Recent projects in SoTL / RUME

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NADYA ASKARIPOUR, University of Toronto Mississauga

Two-Stage Testing: A Method of Assessment to Improve Collaboration and Reduce Math Anxiety

In this presentation, we will discuss two-stage tests, an innovative assessment method where students initially complete their tests individually and then collaborate in pre-assigned groups to answer the same or similar questions. This approach has garnered significant student interest, as it seems to enhance engagement and improve learning outcomes.

We implemented this method in a second-year multivariable calculus course and a fourth-year course on polynomial equations and fields. The presentation will cover our methodology, observations, and survey results. Based on the survey results, students enjoyed the new format of the test and agreed that it helped clarify some concepts during the second stage. This is a joint work with Marina Tvalavadze.

SHANNON EZZAT, Cape Breton University

Logical Reasoning Improvement After One Semester of Calculus for First Year Undergraduate Students

Logical reasoning is a crucial aspect of mathematics, and yet it is often expected that students in mathematics courses, especially courses for non-majors, will learn these ideas "by osmosis". Indeed, research shows that precise logical reasoning is not inherent, and is difficult even for those trained in mathematics. A natural question to ask is whether there is a notable increase in logical reasoning skill after students take one semester of mathematics that does not explicitly teach logical reasoning.

We will discuss a study that compared Calculus II students' performance on a logical reasoning quiz in Winter 2022 with new Calculus I students' performance on the same quiz at the beginning of Fall 2022. Additionally, a number of students were interviewed and we will discuss these students' beliefs and experiences with mathematics and logical reasoning at the high school and university levels. These findings make a case for increased attention to logical reasoning in first year mathematics courses.

MARGARET KARRASS, University of Toronto Mississauga

Undoing Template Thinking: Preparing Students for First-Year Mathematics

In this talk, I will discuss the design, implementation, and preliminary outcomes of the Mathematics Background Tutorials (MBT) project, an intervention developed to support incoming university students entering first-year mathematics courses. The MBT Workshop was conceived in response to widely observed gaps in foundational mathematical skills among transition-year students.

The program consisted of two key components: a four-day intensive refresher tutorial offered before the fall semester, and a professional development workshop for tutorial leaders (TLs). Drawing on principles of active learning, the MBT sessions engaged students in collaborative problem-solving and peer-led discussions. TLs received structured pedagogical training focused on helping students move beyond "template thinking," with the aim of fostering deeper conceptual understanding and a stronger sense of mathematical agency.

This presentation will highlight the pedagogical framework, the curriculum design process, and the reflections of tutorial leaders. I will report on preliminary findings from the TL and student debrief sessions, as well as the test-item analysis conducted following the tutorials.

Initial results suggest that the MBT Workshop provides a scalable, research-informed model for enhancing mathematical preparedness and promoting student agency at the beginning of the transition year. Plans for future implementation and evaluation will also be discussed.

JENNY LAWSON, University of Calgary
What does this mean? Model interpretation capacities of undergraduate differential equations students

With each passing day, society is becoming more and more reliant on mathematical models. And yet, to most of the public, these models are black boxes. The responsibility of interpreting model results in light of the real world, is left to a small group of people with the skills to peer inside the boxes and tell the rest of us what is going on. Undergraduate mathematics students are likely candidates for this job. But are we confident they are graduating with the capacities necessary to interpret modelling results?

In this talk, I will present preliminary results from a case study which investigates the mathematical model interpretation capacities of undergraduate differential equations students. The case study involves a small group of undergraduate students at the University of Calgary, who completed an introductory differential equations course in the Fall of 2024 and were asked to complete two interviews. The first, a task-based interview completed in pairs, where they complete a problem designed to engage the students in the full modelling process, and another problem which specifically asks them to interpret the results of a model. Second, participants complete a semi-structured interview, with the researcher, where they were asked to expand on interpretations seen in the task-based interview and were asked specific questions about model interpretation.

By outlining the capacities that undergraduates currently do/do not demonstrate, I hope to show which areas of the undergraduate mathematics curriculum work well, and other areas that need attention.

ALLYSA LUMLEY, York University
Bringing Solids of Revolution to Life for First Year Calculus Students

First year students in calculus classes tend to find the concept of a solid of revolution challenging—transitioning from a 2D region to a 3D surface is difficult to visualize. Over the years, I've experimented with various methods to help students grasp this idea, including classic freehand drawings and video simulations with varying degrees of success. However, this past semester, I had a breakthrough: an innovative project that allowed students to create a real-life solid of revolution using just paper, scissors, and glue. The outcomes were surprising and enlightening. Not only did students gain a deeper understanding of this complex topic, but they also made connections across multiple learning objectives, from Riemann sums and limits to volume and surface area calculations.

In this talk, I'll discuss what I learned throughout the process of using a project based learning approach for a class of 70+ students, showcase some of the impressive work my students submitted and discuss possible research avenues for this style of calculus engagement.

ANDREW SKELTON, York University
Do Summer Bridge Programs Actually Work?

Retention and academic success in the first year of university are critical predictors of longer-term student outcomes. Summer math bridge programs are one common intervention designed to address these challenges, offering students additional mathematical preparation before the academic year begins.

Prior academic preparation and demographics play a significant role in shaping both who participates in these programs and who benefits most. Identifying which students are being successfully reached, and which students are being left behind, is crucial if these programs are to achieve their goals of promoting equity and improving academic outcomes across diverse student populations.

We will evaluate three summer bridge programs that have been run at York University since 2014. Do they actually work? Do they help bridge performance gaps or enhance inequities? Do program structure and format impact efficacy? How do you go about obtaining and analyzing data? Do they have an equal impact on short-term and long-term success metrics? Answering these questions will suggest whether such programs are a valuable tool in the battle of student preparedness, or a relic that should be replaced with more effective and modern programming.

JAIMAL THIND, University of Toronto Mississauga
Supporting and Assessing Mathematical Reading Comprehension

Mathematical reading comprehension (MRC) requires a set of skills beyond those required for general reading comprehension. Students often have little development of these skills, and can struggle in courses that require independent mathematical reading.

We studied students' MRC in a flipped, redesigned multi-sectioned linear algebra course. That redesign targeted MRC using "scaffolded" independent pre-class readings, and direct instruction on effectively reading mathematics. We used a self-designed tool and student surveys to assess student MRC as part of a larger study related to the redesign. We will discuss our approach to supporting MRC skill development in our course, and share the results of our study, including an interesting, and positive, result related to MRC confidence in ELL students.

This is based on joint work with A. Rennet.

KATERYNA TRETIAKOVA, McMaster University
Bridging Mathematical Reasoning and Communication in Learning

Mathematical reasoning and communication are both fundamental to understanding mathematics, yet they are often treated as separate skills. While proof writing and problem-solving emphasize logical rigor, the clear articulation of mathematical ideas is not always given equal weight. This disconnect may shape how students engage with and internalize mathematical concepts.

This talk presents findings from a study investigating students' experiences and perspectives on the relationship between reasoning and communication in mathematics. Drawing on surveys, interviews, and discussion-based activities with both university students and high school students involved in competitive mathematics, the study explores how learners navigate these skills and whether they perceive broader benefits to engaging in mathematical reasoning. The talk will conclude with implications for mathematics education, including strategies for more effectively integrating reasoning and communication to support deeper understanding and student engagement.

NAHID WALJI, University of British Columbia
Cultivating Mathematical Growth: Designing a Summer Program to Foster Skill Development in Undergraduates

Many traditional undergraduate summer programs often prioritize early research experiences, yet 2nd- and 3rd-year students can frequently benefit from intentional skill-building opportunities at this stage of their development. In this talk, I will discuss work in progress on the design and implementation of a summer program that aims to strengthen key competencies in creativity, collaboration, mathematical communication, and open-ended problem solving. The program also aims to create mentoring opportunities, experimenting with various forms of vertical integration with more senior undergraduate students, graduate students, or postdocs. I will outline the departmental and student context, recent iterations of the program, outcomes achieved so far, and future plans for this project. Our long-term aim is to better prepare students for advanced coursework, future research, and professional growth. This is joint ongoing work with L. Daniels.