Submitted by Mary Jorgenson Sullivan, Chair CCAC, on 4/22/2024

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Fall 2023 Core Curriculum MATH Interim Assessment Report

This report should be a collaborative effort involving the Designation-level Assessment Coordinator, the evaluators and the Designation Subcommittee.	Core Curriculum Designation: Mathematics (MATH)
	Responsible Party: Core Curriculum Assessment Committee (CCAC); Mary Jorgenson Sullivan ELS (chair); Nick Menhart, BIO, DVP Accreditation, chair; Diane Fifles, Asst Dir of Univ Accred; Nicole Ditchman PSYC; Georgia Papavasiliou BME, Priyanka Sharma SSB; Gabe Smith, UGAA; Katie Spink BIO, Gorjana Popovic (MATH), Erin Hazard (HUM), Hannah Ringler (COM), Edoarda Corradi (IPRO)

1. CORE CURRICULUM LEARNING OBJECTIVES EVALUATED: List the Core Curriculum learning objectives that were evaluated in this assessment cycle.

Applicable Core Curriculum Learning Goals

Think critically, viewing problems as opportunities for innovation, able to

- Appropriately employ multiple quantitative and qualitative methods of analysis and evaluation.

Communicate effectively, able to

- Establish an objective, and clearly and cohesively support it.
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Mathematics Outcomes

1. Students will be able to perform mathematical calculations by applying mathematical rules, symbolic manipulations, definitions, and/or theorems correctly.
2. Students will be able to demonstrate their understanding of mathematical concepts and support their work claims using valid arguments.

2. ASSESSMENT METHODOLOGY: Use the table below to describe your assessment methodology.

First Learning Objective		
Learning Objective Assessed	All learning objectives assessed with the same methodology.	
Semester(s) in which artifacts were collected	Fall 2023	
Name of rubric used to evaluate student artifacts (*rubrics are available upon request from the CCAC*)	Assessing student artifacts matching each learning outcome on a (0, 1, 2) point scale. • 0=does not meet expectations, • 1=meet expectations, •2=proficient Artifacts consisted of selected problems that aligned best with the learning objectives in Math. These were taken from a standard final exam that was administered to all sections of each course. Rubrics were developed by the course coordinators in the Department of Applied Mathematics and reviewed by the chairs of the CCAC. For one course outside of Mathematics, the rubric was developed by faculty and reviewed by a CCAC liaison. The committee collaborated with course instructors in determining whether students met the learning objective expectations. For the majority of classes, including courses in the calculus sequence, the threshold for M (meets expectations) was 50%, and for P (proficient) 80%. Scores below 50% were categorized as D (does not meet expectations).	
Artifact source	Course(s) and Instructor(s): Artifact sources included core curriculum requirements fulfilling courses, 100- and 200-level MATH-designated courses.	Assignment(s): Student work from the final exams was collected in all courses.
Sample Size	The total sample population was 595 students.	
Semester of Assessment/Evaluation	Fall 2023	
Names & Titles of the Evaluators	CCAC Committee	

3. ASSESSMENT RESULTS: Insert a table or graph summarizing the results. Results should be presented by a

performance indicator for each learning goal. If the data were collected in Blackboard Outcomes, the IIT Assessment Office will provide the information to insert into this section of the report (see samples below).

See data charts in the discussion section

4. **DISCUSSION OF RESULTS:** Use this section to describe the key findings revealed in the interpretation of the data. *The evaluators should provide input into this section of the report.*

Assessment of student achievement of the MATH LOs was conducted in four 100- and two 200-level classes. Each of the four distinct 100-level classes had multiple sections: Class 1 - 3 sections, Class 2 - 5 sections, Class 3 - 6 sections, and Class 4 - 5 sections. This yields a total sample population of 595 students.

Data has been aggregated by class and is available to departments or faculty by request. To retain focus on student learning outcomes achievement, courses have been anonymized and separated into calculus and non-calculus courses. Classes 2, 3 & 4 were courses in the calculus sequence; Classes 1, 5 & 6 were non-calculus (i.e., statistics and geometry). For classes with multiple sections, each class completed a common final exam.

Of these six distinct classes:

1) Rubrics were developed and implemented for each class, including those with multiple sections. The 100-level courses indicated above utilized a common final exam and a common rubric for grading.
2) For one 200-level class, individual artifacts could not be directly related to the students' A#s. Regardless, the artifacts were included in the analysis of the overall achievement of the math core curriculum objectives.
3) In one of the 100-level classes, three more students' artifacts were collected for LO2 than for LO1. There are two possible explanations for such a situation: either three students' work for LO2 was scanned more than once or the three students' work for LO1 was not scanned at all.

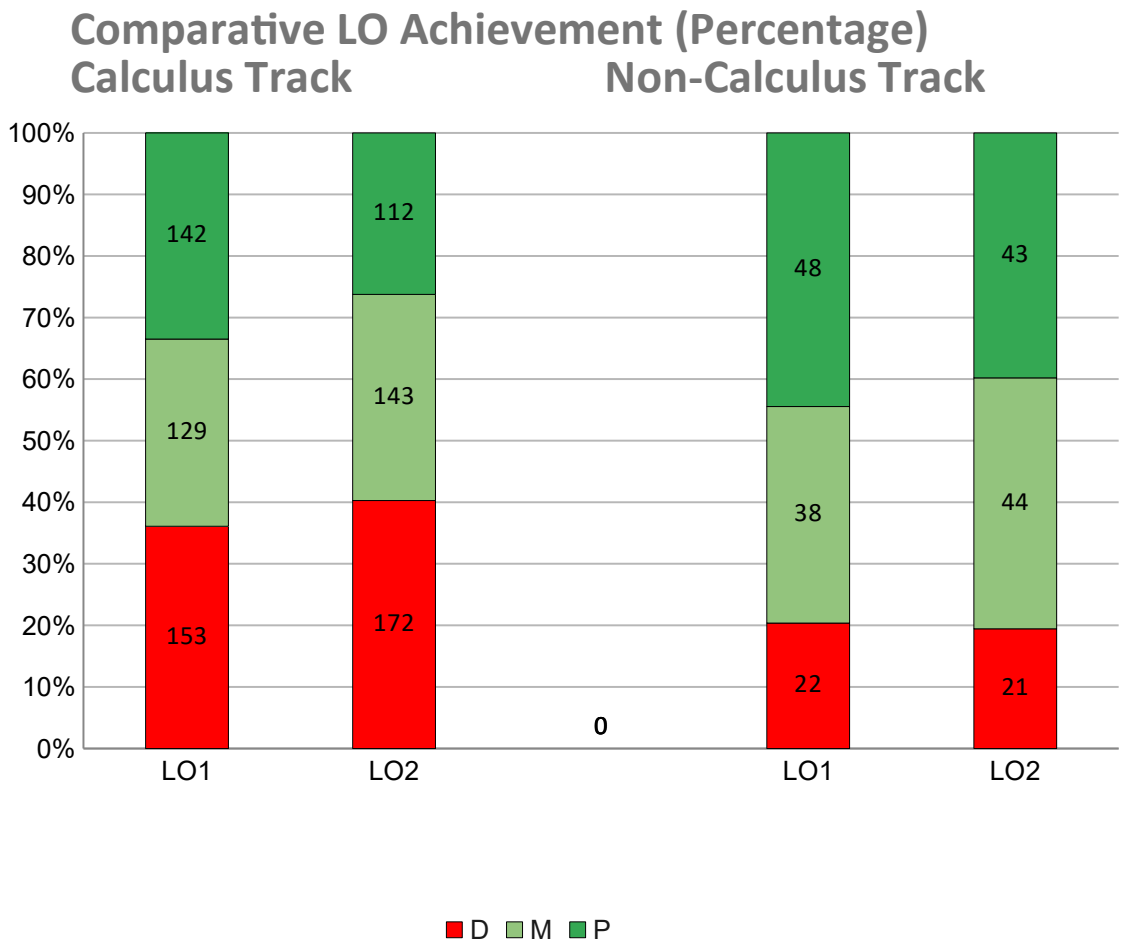
In total, all six classes (100%) provided artifacts aligned with the LOs, and these classes provided data on student achievement. Of the 595 students enrolled in the classes, 543 students took the final exam for their course. The assessment of the achievement with respect to LO1 involved 540, and with respect to LO2 543, or 91% of the population. Missing data for the 9% of the students was due to students who withdrew, received an incomplete, or did not complete the assessment due to extenuating circumstances. All artifacts were individual examples of student work. Instructors in all classes assessed were then asked to provide a rubric to designate

achievement levels across three categories: Does Not Meet; Meets; and Proficient.

OVERVIEW

A summary of LO achievement is given here, and individual LOs will be presented in more detail below. The percentages are calculated for the total number of students who took the final exam, 540 for LO1 and 543 for LO2. Additionally, courses have been separated into those in the calculus and non-calculus tracks, of which students in the calculus track account for 78% of the students assessed. This will be discussed in the LO discussion and recommendations sections below.

	Does Not Meet		Meets		Proficient	
LO	n	%	n	%	n	%
1. calculation	175	32%	176	33%	189	35%
2. explanations	194	36%	181	33%	168	31%



Note: P = Proficient; M = Meets; D = Does not meet

We note that the calculus track displayed a much higher (36 % and 40%) D level than the non-calculus track (~20%) overall. Individual classes varied, as did performance between the two Los, which is discussed below in detail, but this is the overarching result of this assessment.

This is even more significant since at Illinois Tech, most majors require and many more students enroll in the calculus track. We see that 153 and 172 students in the calculus track did not meet expectations. which is a significant fraction of our student body.

It has been observed previously that students in the calculus track have demonstrated an overall higher fail rate. This triggered the addition of preparatory classes, such as MATH 148, and additional support. We are also aware of post-pandemic challenges in many academic areas, including MATH, that may impact students' preparedness. This is a sector-wide challenge that all universities are grappling with. Indeed, the mandate of

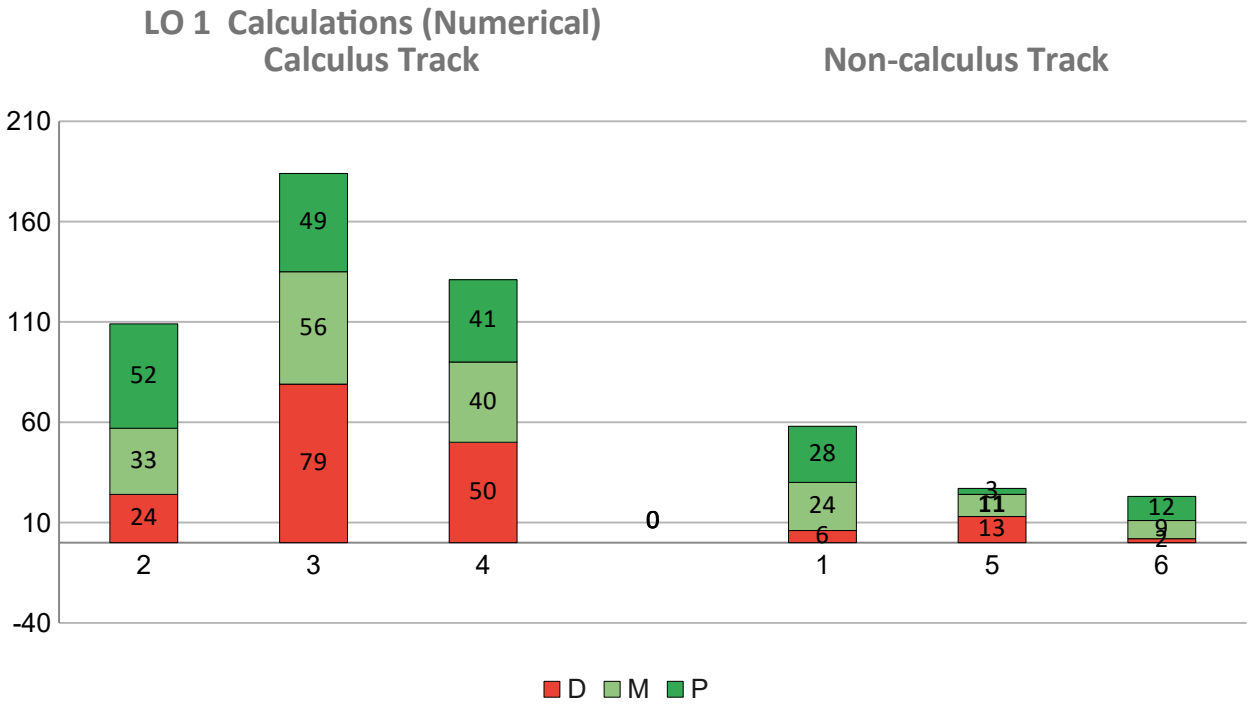
calculus for many STEM tracks is being considered as a national math education issue.

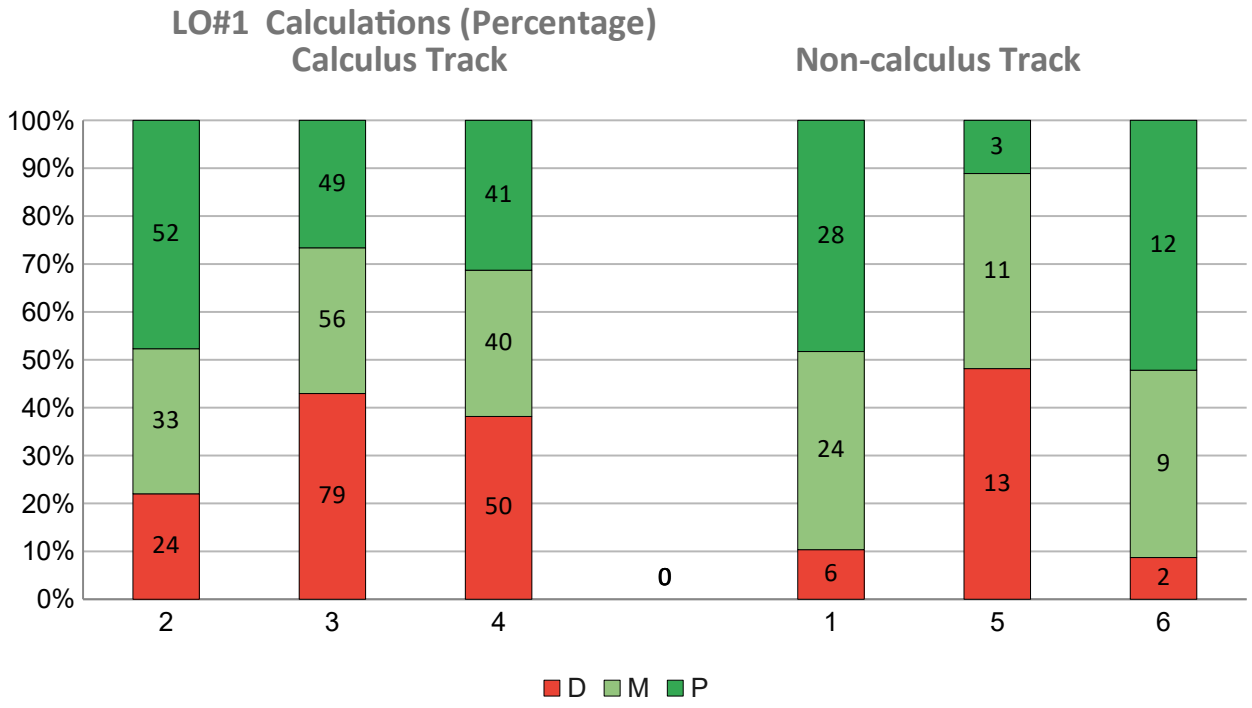
Because of this larger than anticipated D level, as well as this context, we are issuing this report as an interim report now, to drive faculty awareness. We will be providing a final report in F24, with additional analysis on this issue.

LO1: Students will be able to perform mathematical calculations by applying mathematical rules, symbolic manipulations, definitions, and/or theorems correctly.

Student data by class is shown below, with courses separated into the calculus and non-calculus tracks. Overall, of the students assessed, 32% (175) “did not meet” (D) the learning objective, 33% (176) “met” (M) expectations and 35% (189) demonstrated proficiency (P) in this learning objective for courses in both tracks.

We did observe heterogeneity between Math courses in the calculus and non-calculus tracks. Courses in the calculus sequence included a higher percentage of students who did not meet the learning objective. In the calculus track, between 22-43% of students did not meet the learning objectives. This was most pronounced in the second course in the sequence, where ~40% of the students did not meet the learning objective. In the non-calculus track, between 9-48% of the students did not meet the learning objective, in which a 200-level statistics course yielded the highest percentage of students who did not meet the objective. This indicates a need to examine factors that influence student performance in both calculus and specific non-calculus courses.

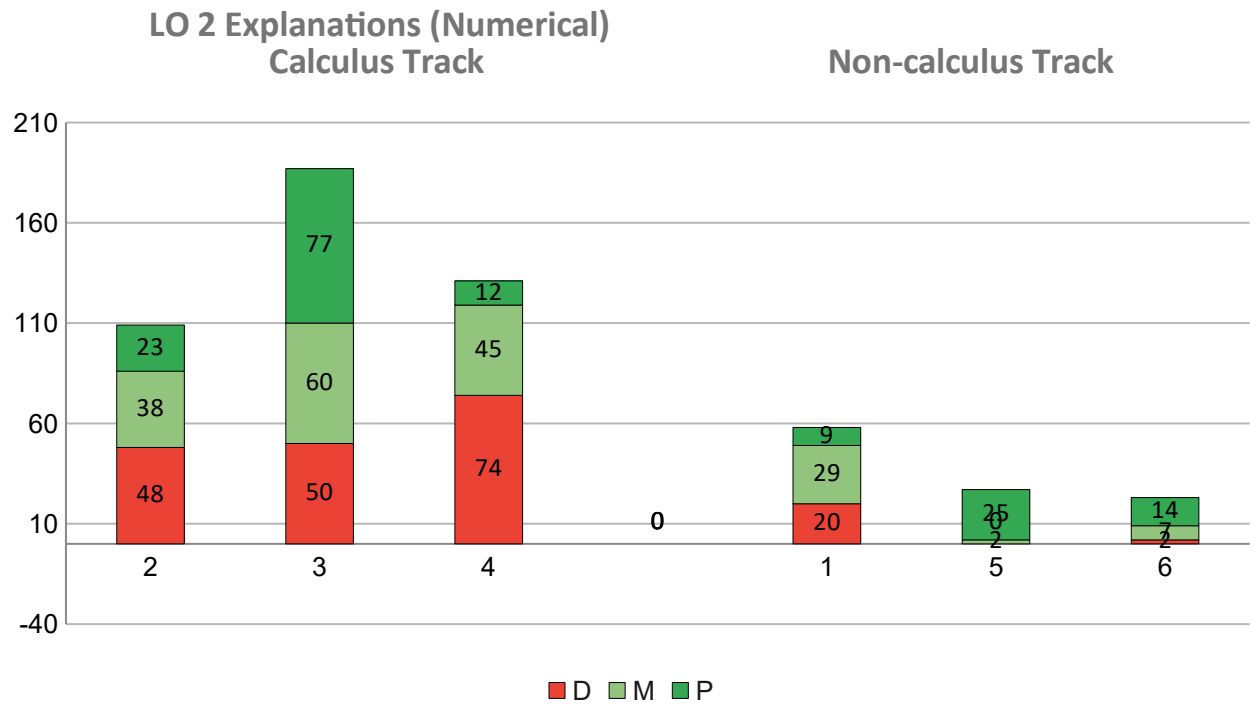

LO 1 Calculations (Numerical)
Calculus Track
Non-calculus Track
210
160
110
60
10
-40
52
33
24
49
56
79
41
40
50
0
28
24
6
3
11
13
12
9
2
2
3
4
1
5
6
D M P

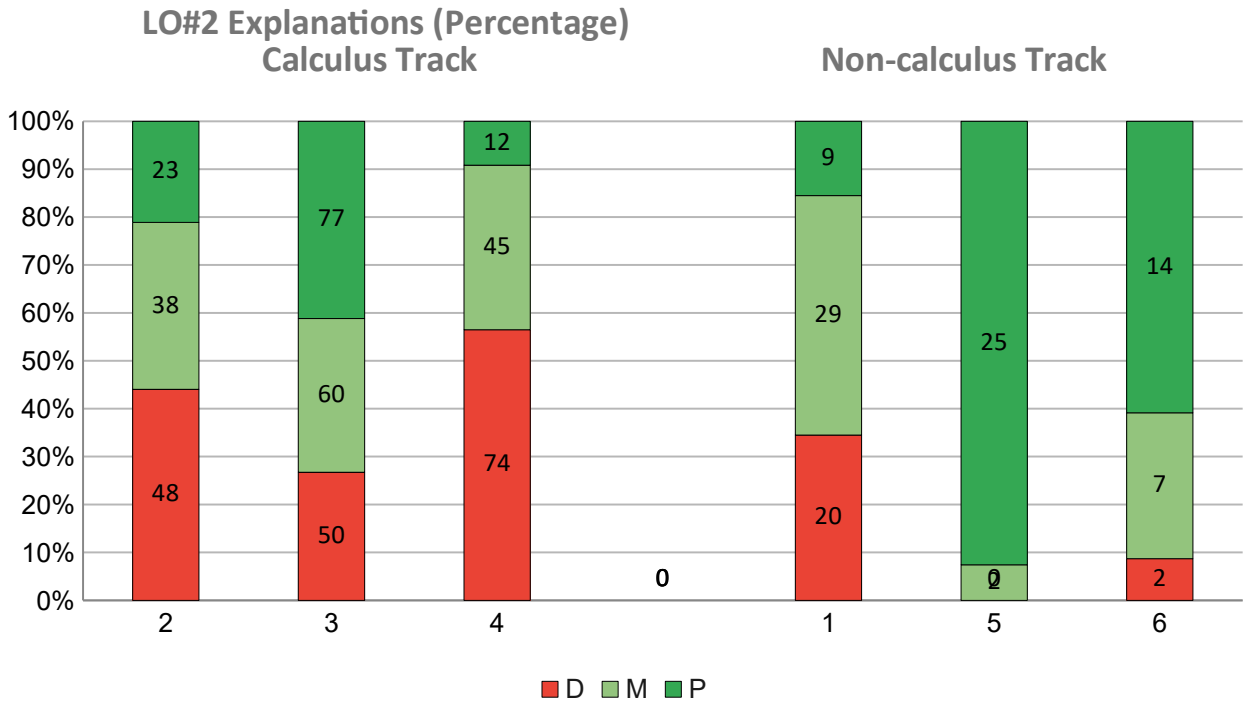

LO#1 Calculations (Percentage)
Calculus Track
Non-calculus Track
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
52
33
24
49
56
79
41
40
50
0
28
24
6
3
11
13
12
9
2
2
3
4
1
5
6
D M P

LO 2: Students will be able to demonstrate their understanding of mathematical concepts and support their work claims using valid arguments.

Student data by class are shown below. Overall, of the students assessed in both tracks, 36% (194) did not meet the learning objective, 33% (181) met expectations and 31% (168) demonstrated proficiency in this learning objective.

In the calculus track, between 26% and a high of 56% of students in one of the courses did not meet the learning objective. In the non-calculus track, between 9-35% of the students did not meet the learning objective. This indicates a need to examine factors that influence student performance in both calculus and specific non-calculus courses.





5. **IMPROVEMENT PLANS:** Use this section to provide specific information about what elements of the curriculum may need to be modified in order to improve the program's performance. *This section should be completed and signed by the UGAA Chair.*

For this interim report, before we issue continuous improvement (CI) recommendations, we will conduct further analysis to understand the possible factors that impact student achievement of the learning outcomes in the core curriculum math courses, specifically, the calculus track. These factors include:

1. the impact of previous math instruction on students' ability to achieve the LOs,

   the required performance for placement determined by the student's score on the ALEKs exam

2. the performance of students who received Advanced Placement (AP) credit (which enables them to bypass MATH 151 and place into Math 152)

3. utilization of the Academic Resource Center (ARC) and Supplemental Instructors (SIs)

4. instructional practices in the Calculus sequence in tandem with efforts to increase the number of diverse students in Calculus

This additional analysis will be conducted prior to Fall 2024, and a final report submitted to

UGSC at that time.

Specific modification	Entities responsible for implementing the changes.	Date by which changes will be in place.	Intended result

Designation Subcommittee Chair should sign below:

Designation Subcommittee Chair Name Signature Date

6. ASSESSMENT PROCESS RECOMMENDATIONS: Use this section to provide feedback on the assessment process itself.

We are suggesting the following recommendations for improving the assessment process:

1) Many issues identified in previous designation assessments were preempted by the utilization of a course coordinator over all sections of a given class; coordinators developed standard exams and rubrics that made use of feedback from earlier assessments. While this level of coordination is not possible for all designations, it provides a clear direction for better quality assessment. It also dramatically increases participation and compliance with assessment. For the first time, we saw 100% compliance where all classes were assessed fir all LOs. This is a significant strength of this model and should be utilized in other designation assessment where possible.

2) Because the current reading of LO1 focuses on calculation, while core Math courses such as calculus focus on symbolic manipulation to achieve the answer, modification of LO1 would allow alignment with more problems on the final exam. Alternatively, the LOs could be measured by a separate and distinct assessment that focuses specifically on the LOs as written.

3) Where students are assessed on specific items in a final exam, concerns were expressed that faculty may have allowed student class performance to impact their reading of the students' exam responses. To the greatest extent possible, students' names should be omitted from the exams to render more objective results based exclusively\on the exam response.

4) Since many or most MATH classes have several sections with multiple instructors, in order to ensure consistent grading, faculty should participate in a norming session, in which they score sample problems against a common rubric. This would provide more consistent awareness of the performance levels and responses that are in line with each one. Independent assessment at least on a sampling level could also reduce bias and increase objectivity.

6. UGSC REVIEW: The Chair of the UGSC should use this space to comment on each of the proposed curriculum changes.

List of specific modifications to courses or the curriculum.	UGSC Response

7. REPORT SUBMISSION: Please submit this report to NAME ***by DATE***. For questions about the completion of this report, email: EMAIL.

Name of person submitting report	Date submitted