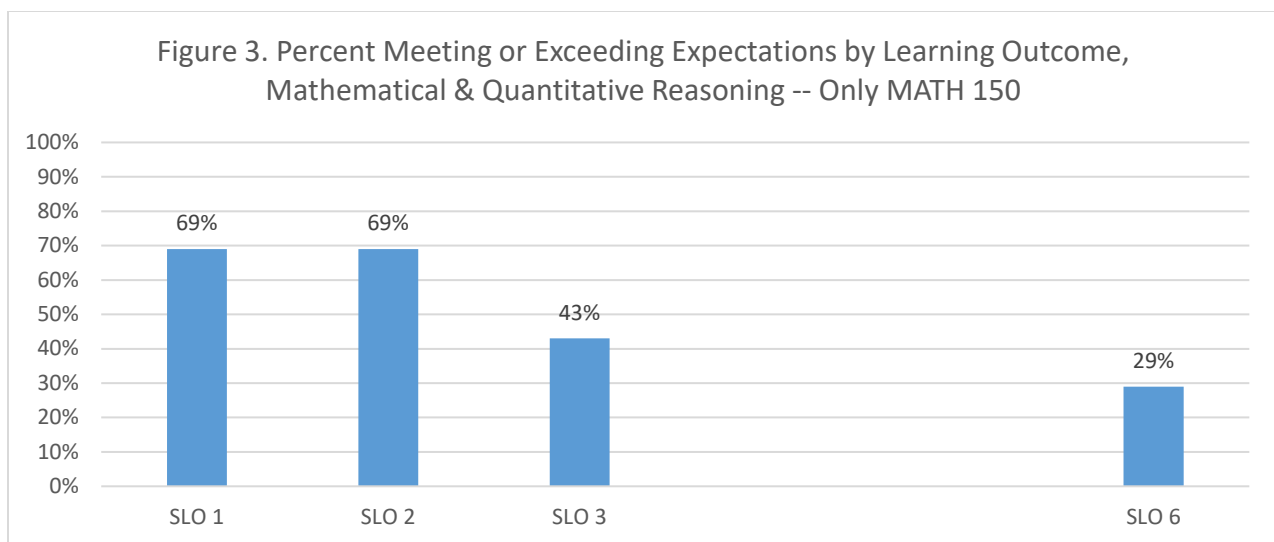
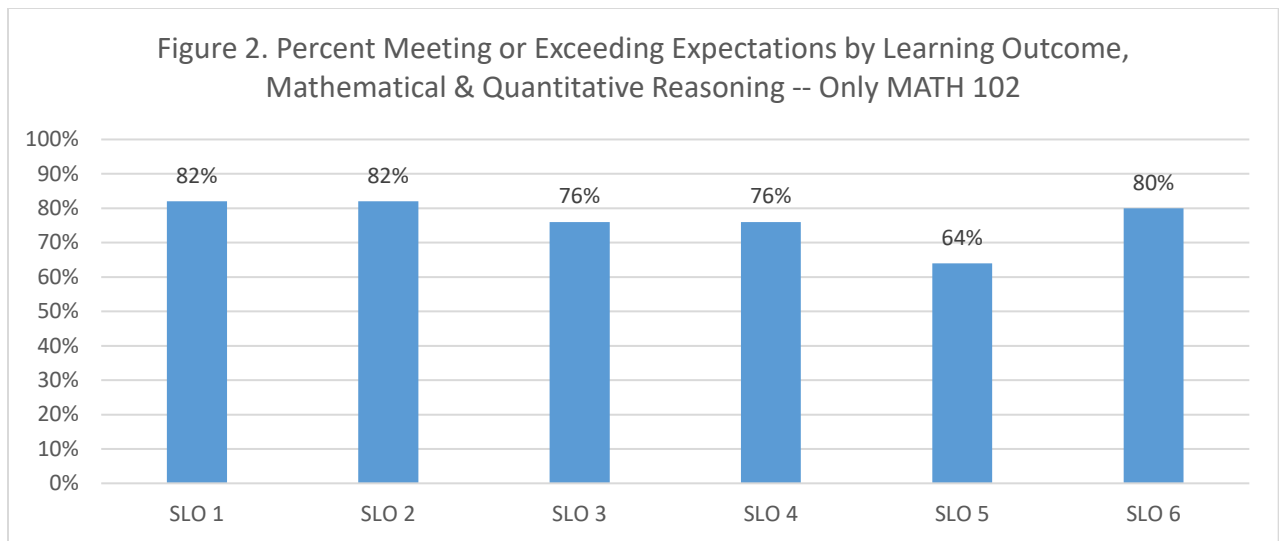
## Assessment Results in Mathematical and Quantitative Reasoning

Mathematical & Quantitative Reasoning General Education Outcomes	Does not Meet Expectations	Approaches Expectations	Meets Expectations	Exceeds Expectations	Top 2 Categories	Total Assessed
1. Interpret and draw appropriate inferences from quantitative representations, such as formulas, graphs, or tables.	11.8%	11.8%	29.1%	47.3%	76.4%	220
2. Use algebraic, numerical, graphical, or statistical methods to draw accurate conclusions and solve mathematical problems.	12.3%	11.4%	29.1%	47.3%	76.4%	220
3. Represent quantitative problems expressed in natural language in a suitable mathematical format.	21.4%	17.3%	25.5%	35.9%	61.4%	220
4. Effectively communicate quantitative analysis or solutions to mathematical problems in written or oral form.	9.8%	13.9%	29.5%	46.7%	76.2%	122
5. Evaluate solutions to problems for reasonableness using a variety of means, including informed estimation.	12.3%	23.8%	36.9%	27.0%	63.9%	122
6. Apply mathematical methods to problems in other fields of study.	16.4%	27.7%	24.1%	31.8%	55.9%	220

**Summary of Results.** As shown in the table above and the charts below, for the majority of learning outcomes, majorities of students were found to be meeting or exceeding the expectations for MQR, although there is substantial variation among outcomes. Of the six outcomes assessed, three showed over 75% meeting or exceeding expectations; two others were over 60%, and the lowest (outcome 6) was only 56%.



Most of these differences among SLOs can be explained by an overall lower performance among students in MATH 150 (Calculus 1), compared to higher performance in MATH 102 (Mathematics of Everyday Life). The former is taken nearly entirely by Math and Statistics, and STEM majors, while the latter is of a model general education course, by design accessible to the less quantitatively-inclined students. Figure 2, below, shows the same figures, looking only at MATH 102 students. Figure 3 shows results for MATH 150 only. It's easy to see at first glance that MATH 102 student results are higher than those for MATH 150. Since both courses were assessed by the same faculty member, the difference must be due to differences in the test items assessed, or it could be due to overall lower expectations for MATH 102 students.



Note the markedly lower performance in MATH 150, particularly in SLOs 3 and 6. This highlights the difficulties STEM-track students face in their foundational courses, including lack of prerequisite skills. Suggestions for helping students overcome these difficulties and addressing the spike in DFW rates in STEM courses are found in the Recommendations below.

## Conclusions

The Mathematics and Statistics Assessment Coordinator who conducted the assessments, discussed the following as his conclusions with regard to the assessment:

Because summative assessments were used, the data gathered does not account for the large number of students who had withdrawn from each class or did not take the Final Exam. Extreme learning loss seen throughout STEM education since the COVID pandemic was apparent. Students have noticeably struggled to recall prerequisite knowledge from earlier courses, to learn new mathematical concepts and methods, and to exercise good study habits.

This was particularly evident in Math 150: For outcomes #1 and #2 over 30% of students did not meet or exceed expectations. This highlights their increased difficulty recalling and using prior math knowledge and synthesizing it with more advanced Calculus concepts and techniques. 57% did not meet or exceed expectations in #3, indicating problems using mathematical language. Finally, 71% did not meet or exceed expectations in #6, applying mathematical skills to other fields of study. These areas have always challenged

students, but there has been a sharp rise since the pandemic in students' extreme difficulty with them. (Outcomes #4 and #5 were not assessed in Math 150 because the course spends little time on the relevant skills.)

In Math 102 over a third of students did not meet or exceed expectations in outcome #5, evaluating solutions for reasonableness and using informed estimation. While the content of Math 102, a non-STEM course, relies on substantially less prerequisite knowledge than Calculus, instructors have nevertheless noted increased issues with students' motivation and effort and basic math skills.

It was also noted that results varied largely by section. Recruiting, retaining, training, and supporting full-time and adjunct-faculty as well as more coordination and standardization across multi-section courses should be considered. A Math/Stat task force partnered with the administration has been created to address these issues.

An additional matter for possible discussion could be whether the MATH 150 might need some enhancement particularly in areas covered by SLOs 4 and 5.

**Recommendations:**

IV. Actions Taken: What actions did you take, or will you take, to respond to the data and conclusions? What actions do you recommend be taken at the institutional level?

Actions To Be Taken	Who Will Take these Actions?	Timeframe for implementation and intermediate steps
Consider partnering with the Dolciani Mathematics Learning Center (DMLC) to support students and refer them individually to tutoring, workshops, etc.	Dept. Chairs and DMLC	2023-2024
Consider "extension" courses or workshops to be offered in Winter and Summer required for students who earn a "C" in a 100-level course, to reinforce their knowledge before taking the next level course.	Dept. Chairs and DMLC	2023-2024
Consider remedial workshops for students who earn "D" or "F" in a 100-level course to help them learn basic skills before retaking the class.	Dept. Chairs and DMLC	2023-2024
Require most or all students take Hunter's in-house Math Placement Test to help them and their advisors decide the right course placement.	Math/Stat Dept. and Hunter Testing Center	Spring 2023 (In Progress)
Urge instructors to utilize CUNY's Early Alert system to refer struggling students to tutoring, counseling, advising, and other services as needed.	Chairs, Course Coordinators, and Instructors	2023-2024
Consider adding more coordination/standardization to multi-section courses.	Chairs and Course Coordinators	Fall 2023
Support coordinators and adjunct faculty with training sessions, etc.	Administration and Chairs	2022-2023
Make sure students are aware of the free counseling and mental health services available. Encourage instructors and advisors who notice students struggling with either to refer them to an appropriate office or service.	Chairs, Faculty, and Advisors	Spring 2023

Were actions recommended in the previous assessment cycle implemented as planned? (Again, actions may include modifications to pedagogy and curriculum, as well as faculty development or resource/staffing/budget requests.) *Please explain.*

The Math/Stat department's full 100-level curriculum overhaul was implemented. This included extra training and support for adjuncts, for a time, as well as offering additional courses to sharpen students' logical reasoning skills, taken as an option or sometimes required before students move on to an advanced course. Asynchronous online workshops were added to better prepare students who were not deemed CUNY Math Proficient for their STEM coursework. The pandemic made it difficult to measure the effects of these changes, but the post-pandemic learning loss crisis has shown that they are not sufficient. The need for more full-time Math/Stat faculty has largely been left unaddressed, as of Fall 2022.

If you have made curricular changes as a result of previous assessment results, were any of your assessments this year related to those modified areas? *If yes, how did they go?*

This year's assessment plan focused on diagnosing students' recent and unique learning loss issues since the pandemic, rather than prior curricular changes.