

Mellon Inclusive Teaching Grant Proposal - Mathematics Department

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Each academic year, total enrollment in courses in the Calculus sequence are approximately

Math 131	Calculus 1	200+ students	(8-10 sections)
Math 132	Calculus 2	100+ students	(5-7 sections)
Math 231	Calculus 3	50+ students	(3-5 sections)

Completion of the sequence is a requirement for majors in Math, Physics, Engineering, while a few other majors require at least one semester. By Calculus 2, and certainly Calculus 3, an overwhelming proportion of the students are from these majors.

On the other hand, in addition to these “STEM students”, Calculus 1 has many students who do not intend to study anything that requires it (perhaps because they have already taken AP Calculus in high school, or are just curious). In addition to the Math Placement Exam, students with sufficient preparation, but no AP or equivalent credit, can opt to take a Calculus Placement Exam, administered by the department. Thus not all students start the sequence at the beginning, since some are able to “pass out” of Calculus 1 and/or Calculus 2. Additionally, a sizeable majority of students in Calculus 1 will have already taken AP Calculus, Honors Calculus, or some other high-school calculus course. The differences in the depth and breadth of the curriculum among these classes can be vast.

Since the type and level of preparation of students in Calculus 1 can be so varied, the main goal of this project would be to identify the distribution of student backgrounds typically encountered in Calculus 1, and to track the performance of various groups over the course of the semester, and on into Calculus 2. This would give us valuable information about student success, and inform our future work to make sure our courses are designed effectively.

Five years ago, the department started using a new textbook for the Calculus sequence, and initiated offering an optional, supplemental, 0.25 credit “Calculus Workshop”, to give students more structured time to engage with the material. Since then, we have not systematically looked at data to compare how students who opted to take the workshop performed relative to their peers. Similarly, we have not performed analysis of how students have historically progressed through the sequence, or how their experiences and success depend on certain aspects of their background and preparation. In particular, we propose to collect the following anonymized data from all Calculus students for the last five years:

- How many courses in the sequence did they take, and what were their grades.
- Did they take a Calculus Workshop
- What were their results on the Math Placement Test, and responses on the STEM Questionnaire given to incoming first-year students
- What was their overall GPA at the time they took any given class
- Did they take any other prior math classes at Trinity. If so, when and what were the grades
- Gender, Class Year, Major (if known)

From this data, we will perform exploratory data analysis, and attempt to investigate the following:

1. How do grades and continuation (in the sequence) depend on gender, major, Math Placement Test score, STEM Questionnaire responses, class year.
2. How do grades and continuation of students in Calculus 1 depend on whether they took Math 127 at Trinity, and/or what type of Calculus in high school, if any, and/or were enrolled in the Calculus Workshop
3. How do grades and continuation of students in Calculus 2 depend on whether they took Math 131 at Trinity, and/or were enrolled in the Calculus Workshop

In addition to the preceding aspects of our project which are based on past data, we will also devise a survey to give to students in Calculus 1 classes in Fall '20 and Calculus 1 and 2 in Spring '21 with an aim of identifying perceived inequities in the structure of the individual courses, and the sequence as a whole, from the students point of view.

This work will allow us to identify possible biases we may be unaware of, as well as to help us understand the effectiveness of the Math Placement Test for calculus placement, and the Calculus Workshops, as well as to understand our students and our course offerings better. Understanding the diverse backgrounds of our students and the impact it has on their success will help us make sure we are teaching most effectively.