CCSU General Education Assessment Retreat

January 2022

Quantitative Reasoning Learning Outcome Results

Artifacts from Fall 2021

Office of Institutional Research and Assessment

Central Connecticut State University

Introduction

As part of our Davis Educational Foundation (DEF) grant, Central Connecticut State University (CCSU) faculty participated in assignment alignment workshops for the Quantitative Reasoning general education learning outcome (General Education Objective 6). This rubric, created by Association of American Colleges and Universities (AAC&U), was adopted for use by CCSU faculty in 2014. (Rubric attached.)

The rubric features five dimensions on a rating scale of 1 to 4, where 1 represents the lowest assessable performance and 4 represents the highest performance. A score of zero is awarded in cases where a student failed to address the dimension. The rubric is grounded in the following definition:

> *Quantitative Literacy (QL) – also known as Numeracy or Quantitative Reasoning (QR) – is a "habit of mind," competency, and comfort in working with numerical data. Individuals with strong QL skills possess the ability to reason and solve quantitative problems from a wide array of authentic contexts and everyday life situations. They understand and can create sophisticated arguments supported by quantitative evidence and they can clearly communicate those arguments in a variety of formats (using words, tables, graphs, mathematical equations, etc., as appropriate).*

The six dimensions of the rubric include:

- Interpretation
- Representation
- Calculation
- Application/Analysis
- Assumptions
- Communication

In both Spring 2021 and Fall 2021, a number of faculty participated in DEF workshops to align existing assignments to this rubric. Working in teams, faculty helped each other align their respective assignments to ensure that each dimension of the rubric was evident in the assignment. Those assignments were then given to students; upon completion, the assignments were submitted to the Office of Institutional Research and Assessment for scoring by faculty at the annual winter assessment retreat.

In January 2022, a team of three CCSU faculty scored 164 student artifacts using the Quantitative Reasoning (QR) rubric. The artifacts were contributed from the faculty participating in the DEF workshops and represented student work throughout the Spring 2021 and Fall 2021 semesters. For scoring purposes, only first-year and seniors student artifacts were assessed. This model provides important information, allowing for the comparison on where first-year students start and where seniors are prior to graduation.

The QR artifacts scored at this retreat represented 47 first-year students and 117 senior-level students from 14 courses taught in the College of Liberal Arts and Social Sciences and the School of Engineering, Science, and Technology. This was the first time where the assignments used had been intentionally aligned to the rubric. Each artifact was scored by two different faculty and the scores were averaged.

It is important to note that our general education learning outcome assessment model measures student learning on skills and knowledge that are gained across their courses and academic career. As such, this assessment is not reflective of a single instructor nor a single course, but rather a reflection of where students are in their academic journey.

The results presented on the following pages are from our January 2022 assessment retreat, with comparisons between academic groups and demographic data.

Overall Results

As seen in Figure 1, the overall score for first-year students evaluated on their Quantitative Reasoning artifacts was 2.2 and represents mid-level performance. The score for each individual dimension fluctuated between 1.5 and 2.6. Similar to previous assessments, the Assumptions dimension continues to lag behind the other dimensions and clearly has the greatest need for improvement.

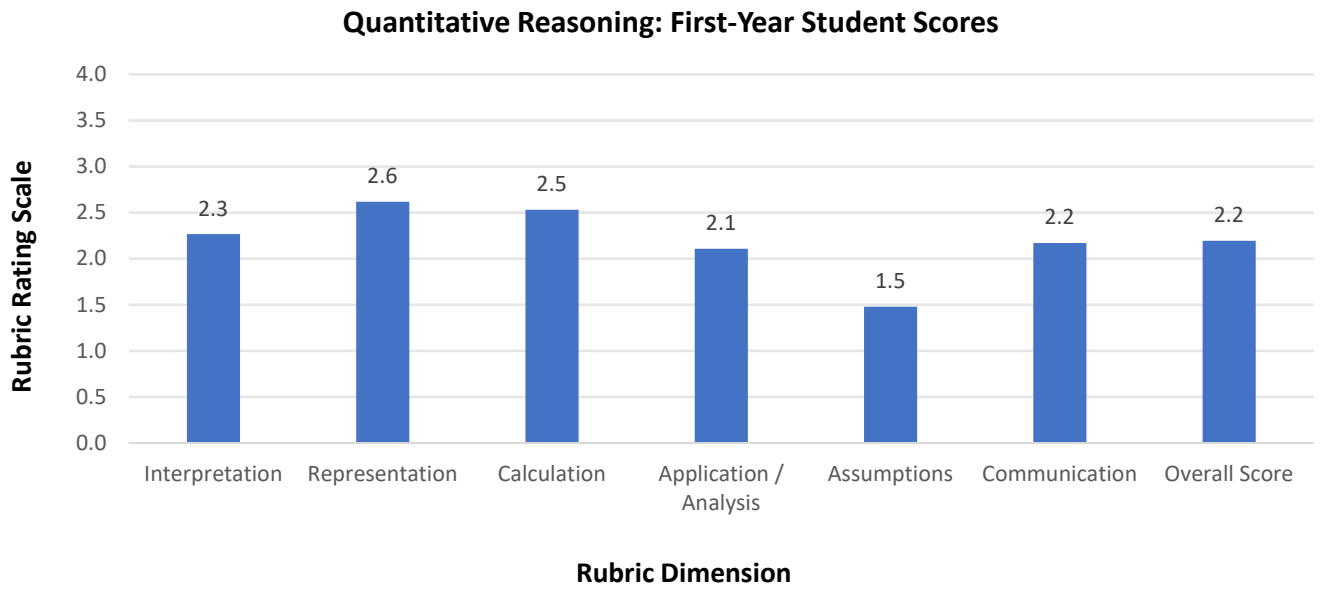

Figure 1. Overall scores of first-year students for Quantitative Reasoning Rubric, n=47

The overall score for seniors was 2.6, which is 0.4 points higher than first-year students. While senior performance was slightly more consistent than that of first-year students, once again, the dimension related to articulating assumptions scored noticeably lower than the other dimensions and thus has the greatest need for improvement.

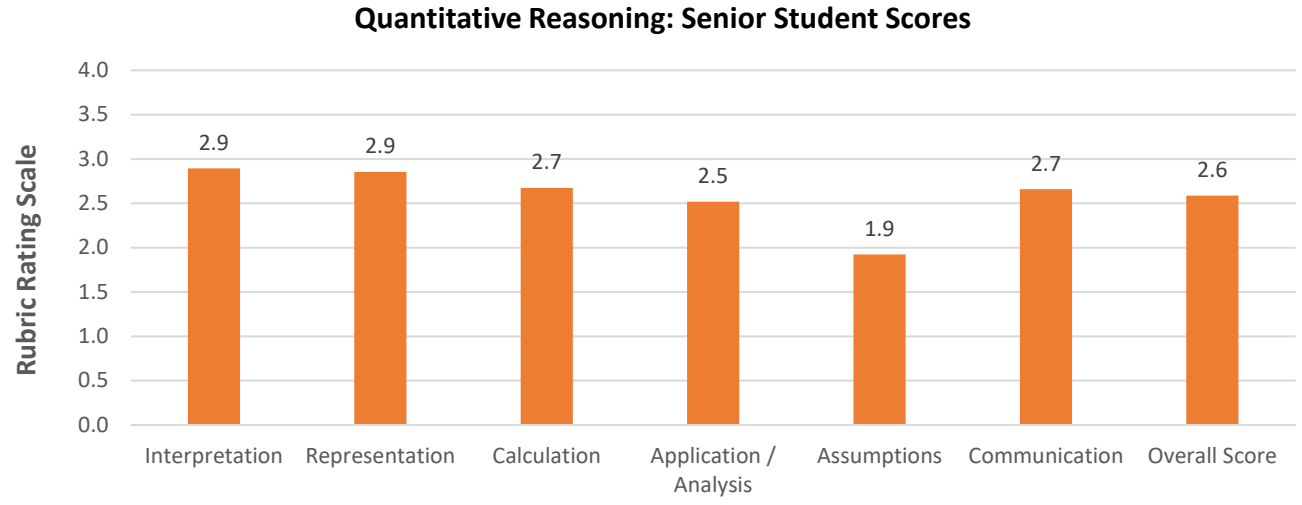

Figure 2. Overall scores of senior-level students for *Quantitative Reasoning* Rubric, n=117

Data Disaggregated by Gender

When looking at the results of first-year students by gender, the average scores overall were somewhat similar for females and males (Figure 3), however, females did have higher average scores than males on four of the six dimensions. As mentioned previously, articulating assumptions continues to have the lowest scores regardless of gender.

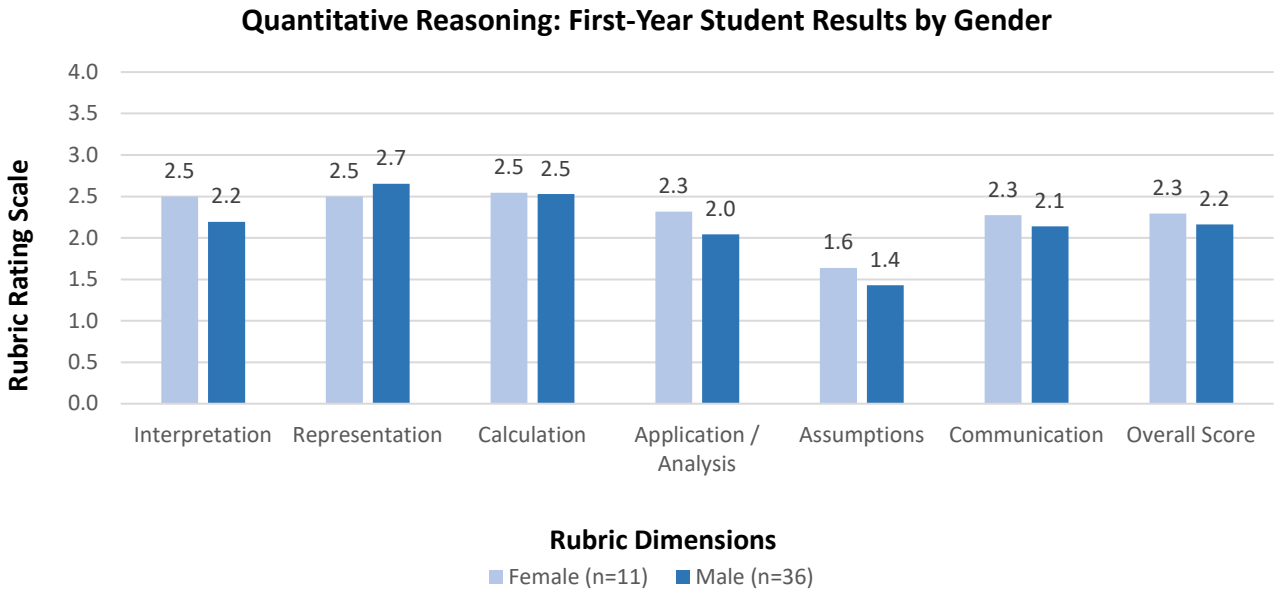

Figure 3. Scores of first-year students by gender

For senior students, both females and males had an overall score of 2.6 (Figure 4). Female students scored slightly higher than males on three of the six dimensions, with a differential up to 0.2 points. Male students performed somewhat higher on two of the dimensions, with a maximum differential of 0.3 points. Male and female students scored 2.9 on Interpretation. The Assumption dimension, once again, is considerably lower for both female and male students.

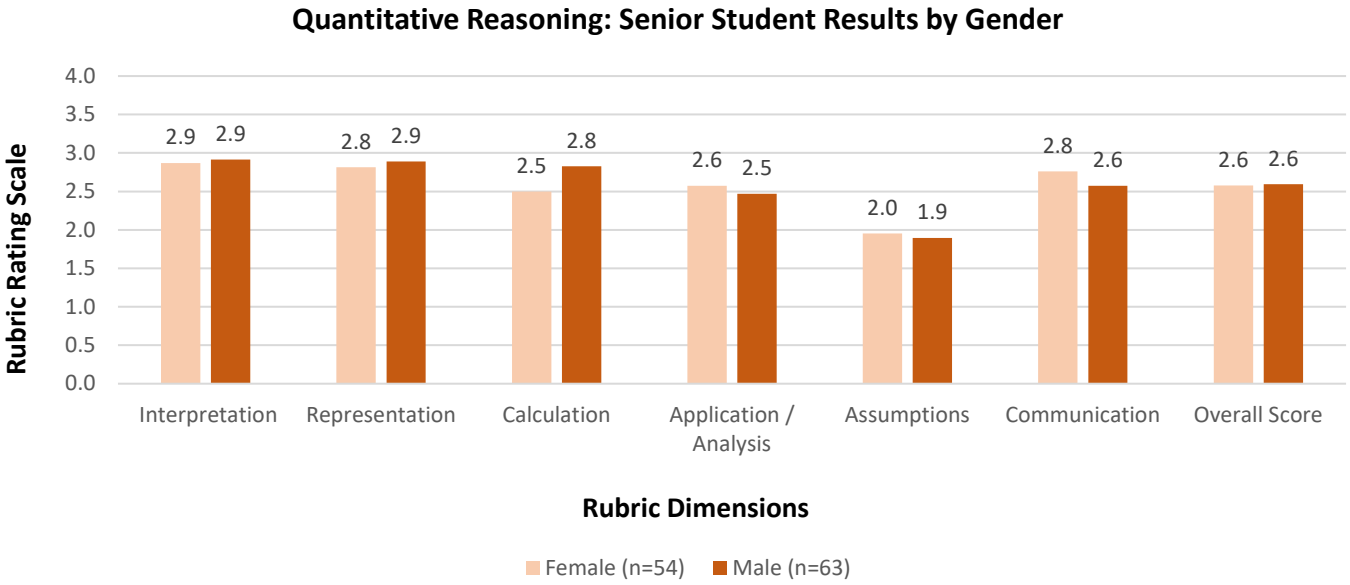

Figure 4. Scores of senior-level students by gender

Data Disaggregated by Race/Ethnicity

Results of first-year students disaggregated by race/ethnicity show that Hispanic/Latino, Black or African American, and White students had overall average scores ranging between 2.0 and 2.3. Setting aside the scores for Assumptions, students across all three race/ethnicities are strongest in the dimensions Representation and Calculation. The greatest opportunity for improvement is in Application/Analysis, Interpretation, and Communication.

Table 1. *First Year Student Results by Race/Ethnicity**

	Hispanic/Latino (n=9)	Black or African American (n=7)	White (n=28)
Interpretation	2.2	1.9	2.4
Representation	2.4	2.7	2.7
Calculation	2.4	2.6	2.5
Application/Analysis	1.9	1.9	2.2
Assumptions	1.2	1.3	1.6
Communication	1.8	2.1	2.3
Overall Average Score	2.0	2.1	2.3

*The sample sizes for American Indian or Alaska Native, Asian, Native Hawaiian or Other Pacific Islander, Non-Resident Alien, and Unknown were too small and their data were not included in the table for privacy concerns.

For senior-level students, White students had a higher overall score (2.7) than the other three race/ethnic groups (2.4). Black or African American and White students scored highest on Interpretation and Asian and Hispanic/Latino students scored highest on Representation. Consistent with other findings, Assumption continues to be the most challenging with scores ranging from 1.6 to 2.0. The next area with the greatest need for improvement is Application/Analysis with scores ranging from 2.3 to 2.6.

Table 2. Senior *Student Results by Race/Ethnicity**

	Hispanic/Latino (n=19)	Black or African American (n=10)	White (n=79)	Asian (n=5)
Interpretation	2.6	2.9	3.0	2.4
Representation	2.7	2.8	2.9	2.7
Calculation	2.6	2.4	2.7	2.6
Application/Analysis	2.3	2.3	2.6	2.3
Assumptions	1.6	1.7	2.0	2.0
Communication	2.4	2.4	2.8	2.5
Overall Average Score	2.4	2.4	2.7	2.4

*The sample sizes for American Indian or Alaska Native, Native Hawaiian or Other Pacific Islander, Non-Resident Alien, and Unknown were too small and their data were not included in the table for privacy concerns.

Data by Distribution of Scores

Looking at the distribution of scores within each dimension, the largest percentage of first-year students had a score between 2.00 and 2.99 for five of the six dimensions (Figure 5) and for the sixth dimension, Assumption, 66% of students scored less than 2.0. At least one student scored a 4.0 in three of the dimensions – Interpretation, Representation and Calculation.

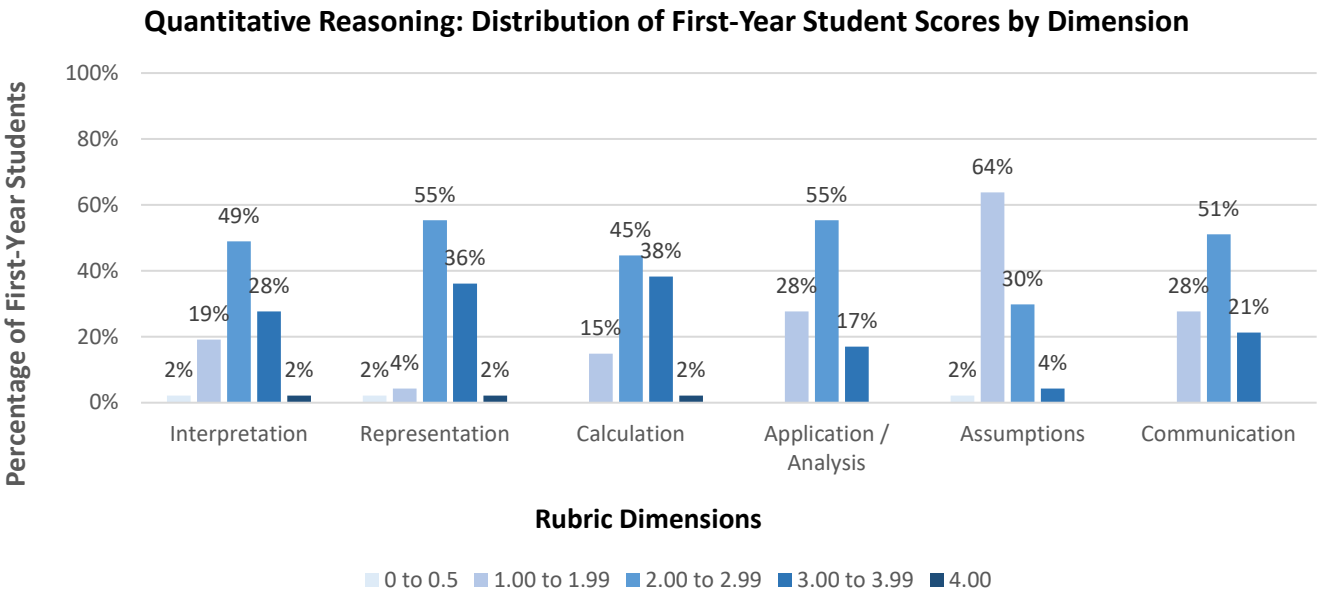

Figure 5. Percentage of first-year students based on rating scale

Figure 6 shows that the largest percentage of seniors scored between 3.00 and 3.99 for four of the six dimensions. For the dimension "Application/Analysis" a higher percentage of students had an score between 2.00 and 2.99, and for "Assumptions," a higher percentage of students had a score between 1.00 and 1.99. Notably, a number of seniors scored 4.0 on five of the six dimenions. The data show that senior-level students are more able to demonstrate their grasp of these dimensions than first-year students. Comparing Figures 5 and 6 reveal that 30% of first-year students scored 3.00

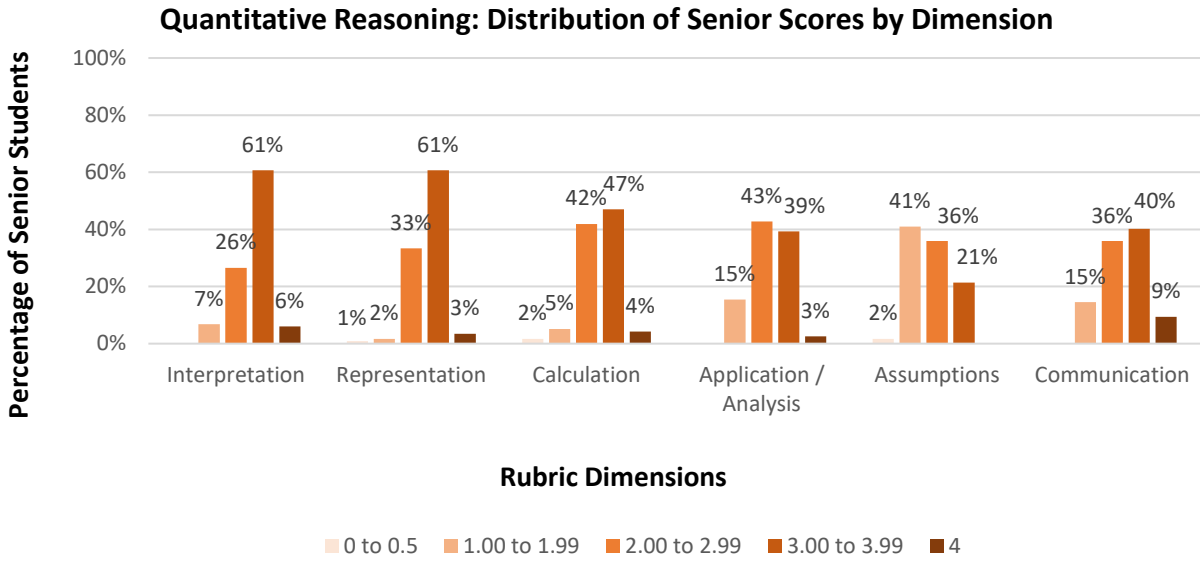

Figure 6. Percentage of senior-level students based on rating scale

or higher in their ability to interpret data compared to 67% of seniors. Likewise, when it comes to Application/Analysis, 42% of seniors scored a 3.00 or higher compared to 17% of first-year students.

Conclusion

It is our hope that you find these results both informative and valuable. As with any assessment, the results can be used to validate current practices, applaud successful outcomes, and/or identify areas for further attention.

Some faculty have found the following questions helpful as they review these data:

- Where did our students demonstrate success in Quantitative Reasoning?
- Which Quantitative Reasoning dimensions are clear areas for continued growth?
- How might these data be used to inform teaching and further students' Quantitative Reasoning learning?

To conclude, it is important to note that these scores reflect multiple factors at work and should be viewed within that context. As we continue to seek improvements on the various factors that go into scoring, our ultimate goal is to have CCSU undergraduate students demonstrate enhanced performance for our Quantitative Reasoning Learning Outcome, providing them with a solid foundation for future intellectual and personal pursuits.

To this end, faculty participation is key. As more faculty participate in these assessments, we will be able to ensure a more balanced population of students are assessed when it comes to student level and demographics.

Please contact Martie Kaczmarek, Assessment Coordinator, OIRA, if you would like additional information. Email: mkaczmarek@ccsu.edu or call 860-832-2304.

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