



RICE UNIVERSITY

Midweek Math Training:

Supplemental Instruction to Support Exam Performance

2025 MAA Mathfest

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The context:

Introductory calculus at Rice University

- Calculus is a major requirement for most students
- ~35-50 students in a typical section
- No lab/discussion section
- *Highly-coordinated* - common homework, quizzes, and exams
- *Active-learning based* - regular in-class activities and groupwork
- Exams dominate course grade (65-85% of course grade)

The students:

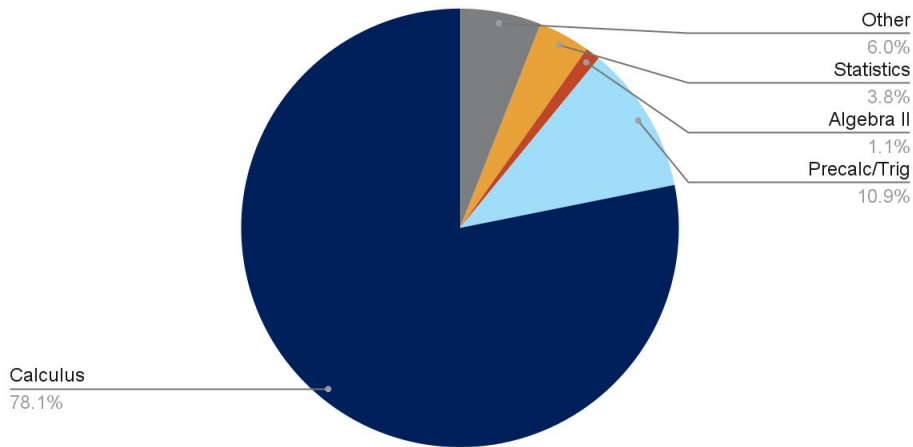
A given section of **first semester Calc I** contains students who have:

...**completed** some version of calculus.

...**never seen** calculus.

...**never seen** pre-calculus(!)

Previous to this class, what is the highest level of math you have taken?



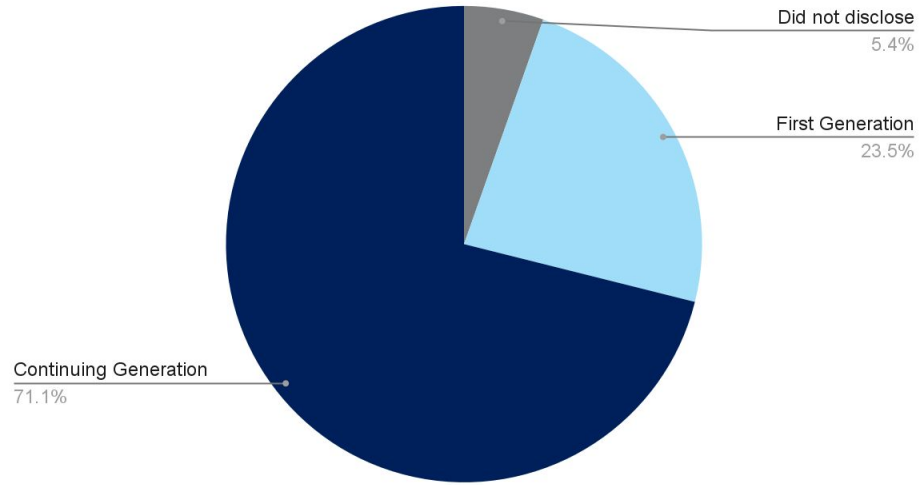
Fall 2024 Calc I survey, $n = 183$

Note: Data was self-reported.

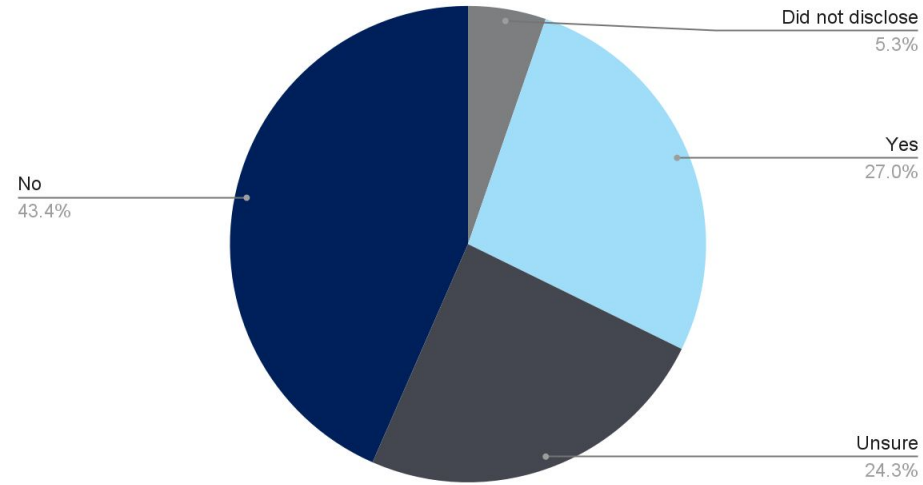
Fall 2024 Math 101 Survey

Demographic Data (n = 149)

First-gen status



Pell Grant eligibility



Note: Data was self-reported.

Students enter calculus at Rice with:

...different mathematical backgrounds

...different academic backgrounds

...different socio-economic backgrounds

Program Objectives

Equip students with a toolkit for exam preparation

- Improve student performance on exams
- Level the playing field
- Decrease test anxiety

What is MMT?

Peer-led calculus exam simulation

The setting

- Participation is voluntary, but incentivized
- 1 evening hour **each week**
- SCALAR seating
- Led by undergraduate “trainers”

The experience

- Students attempt problem(s) for ~10 minutes in an **exam-like** format.
- Trainers then facilitate **small group discussions**.
- Correct solution(s) are shared.
- Process repeats.



Each week, MMT

provides:

...accurate exam practice

...test-taking advice

...efficient individual learning

...organic student-student
interaction

...a community of learners

The philosophy

MMT is to exam day as scrimmaging is to game day

- Practice spaced over time solidifies learning¹
- Expert guidance expedites learning process²
- Peer learning builds ownership³

[1] Smolen, P., Zhang, Y., & Byrne, J. H. (2016). The right time to learn: mechanisms and optimization of spaced learning. *Nature Reviews Neuroscience*, 17(2), 77-88.

[2] Kirschner, P., Sweller, J., & Clark, R. E. (2006). Why unguided learning does not work: An analysis of the failure of discovery learning, problem-based learning, experiential learning and inquiry-based learning. *Educational psychologist*, 41(2), 75-86.

[3] Boud, D., Cohen, R., & Sampson, J. (1999). Peer learning and assessment. *Assessment & evaluation in higher education*, 24(4), 413-426.

Data on MMT

Student engagement

Fall 2024 Calc I MMT Attendance

798 total visits

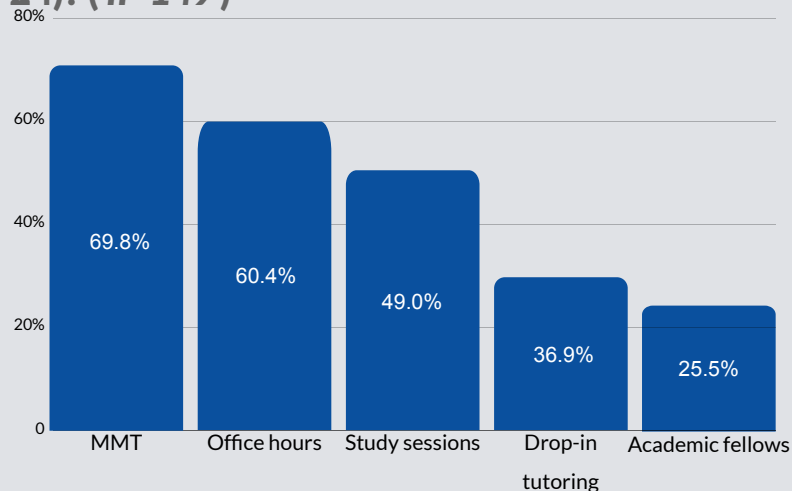
178 unique visitors (69.8% of enrolled)

Spring 2025 Calc II MMT Attendance

915 total visits

165 unique visitors (74% of enrolled)

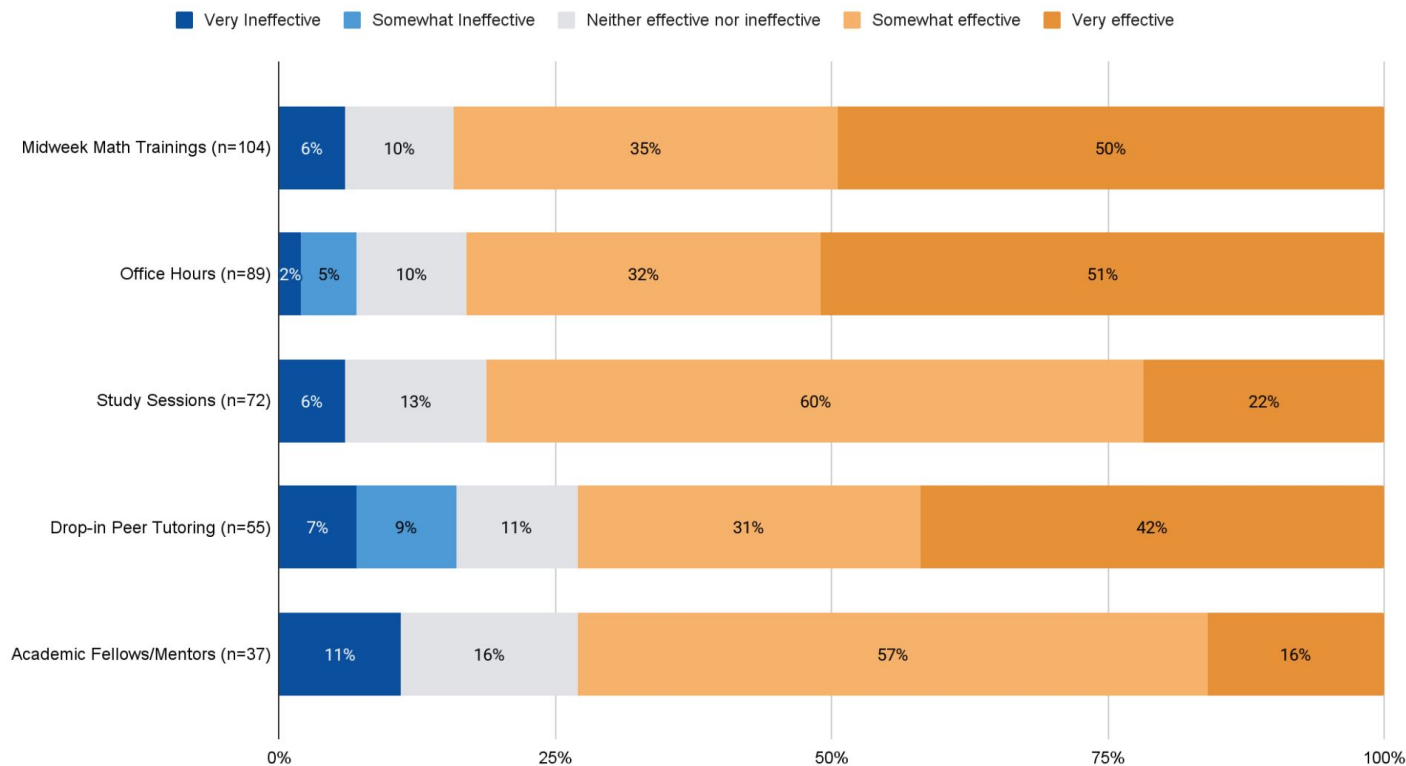
Which of the following math-related resources have you utilized this semester (F24)? (n=149)



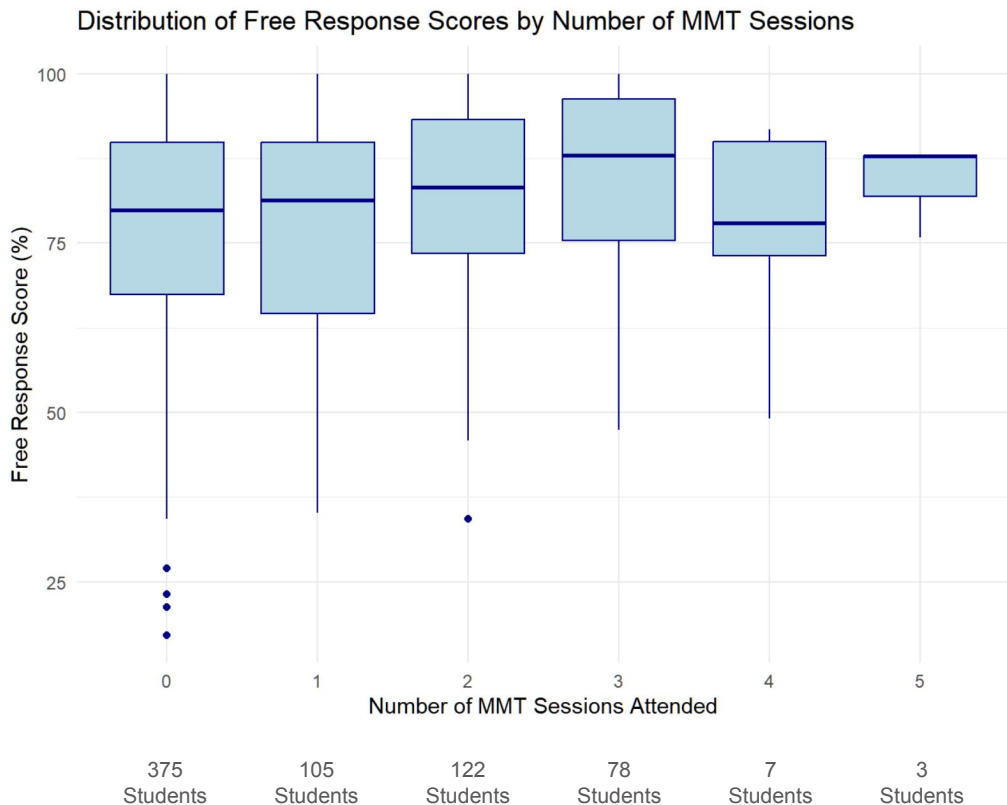
149 students were enrolled in both 24F Math 101 and 25S Math 102. Of these students,

- 72.48% attended any MMT session in Spring 2025
- 67.11% attended a regular MMT session in Spring 2025

How effective was [resource] in assisting your learning of calculus this semester (F24)? (n=163)



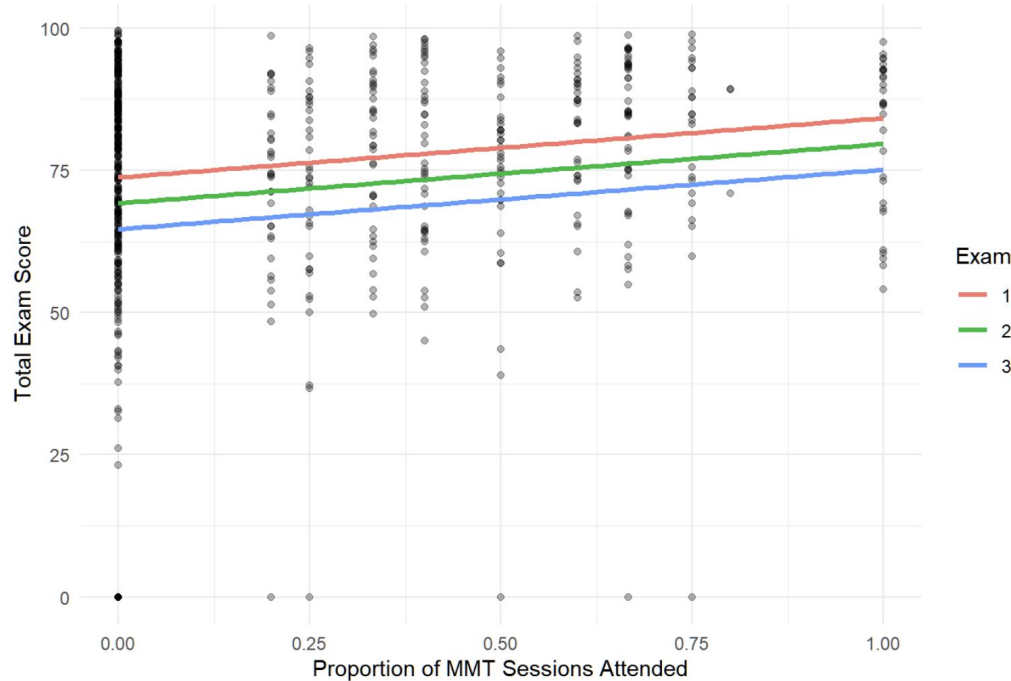
Spring 2025 Calc II Free Response Performance



There is a *significant relationship* between the **number of MMT sessions attended** (excluding exam review sessions) and **free response exam scores**.

Each MMT session attended is associated with a *1.35% point increase* in free response score (holding all other factors constant).

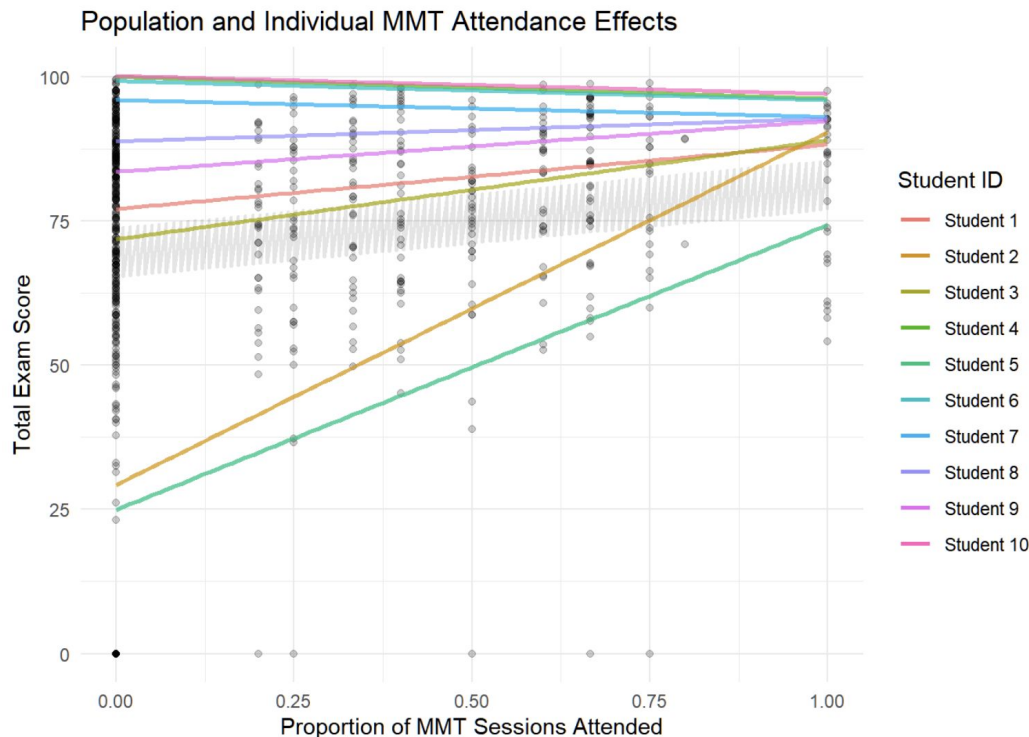
Spring 2025 Calc II Exam Performance



There is a *significant relationship* between the **proportion of MMT sessions attended** (excluding exam review sessions) and **exam scores**.

Each 10% increase in the proportion of MMT sessions attended is associated with a *1.05% point increase* in exam score (holding all other factors constant).

Spring 2025 Calc II Overall Exam Performance



There is a *significant relationship* between the *proportion of regular MMT sessions attended* (i.e. excluding exam review sessions) and **exam scores**.

Each 10% increase in the proportion of MMT sessions attended is associated with a *1.05% point increase* in exam score (holding all other factors constant).

Students with **lower** starting scores tended to see **more** improvement than students with high starting scores.

Student Reflections on MMT

“...This is my biggest piece of advice: **GO TO MMT**. It is by far the best resource for this class, they always have chips and sometimes have those pink frosting sugar cookies. If your classes that you're signed up for right now don't allow time in your schedule to go to one MMT, move your classes... **Going consistently means you don't have to study as much for the midterms, you're way better prepared for the final, you get participation points (if you get enough you might get extra credit at the end of the year!) and it's just a great way to get better at math.**”

“...I think that MMT is one of the main reasons that I passed the two midterms for math. In addition to **MMT being good for practicing what we were learning**, it also was fantastic to go back through the MMT problems and be able to do all of them again before the exam.”

“One thing I changed during my time in the course was taking more advantage of the MMTs. I only attended the last few MMTs before the first midterm, but **I found that they were the most useful part of my preparation**. For the next two exams, I tried to be more regular with going to MMT, or doing the MMT pdfs in my own time. The mini-exam questions are the exact type of questions you get during the real exams, and therefore, were the best practice for me.

Next Steps:

- Increasing MMT Trainer independence
- Qualitative study of MMT effects on student anxiety
- Growing supported courses list

Thank you!



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