University Summary Report:
Quantitative Reasoning
Assessment of Student Learning for
Graduate Programs

December 15, 2020, version 1

INTRODUCTION

Special Note about COVID-19: It is important to note that a significant amount of the work referenced in this report was completed during the COVID-19 pandemic that began in the Spring of 2020 and continued in the Fall of 2020 when this report was written. This includes the collection, assessment, and analysis of student work in college discussions, and implementing college and University changes - all of which were impacted to some degree. While a moderate amount of assessment work was delayed one term, assessment efforts moved forward. The Educational Effectiveness Committee, along with other academic committees such as CAPR and the ILO Subcommittee, supported ongoing reflection about student learning for mindful, flexible, and nimble decision making during this dynamic period. Additionally, teaching, learning, and assessment discussions and decision-making related to diversity, inclusion, and social justice issues were a critical part of academic assessment during this time.

Purpose

Institutional Learning Outcomes (ILOs) are those learning outcomes that are expected of every graduate of the institution, both undergraduate and graduate, and are closely aligned with General Education requirements. ILO Assessment follows the ILO Long Term Assessment Plan which aligns the assessment schedule for undergraduate, graduate, and the GE Long-term Assessment Plan.

Following the schedule for the ILO Long Term Assessment Plan, Cal State East Bay has gathered recent student learning data to support the assessment of the University's Quantitative Reasoning Institutional Learning Outcome. These data are intended to provide additional context for existing academic review discussions, analysis, and decision making to improve student learning.

Overview of Quantitative Reasoning

Graduate students would be expected to have mastered general quantitative reasoning skills as part of their undergraduate degree. Quantitative reasoning goals in graduate programs would then be aimed at developing and mastering discipline-specific skills such as performing statistical analysis, applying mathematical methods within an applied context, making decisions based on data, and creating well-reasoned arguments supported by quantitative evidence.

Development of these discipline-specific quantitative reasoning skills is completed within major courses in a student's degree major. Students who have not mastered general quantitative reasoning skills prior to admission may address that deficiency by completing courses which fulfill the undergraduate GE B4 requirement, or by completing major-specific courses incorporating quantitative reasoning in programs where those courses are available. Co-curricular support in mathematics and statistics is available for all students through the Student Center for Academic Achievement (SCAA).

METHODS

CSUEB Academic Senate policy requires that each graduate program align to at least two university ILOs, as specified in the ILO Long-Term Assessment Plan. All graduate programs have submitted ILO-PLO mappings to indicate the ILOs to which they would align, and these alignments are available on the College assessment web pages.

There is wide variation in the goals of the various graduate programs with respect to the Quantitative Reasoning ILO (e.g., proficiency in applying mathematical methods vs. representation/visualization of data.) In addition, some programs are subject to outside accreditation organizations which specify their own criteria and rubrics for assessing Quantitative Reasoning skills. As a result, each aligned graduate program was asked to specify a rubric to be used to assess the Quantitative Reasoning ILO. Programs could choose to use the university rubric developed to assess undergraduate work, modify the university rubric, develop their own discipline-specific rubric, or use a rubric specified by an outside accrediting agency. This process is in contrast to the assessment of ILOs in the undergraduate programs where a common university rubric is used to assess all undergraduate work across all programs for each ILO.

Each aligned graduate program identified one or more graduate courses in which the ILO was to be assessed, and the instructor of the course was asked to identify or develop an assignment that could be effectively used for assessment purposes. Individual programs decided how many samples they would gather in each assessed course and also identified faculty members responsible for applying the specified rubrics to generate the assessment data. The results of the assessment efforts were provided in each program's annual report to the Academic Senate Committee on Academic Planning and Review (CAPR) and to the Office of Graduate Studies.

Assessment of Graduate Level ILO Quantitative Reasoning Student Work 2019- 2020

Twelve of the thirty-five graduate programs at CSUEB chose to align one or more of their Program Learning Outcomes with the Quantitative Reasoning ILO and hence participated in assessment of that ILO in 2019-2020. Programs from three of the four CSUEB colleges were represented. Most programs in the last college, CLASS, primarily chose to align with the Critical Thinking subarea of the Thinking and Reasoning ILO instead of the Quantitative Reasoning subarea.

Table 1. Numbers of programs aligned by college for Quantitative Reasoning ILO 2019-20.

College	Programs Represented	# Programs Aligned to Quantitative Reasoning ILO
CBE	Business Analytics Economics	2
CEAS	Counseling- School Counseling concentration Counseling – School Psychology concentration Counseling – Marriage and Family Therapy concentration	3
CLASS	None	0
CSCI	Biostatistics Chemistry and Biochemistry Computer Science Construction Management Engineering Management Mathematics Statistics	7

No common process was specified for collecting or assessing data. Again, some programs were subject to assessment requirements from outside accrediting organizations. Others intended to gather data from small available samples of students completing theses, or from courses with large enrollment and multiple sections. As a result, each program was asked to specify their own assessment process and describe the process when reporting their results. Some programs assessed assignments from all students in an assessed class, and others chose a small number randomly. Most programs used a single assessor to assess each assignment.

RESULTS

Assessment of Graduate Level ILO Quantitative Reasoning Student Work 2019-2020

Student Performance

The results of the assessment from each graduate program were specified based upon the rubric that they used. Two programs used the university ILO rubric for assessing undergraduate programs and one used a modified version of the university rubric. The remainder developed

their own rubrics or used the ones required by their accrediting bodies. The variations in rubric criteria and the number of criteria may exemplify wide variation in the outcomes specified by the graduate programs at CSUEB in terms of quantitative reasoning skills or may be the result of discipline-specific terminology and proposed assessment methods in specifying those outcomes.

Table 2. Characterization of Rubrics for Quantitative Reasoning ILO Assessment

College	Program	Rubric	# Criteria	Scale
CBE				
	Business Analytics	Accrediting Organization	3	1-4
	Economics	Accrediting Organization	4	0-8
CEAS				
	Counseling			
	Marriage and Family Therapy concentration	Accrediting Organization	N/A	N/A
	School Counseling concentration	Accrediting Organization	3	1-4
	School Psychology concentration	Accrediting Organization	1	1-4
CLASS				
	None			
CSCI				
	Biostatistics	Discipline-specific	1	1-5
	Chemistry and Biochemistry	Modification to University	7	1-4
	Computer Science	University	5	1-4
	Construction Management	Discipline-specific	1	1-8
	Engineering Management	Discipline-specific	1	1-8
	Mathematics	University	4	1-4
	Statistics	Discipline-specific	1	1-5

Given the variation in criteria used for assessment, direct comparison is problematic. That said, all programs have a common goal of measuring various aspects of proficiency in quantitative reasoning skills. As such, there appears to be a degree of commonality in the criteria with many programs using at least a number of criteria similar to the university rubric criteria. In the absence of a mapping from discipline-specific criteria to university rubric criteria, which might allow for detailed comparisons on a per-criteria basis, a rough comparison was completed using the following method. Scores were averaged across criteria on a per-program basis, rescaled to a 1-4 scale, and then averaged across all programs in a college, and finally across all programs in the university. One might interpret these numbers as estimates of how programs themselves see the proficiency levels of their students, where various programs may hold different expectations as to the manner in which proficiency may be demonstrated by their students.

The results of the assessment of quantitative reasoning performance for the Quantitative Reasoning ILO on a per-program basis ranged between 3.06 to 3.6 on a 1-4 scale. The interpretation of the ranking values for the university rubric is given below. No programs from CLASS were aligned with the Quantitative Reasoning ILO.

Table 3. Average score on all Quantitative Reasoning criteria on scale of 1-4

	University	**CBE**	**CEAS**	**CLASS**	**CSCI**
Average score	3.43	3.33	3.42	No assessment done	3.47

1 – Major Gaps 2 – Some Gaps 3 – Competent 4 – Fully Competent

Perhaps more useful are some themes that emerged throughout the ILO assessment reports.

- Most programs were satisfied with the quantitative reasoning proficiency of their students across most of the criteria that they assessed.
- Several programs identified one or two criteria in which their students struggled to show proficiency, where the criteria of concern varied with the program. In most cases, the programs suggested possible solutions for addressing the concerns.
- In all cases, programs which identified concerns specified that those concerns could and would be addressed within the programs themselves. This is in contrast to comments made when reviewing results of the Written Communication ILO assessment from 2018-2019 where many programs suggested solutions that would need to be implemented at the University level.

Program Feedback Highlights for Quantitative Reasoning

Highlights of feedback from programs which aligned to the Quantitative Reasoning ILO, taken from their ILO assessment reports, included:

Example Successes

- "No students were assessed as below expectations on any rubric trait. Overall, students performed very well on all areas of this learning objective."
- "The students did best in formulating, representing, and analyzing problems, as well as in overall communication."
- "… the highest score for both types of questions was in "Problem Formulation," a testament to the students' understanding the correct model and solution methodology."
- "The graduate committee was encouraged by the results as they show that the students were very near the highest ranking (4) for each category. "

Example Challenges

- "The lowest score was in the "Overall Communication" category. Mostly this is an indication of the lack of connections and explanations that students need to include in their write-up of solutions."
- "The area in need of most attention is Trait 4: Use of Results, with 36% of students scoring below expectations."

- "The areas that need the most work were in the students' discussions of implications and limitations."
- "The categories which show need for improvement include problem formulation with interpretation of data and analysis of results using analytic methods."

STUDENT LIFE AT CSUEB IN 2019-2020

The University Summary Report on Quantitative Reasoning assessment includes extensive information regarding the impact of COVID-19, the resulting quarantine, the Black Lives Matter movement and other social justice movements on the well-being and mental state of CSUEB students. Graduate students underwent the same stressors as CSUEB university students as a whole. In addition, due to the larger proportion of graduate students who are international, they also were subjected to uncertainties regarding visa status and international travel, and possible racial discrimination. Graduate students are more likely to be the heads of households and to hold full-time jobs, leading to greater consequences if their employment was reduced or eliminated. Finally, graduate students are more likely to be conducting research than undergraduates. As almost all lab-based research and research that was to be conducted in the field was suspended for the last half of Spring 2020, many graduate students were unable to complete capstone course requirements.

CSUEB faculty and staff were greatly impacted and affected by COVID-19 and social justice movements as well, both personally, and in their efforts to support CSUEB students. The fact that all programs completed assessment activities in the face of these challenges reflects the importance the university attaches to the assessment process and the dedication of the faculty and staff personnel.

PROCESS CONSIDERATIONS FOR FUTURE GRADUATE PROGRAM ILO ASSESSMENT CYCLES

In discussions with Educational Effectiveness Committee (EEC) members, and the Dean of Academic Programs and Services, it became clear that it would be advantageous to refine some processes regarding the reporting of ILO assessment data to the Committee on Academic Programs and Resources (CAPR). Some of the issues that could be clarified include:

- Specifying responsibility for ensuring that program annual reports are submitted to CAPR by the due date.
- Specifying responsibility for ensuring that program annual reports contain the required ILO assessment results.
- For programs undergoing five-year review, who are eligible to submit truncated annual reports, that those reports include ILO assessment results.
- For programs which are accredited by discipline-specific accreditation organizations, that a clear mapping of accreditation organization assessment criteria to university ILO criteria be supplied.

In addition, while CAPR has specified a long-term schedule for ILO assessment, most programs do not follow this schedule and use their own assessment schedule or one specified by their

accreditation organization. This often results in programs assessing both their own PLO and an unrelated university ILO in one year. In some cases, due to the confusion, programs have failed to assess and collect the assessment data needed for ILO assessment. If program and CAPR schedules were synchronized, there would less opportunity for error and hopefully less work to complete. It might be useful for CAPR to recommend that programs match their assessment schedules to the CAPR schedule to the extent possible.

DISCUSSIONS

SUGGESTIONS FOR COLLEGE AND GRADUATE ADVISORY COUNCIL DISCUSSIONS

Role of ILO Subcommittee
The ILO Subcommittee will review calibration results and faculty feedback in order to recommend potential changes to the Quantitative Reasoning ILO Rubric and the ILO Assessment process for undergraduate work. Graduate programs currently using the university rubrics may then decide whether to adopt any proposed changes or move to a discipline-specific rubric.

Graduate Advisory Council meetings
Discussion of ILO assessment results will be placed on the agenda for the Spring 2021 Graduate Advisory Council meetings. Graduate coordinators will be asked to review results and discuss changes made to improve students learning, as well as evaluating the assessment process in order to add meaning to the results and help to improve processes for future assessment cycles.

College/Unit Discussions
Led by associate deans, each college/unit will decide their own approach to reviewing results and conducting discussions generally following the schedules outlined in ILO Long Term Assessment Plan and EEC Communication Plan focused on discussions in fall of 2020 and implementation in Spring 2021. This includes reviewing those results that add meaning to their discussions about improving student performance in Quantitative Reasoning skills.

Support for College and Graduate Advisory Council Discussions
Please see University Summary Report for contacts and potential meeting format. Possible additional graduate-specific discussion questions include:

1. How do results of graduate assessment compare to undergraduate assessment in departments with both undergraduate and graduate programs? Were results as expected?
2. Were there commonalities between programs in areas of student proficiency or gaps? Can common solutions for addressing gaps be suggested?
3. What is the importance of each criteria within a rubric? Should weights be assigned?
4. Are expectations for proficiency for similar criteria different between programs or colleges? Should they be?

5. Which quantitative reasoning interventions are working well, and which are not, for graduate students in particular?
6. What else can be done to improve quantitative reasoning skills?