CANADIAN MATHEMATICS EDUCATION STUDY GROUP
50TH ANNUAL MEETING
MAY 29TH TO JUNE 2ND, 2026

ANNOUNCEMENT AND PROGRAM

We're happy to welcome you to Queen's University for the 50th Annual Meeting of CMESG/GCEDM, which begins at 6:45 pm on Friday May 29 and ends at 12:30 pm on Tuesday June 2.

Queen's University is situated on traditional Anishinaabe and Haudenosaunee Territory. The Kingston Indigenous community continues to reflect the area's Anishinaabek and Haudenosaunee roots. There is also a significant Métis community and there are First Peoples from other Nations across Turtle Island present here today.

From the modest roots of a tiny local college founded in 1841, Queen's has grown into a dynamic national institution renowned for an exceptional student learning experience and prominence as one of Canada's leading research-intensive universities. Located in Kingston, Ontario, Canada, it is a mid-sized university with many faculties, colleges and professional schools.

To locate Queen's University and its various components, you can visit the website http://www.queensu.ca/ or visit the campus map at the following address: http://www.queensu.ca/campusmap/. All of the conference activities will be on the Main Campus site except for the excursion to Wolfe Island.

WELCOME AND REGISTRATION

Most activities will take place in Kingston Hall and Grant Hall (both east of University Ave) and at Ban Righ Hall (west of University Ave.). In particular, the welcome reception Friday evening will be held in Grant Hall and the Monday evening dinner and dance will be in Ban Righ. The location for all regular meals is still to be determined. For those who arrive early enough on Friday, dinner will be available from 5:00 to 6:30 p.m.

Registration opens from 2:30 to 6:30 p.m. on Friday in the Kingston Hall lobby. You can also register from 8:00 to 9:00 a.m. on Saturday at the same location.

We want to minimize waste and the use of plastic. We encourage you to bring a cup and/or water bottle for coffee breaks, and to also bring a lanyard for your name tag. We will also recycle as many plastic name tag holders as possible.

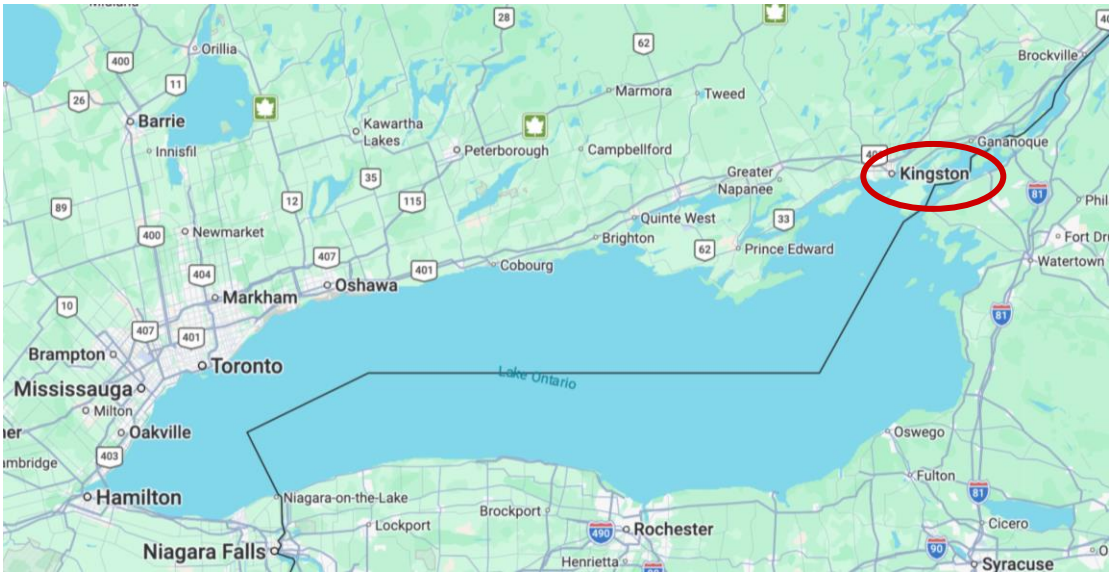
HOW TO GET THERE AND GET AROUND

Depending on the direction, north, south, east or west, there are several roads leading to Queen's University. Here are the different routes from the major cities near Kingston.

By Car

- *From Montréal*
  - West on Autoroute 720, then west on Autoroute 20, then west on Ontario's Highway 401
  - About 290 km, or about 3 hours by car
- *From Ottawa*
  - South on Highway 416, and west on Highway 401
  - About 200 km, or about 2 hours by car
- *From Toronto*
  - East on Highway 401
  - About 260 km, or about 2.75 hours by car
- *From Syracuse*
  - North on I-81 to the border of Canada
  - West on Thousand Islands Bridge to Highway 401
  - West on Highway 401
  - About 215 km, or about 2.5 hours by car

Exit:
Follow Highway 401 to Kingston and exit south on Division street. Follow this street south to Union Street. Turn right onto Union and you will be on campus.



By Train, Bus, or Air (and Tax/Ride Share)

Train service to Kingston arrives at the Kingston VIA Rail Station, 1800 John Counter Blvd. (viarail.ca). Uber is the only Ride Share company in Kingston, there are also taxis. Approximate cost to the Queen's Campus is $20.

Bus service arrives at the Kingston Terminal, 1175 John Counter Blvd. (Megabus). There is a FlixBus stopping at downtown Kingston (sometimes it stops around Queen's campus). An Uber ride from downtown Kingston to Queen's University is approximately $14.

For those flying into Toronto, there are a few options:

- Bus from Toronto Airport to Kingston Terminal, or straight to Queen's campus
- Union Pearson (UP) Express Train Service (https://www.upexpress.com/) to Union Station (Via). Adult one-way tickets are $12.35 valid any time or $9.25 with a PRESTO card.
- Shared Ride/ Poparide from designated pick-up points (Toronto Pearson Airport, Scarborough Town Center, Yorkdale Shopping Centre) in Toronto to Kingston, with drop-off at 1165 Division Street. Approximate cost $ 54.

PARKING

Surface lot parking is available in Tindall Field parking lot by either using the HonkMobile app to pay daily or daily parking passes. It can also be purchased from the front desk in the Endaayaan building.

Nearest to the Residence (Smith House) is Stuart St. parking, which requires a permit between 0700 hours and 1700 hours, from Monday to Friday – otherwise it is free outside of those hours and on Saturday and Sunday.

ACCOMMODATIONS

We have reserved 60 2-bedroom units in the university residence Smith House. These are premium double bedroom units—two separate bedrooms with a shared adjoining washroom in the middle. Each booking is for a unit and that includes both bedrooms. Nightly rate for a two-bedroom unit is $134. If you are happy to share a bathroom with someone, you should find a partner. Mini fridges in each of the rooms and larger, shared fridges in each of the common rooms.

Before the Residence is open for the season in May, you may contact Event Services: Email event.reservations@queensu.ca Phone number: 613-533-2223.

HOTELS

There are several hotels available in the Kingston area that are a short drive (or 15-20 min) walk from campus. Here are some options:

Delta Kingston Waterfront Hotel, 1 Johnson Street (https://www.marriott.com/en-us/hotels/ygkdk-delta-hotels-kingston-waterfront/overview/). Approximately $ 287.00 per night.

Holiday Inn Kingston, 2 Princess Street
(https://www.ihg.com/holidayinn/hotels/us/en/kingston/ygkca/hoteldetail)
Approximately $224.00 per night.

Confederation Place Hotel, 237 Ontario Street (http://confederationplace.com/).
Approximately $257.00 per night.

Residence Inn Kingston Water's Edge, 7 Earl Street (https://www.marriott.com/en-us/hotels/ygkri-residence-inn-kingston-waters-edge/overview/) Approximately $232.00 per night.

Donald Gordon Hotel and Conference Centre, 421 Union Street (https://www.queensu.ca/donaldgordoncentre/). Approximately $189 per night.

There are a number of B&B's located 5-15 minutes walk from Campus. Explore on a B&B website. Any questions about these feel free to drop a line to Peter <peter.taylor@queensu.ca>

IN CASE OF EMERGENCY

During the conference, Kitty Yan can be reached on her cell phone at (647) 298–8028. Queen's University security is available at all times at (613) 533-6111(Urgent).

FEES

The conference fee ($260 if registration and the full payment made before May 15; $290 thereafter) covers the cost of the afternoon excursion and other local costs.

The academic program fee is $110 for all participants except full-time graduate students, for whom the fee is $60. This fee is waived for all *invited* presenters (plenaries, working groups, topic sessions, New PhDs).

Please note: "Ad Hoc" and "Gallery Walk" presenters are required to pay the academic program fee.

FOR THE LEARNING OF MATHEMATICS [FLM] QUESTION & ANSWER SESSION

All members of CMESG are also members of the FLM publishing association.

You are invited to meet the FLM journal editor, managing editor and board members at the annual FLM Q&A session during the Ad Hoc sessions. This is an informal welcome event organized by the association and an opportunity to learn more about FLM. What makes FLM different? It's the people and more! Everyone is invited.

FLM also sponsors our opening reception.

ABOUT THE CONFERENCE

CMESG is not a typical academic conference, for it is not organized around presentations and audiences. Instead, it is a conference based on *conferring*.

Its main feature is the **working group**. Each working group will meet for three full mornings to interact around a particular topic. There are two **plenary speaker sessions** which will each address the whole conference. In contrast with other conferences where questions are often taken at the end of the presentation, a time slot is assigned for the audience, broken into small groups to discuss and prepare questions that will be presented to the speakers in a question period. Two other types of sessions provide more traditional forms of presentation: invited **topic sessions** and the **new PhD sessions**.

Over the course of a meeting (and from meeting to meeting) various discussions and ideas emerge among CMESG members. Our program is designed with time and space for members to come together to work on their emergent ideas. In order to facilitate **Ad Hoc discussions**, there will be a notice board available to request and announce the sessions. Local organizers will assign space for the sessions posted. The nature of the spaces available for ad hoc sessions will reflect the discussion format and the number of sessions proposed. Ad hoc proposers should not expect access to a classroom, computer, projector or power. Hence sessions proposed should be designed with this in mind. There is no reduction in conference fees for presenters in this category. Note — Any person(s) having work prepared in advance to share at the conference should register for the **CMESG Gallery Walk**.

The CMESG Gallery Walk is intended to provide a forum for members to contribute to our meeting and in doing so enhance our awareness of each other's work. We hope this session will increase opportunities for showcasing members' work and building networks among members. We encourage a range of contributions from research posters, to presentations on community initiatives, from mathematics problems, to mathematics art works, anything that can be shared in a gallery format (imagine a poster session or math fair). The session will be broken into two parts allowing every member to participate both as a presenter and as a "walker." One of: a poster board, a piece of the

wall, or a table will be provided for each presenter. Presenters will have to supply their own materials and computers (note also, power may not be available). There is no reduction in conference fees for presenters in this category. For more information about this session please contact Lisa Lunney Borden lborden@stfx.ca.

Finally, there is a session that many of us highly value: **meals**! Sit with those you know, sit with those you are getting to know, sit with someone you don't know – the meals are an integral part of the conferring that makes CMESG such a special conference.

We would like to acknowledge the financial support of STEAM + Research and Education Group of Queen's Faculty of Education as well as Queen's Faculty of Arts and Science.

PLENARY LECTURES

Lecture I *Peter Taylor, Queen's* *Florence Glanfield, University of Alberta* *Frédéric Gourdeau, Université Laval* *Caroline LaJoie, UQAM* *Moderator: Nathalie Sinclair, SFU*	***Reflecting and moving forward: 50 years of CMESG***

The panelists will be invited to discuss their own work as it intersects with CMESG. They will also exchange views on a number of themes, including the nature of CMESG and its affordances for learning and creating community; the interchanges between mathematics education researcher and mathematicians; cross-provincial and international connections; and action around Indigenous mathematics/education.

Plenary II	

Michèle Artigue
Laboratoire de Didactique André Revuz, Université Paris Cité

Instrumental approach in mathematics education: Development, contributions, and prospects

The instrumental approach to technological issues emerged in France in the mid-1990s, driven by research into the integration of formal calculation tools in secondary school mathematics education, combining recent advances in cognitive ergonomics with those in mathematics education. It significantly renewed the approach to the integration of technological tools in this discipline, emphasizing the fact that a technological tool is not automatically an instrument for its user, that this requires an instrumental genesis, pointing out the general underestimation of the complexity of these instrumental genesis and the need for institutional support. This approach was then extended to other digital tools, spreadsheets, dynamic geometry software, tutorials, electronic whiteboards, and other levels of education, from primary to higher education. It also took into account the instrumental genesis of the teachers themselves, their specific needs, and more generally their instrumented professional practices. generative artificial intelligence. Researchers from various backgrounds have contributed to and gradually enriched it, combining it with other theoretical approaches. In this lecture, I propose to briefly trace the development of this approach, reflect on its contributions with the hindsight provided by three decades of development and use, and also question its potential for addressing the challenges posed today by the educational tsunami of generative artificial intelligence.

WORKING GROUPS

Working Group A *Leaders: Alayne Armstrong, Véronique Bazier-Matte*	***Reconciling future teachers with mathematics***

A frequent challenge in working with prospective teachers is their attitudes towards mathematics. For instance, in recent years CMESG working groups have considered how to change prospective teachers' conceptions of mathematics (Holm & Martin, 2017) and how to conceptualize and interrupt the cycle of anxiety (LeBlanc, Pyper & Towers, 2019). As fear, dislike and perhaps a distrust of mathematics continue to be an issue for many prospective teachers, we feel this topic is worth further attention.

In this working group, we will consider how teacher educators might help to occasion more positive relationships between prospective teachers and mathematics within "math for teachers" and "math methods" courses. Although one may despair that one or two courses can never make up for previous years of poor relations with mathematics, you never know what might cause a change.

During our group's activities and discussions, we propose to explore the following questions:
What types of relationships have we, as teacher educators, observed between prospective teachers and mathematics?

How are these relationships revealed by what prospective teachers say and do during their courses?

How might teacher educators encourage a positive shift in students' relationships with mathematics?

Working Group B *Leaders: Wes Maciejewski, Yvan Saint-Aubin*	***The exquisite balance: difficult choices in postsecondary mathematics education***

All mathematics educators wish their students understand mathematics, to truly excel at mathematics and in their future career. But what this means changes over time and from place-to-place: we would not dream of preparing our students in 2026 to be the human calculators so vital to science in 1956. Further, we have no indication of the

world in 2096. Clearly our values as educators and our expectations of our students are not timeless and must evolve over time.

How might we continually engage our students in a relevant, rigorous mathematics curriculum?

As instructors, how do we hit the perfect balance between all we desire for our students, external forces, institutional expectations, new trends and results, and the complex, ever-evolving milieu of education? The easy answer is to claim that this is a false problem, that all are interdependent and need to be taught simultaneously. We think this answer is careless in disregarding the realities of education---every minute spent teaching one topic is a minute not spent teaching another; every problem given involves countless others that are not given. So, we mathematics instructors continuously make choices. What informs these choices? How might we continue to make the choices which best suit and prepare our students?

Here are questions that any forward-thinking instructor has to face.

Many of our basic courses at university (eg., calculus, linear algebra) became established during the space race---the mathematics in those courses is especially suited for engineering and launching projectiles. Is that mathematics, the concepts and the skills, still as relevant for the current scientific challenges, e.g. the development of artificial intelligence, the modeling in human and life sciences, etc? What might be the exquisite balance today?

Mathematics departments are primarily service departments, with our large first and second year courses taken primarily by non-math majors, including computer scientists, physicists, future high-school teachers, and sometimes life and human scientists. This grouping of diverse interests is particularly true in small or medium-size universities. How can the exquisite balance be struck? What type of exercises and exams should be handed out? What do we desire of our mathematics students in linear algebra, and how might that contrast with what we desire for the pre-service elementary teachers in the same course?

Taking as axiomatic that most routine, procedural, and computational mathematics can now be accurately and efficiently performed by computers owned by every human being (i.e., cellphones), what are the procedural abilities that should be kept in our courses, if any? Are there any procedural skills that may deepen conceptual knowledge?

What does “rigorous thinking” mean exactly in the current, global, technological context? Does it include the abilities to come up and write a proof? Has some computation ever helped you see how to prove a claim?

At what point does a student have “enough” math? Should all courses necessarily prepare for further study, knowing that many students may “jump off” at any time?

Should there be a course ending by “this is your last math class ever, use it to be good citizens”? And how should these courses prepare students for real analysis and group theory, and also data science and artificial intelligence? How might we revise our current cannon of introductory mathematics courses in response to evolving technological trends?

Working Group C *Leaders: Jean-François Maheux, Jo Towers*	***Research in mathematics education***

From the outset, as visible in the first proceedings (from 1977), mathematics education research has been at the core of CMESG... and will certainly remain so in the future.

In this working group, we will revisit selected questions and themes related to research in mathematics education that have been addressed within CMESG over the past fifty years. Drawing on excerpts from past proceedings and re-engaging with earlier problematizations, participants will be invited to reflect on how understandings of research—such as what counts as data, results, or legitimate research practices—have shifted over time, and which tensions remain.

The working group will also look forward, inviting participants to consider what our shared past can tell us about possible futures for research in mathematics education. In doing so, we aim to open a reflection on emerging challenges, opportunities, and directions for research within and beyond the CMESG community.

In addition to discussions, the sessions will include hands-on activities designed to foster collaborative reflection. For instance, we may begin by examining past proceedings of CMESG to explore topics once considered “most important” in the field of research. Reflection on what was present/absent in years past might tell us about our current research focus/blindspots, and project to the future of mathematics education research. Looking forward, participants will be invited to consider new

tools for research, by experimenting with AI and considering its potential and perils for research activity.

Working Group D *Leaders: Geneviève Barabé, Josh Markle*	***Learning and Teaching Mathematics: Looking Backward, Moving Forward***

"I teach, but do they learn?"
(Our translation; St-Onge, 2008)

"They learn, but do I teach?"
(Barabé & Markle, 2026)

One working group at the first CMESG meeting was entitled, "Learning and Teaching Mathematics." With respect to learning mathematics, the discussion appears to have focused on ideas of mastery (e.g., does mastery look in mathematics like it does in music?), agency (e.g., does a learner determine their own approach to developing mathematical understanding?), and authority (e.g., does authority reside with the learner, teacher, or the discipline itself?). Discussions of teaching, in turn, focused on various qualities of good teaching (e.g., disciplinary expertise). Perhaps unsurprisingly, these and many other aspects of learning and teaching mathematics have informed working group discussions in every subsequent CMESG meeting. They persist as active areas of research in our field and remain central to mathematics education researchers' concerns.

In this working group, we raise questions both old and (relatively) new.

We will draw on questions that are perennial in our field: What does it mean to learn mathematics? What does it mean to teach mathematics? Which teaching practices support students' learning of mathematics? What kinds of learning are we actually referring to? And what role does our conception of what it means to "do mathematics" play in all of this?

Using transcripts and video of mathematics learners and teachers, we will raise new questions and distinctions by exploring contrasting perspectives of what it means, and what it can mean, to teach and learn mathematics. To this end, we will bring into dialogue different epistemological, theoretical and practical conceptions drawn from both research and professional experience.

Our approach will include (but is not limited to):

Exploring and applying diverse conceptualizations of learning (e.g., as individual or collective, as becoming familiar with, as communicating, etc.)
Investigating the distinction between mathematics as conceptualized by researchers, as planned and enacted by teachers, and as experienced by learners
Thinking about what necessary and/or sufficient conditions there might be for teaching and learning mathematics

Throughout the working group, we will use these as points of departure to revisit our foundations as a Canadian community of mathematics education researchers, and to reflect on the paths we have forged and/or followed, the questions we have been able to illuminate, and the new questions that emerge from our work together.

Working Group E *Leaders: Richard Barwell, Cynthia Nicol, Yasmine Abtahi, Ed Doolittle, and Kwesi Yaro*	***Re-imagining mathematics for our collective futures***

Our world is confronting major challenges, including social polarization, climate change, and the ethical and environmental implications of AI (UNESCO, 2021). These challenges are multidimensional and interconnected; they involve high levels of complexity, risk, and uncertainty; the values at stake are often contested; and the outcome of any course of action is uncertain. Past CMESG working groups have examined numerous critical challenges including Indigenous ways of knowing, decolonisation, social justice, climate change, queer perspectives and peace. Calls for a new social contract for education (UNESCO, 2024) in the light of these challenges raises many questions. For this working group, we focus on the role of mathematics within mathematics education:

How is the mathematics that we currently teach responsive to these challenges? Are we satisfied with the status quo?

What is the nature and role of the mathematics we teach in relation to these challenges?

What are the limits of the mathematics we teach?

Are we demanding too much of the ‘old’ mathematics in curricula?
Is there a neutral mathematics? Is such a thing even possible?

How can we reimagine mathematics to respond to these challenges?

What new narratives and ideas might we imagine for mathematics teaching that integrates critical mathematics education for social and ecological good?

Participants may like to think about these questions with us from a variety of critical perspectives, such as social, political, ecological, Indigenous, gender, queer, cultural, decolonial, anti-racist, anti-ablist, anti-adultist and any other perspectives.

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Working Group F *Leaders: Nadine Bednarz, Laurent Theis*	***"Didactique des mathématiques" and its connections to CMESG: Contributions, Challenges, and Perspectives***

One of the defining characteristics of our community over the past fifty years has been its sustained effort to integrate the two languages --french and english— and to foster interaction between perspectives from the English-speaking and French-speaking worlds. Since the inception of CMESG, the field of didactique des mathématiques, as conceptualized by French-speaking researchers and teacher educators, has been an integral part of the discussions held at the annual meetings. In this working group, we will examine, drawing on themes and tasks addressed within CMESG over the past 50 years, the perspectives adopted within "didactique des mathématiques", the challenges it has brought to light, and its past and present contributions to our broader community of researchers, teacher educators, and

teachers. We will also seek to identify potential avenues for further work related to the contribution of didactique des mathématiques to CMESG.

Working Group G *Leaders: Richelle Marynowski, Carolina Ruminot*	***From Measurement to Professional Judgment: Trajectories, Practices, and Challenges of Assessment in Mathematics***

Over the past decades, the assessment of learning has evolved from a primarily certificative logic toward formative, ongoing, and learning-integrated approaches (Black & Wiliam, 2018; Mottier Lopez, 2021). In mathematics, this shift is particularly salient given the complexity of students' reasoning processes and problem-solving strategies (Suurtamm et al., 2016). Despite growing endorsement of these principles, a substantial body of research highlights a persistent gap between teachers' stated intentions and their actual assessment practices, which remain largely centered on performance and measurement (DeLuca et al., 2018; Suurtamm & Koch, 2014).

Within mathematics education, assessment is increasingly conceptualized as a process of professional judgment, grounded in the interpretation of students' reasoning and mathematical productions rather than the mere verification of correct answers (Black & Wiliam, 2009; Laveault & Allal, 2016). This shift, however, brings to light ongoing tensions related to task validity, the nature of learning evidence, and institutional demands.

Examining assessment through a psychological lens foregrounds purposes that emphasize measurement and comparison of individual performance, in contrast to educational sciences, which prioritize understanding and regulating learning in classroom contexts. These tensions are reflected in teachers' professional trajectories, as they progressively move from measurement-oriented assessment practices toward approaches focused on interpreting students' mathematical reasoning (DeLuca et al., 2019; Suurtamm et al., 2016).

Recent research further suggests that artificial intelligence has the potential to renew assessment practices in mathematics by providing access to fine-grained traces of students' activity (e.g., strategies, processes, and reasoning), while also raising important concerns regarding data validity and the central role of teachers' professional judgment in interpreting such information (Emprin & Richard, 2023; Bruillard & Richard, 2024).

Building on formative assessment dialogues initiated by Suurtamm and Hardy in 2014, this working group seeks to continue the conversation in light of recent research on the evolution of assessment practices in mathematics. Drawing on empirical studies, analyses of practice, and authentic assessment situations, the working group will explore the following questions:

- How do teachers construct their professional judgment in mathematics assessment?
- What trajectories can be observed between measurement-focused assessment practices and those centered on interpreting students' mathematical reasoning?
- What types of tasks and learning evidence support valid, equitable, and formative judgment in mathematics?
- How do institutional constraints and the rise of artificial intelligence reconfigure assessment practices and the conditions for professional judgment?

This working group invites researchers and educators to share their reflections and research in order to foster a critical dialogue on current transformations in mathematics assessment and on the conditions that support more equitable and learning-oriented practices.

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TOPIC SESSIONS

Topic Session A *Ami Mamolo, Ontario Tech University*	***Gazing at the Mathematical Horizon***

For a while now, my gaze has been drawn to the mathematical horizon. By gazing at the horizon, I have come to know better where I am and where I could be. More than that, the horizon has provided a view of ways to be in the spaces around me. This session will explore the mathematical horizon, its philosophical underpinnings, and its implications for conceptualizing (and teaching) mathematics. With examples.

Topic Session B *Vincent Bouchard, University of Alberta*	***Ungrading in an undergraduate math course: an experiment in horizontal teaching***

Ungrading is a pedagogical approach that minimizes the use of grades and engages students in the learning and assessment process, promoting meta-cognition, self-reflection, engagement, accountability and risk-taking. My motivation towards ungrading is both pedagogical and philosophical: following anarchist principles, my aim is to challenge hierarchies in the classroom, and the traditional grade assignment process is certainly very hierarchical. In this study session I will report on an experiment that I ran the last few years, in which I designed and implemented an ungrading framework within a large calculus class (Calculus IV, generally taken in 2nd or 3rd year). I will explain the framework, report on student

feedback, and share my own reflections. I would also like to propose a few questions: What can be improved in the assessment framework that I used? Could a similar framework be developed for a large entry-level, first-year university course? Do you have any other concrete ideas that can be implemented to challenge hierarchies in university mathematics education?

Topic Session C *Egan Chernoff,* *University of Saskatchewan* *Simon Fraser University* *University of Toronto*	***The Current State of Mathematics Education in Canada: According to Egan***

Where better, than amongst friends and colleagues, and when better, than on the occasion of CMESG/GCDEM and Egan both turning "50", to have a definitely warranted, professional existential crisis. Please join me for this auspicious Topic Session. Much time for questions will be strictly preserved.

Topic Session D *Sarah DuFour, University of Montreal*	***When math feels scary: a creative approach to exploring preservice teachers' relationship with mathematics***

In my role as an instructor, I have had the opportunity for several years to teach the mathematics course for the bachelor's degree in preschool and elementary education. This course, which focuses on subject content rather than teaching methods, comes at the very beginning of the students' bachelor's degree program. Every year, a certain tension arises: many students feel significant stress, even anxiety, at the idea of returning to mathematics. Their complex relationship with this discipline, which is well documented, is palpable.

I therefore wanted to address this relationship with mathematics directly with the students by proposing a tool that invites them to reflect on their own relationship with this discipline. Inspired by a tool originally developed in arts education, this approach will be the subject of my presentation. I will introduce you to the "aesthetigramm," a tool for both teaching and research that allows to explore and better understand relationship with mathematics.

Topic Session E *Tina Rapke, York University*	***Para-Imaging***

Para-imaging sits at the core of my research, teaching, and collaborations—three spaces that do not stand apart but actively merge and are intertwined. Para-imaging is an instructional move that makes students' dynamic mental imagery visible for collective exploration. By extending familiar talk-based strategies into the visual and kinaesthetic, it brings to life what learners see and do in their minds as they solve problems.

In this session, we will dive into the emergence and theoretical grounding of para-imaging, experience it in action, explore current Canadian research collaborations, and imagine bold new directions for future work—together.

Topic Session F *Amenda Chow, University of Toronto*	***Adding Perspective by Adding Senses***

There are many ways to visualize information, such as graphs of functions, pie charts, scatterplots, Venn Diagrams, etc. and these are used as tools to support learning. In addition to visualizing, this talk provides ideas to engage more with sound, touch, and embodiment when interpreting information. In the talk, I will share some mathematical examples, student reactions, and other insights based on personal experience. Some of the examples will be presented live, and hence audience participation may be requested.

NEW PHD SESSIONS
(ABSTRACT TRANSLATIONS PROVIDED BY THE SPEAKER.)

Amannjot Toor ***Institution:*** ***Supervisor: Joyce Mgombelo***	***Mathematics Teachers' Lived Experiences of Teachable Moments***

This study emerged from moments in my teaching when unexpected insights surfaced, inviting a reflective turning toward the lived meanings unfolding within my classroom. The study sought to interpret K–12 mathematics teachers' lived experiences with teachable moments: What is it like for K–12 teachers teaching mathematics to experience teachable moments? How is it like for these teachers to notice teachable moments? In what ways do these teachers take

up teachable moments? Using a pragmatic hermeneutic phenomenological approach, open ended interviews gathered six participants' lived experiences, and thematic analysis distilled their essence into crafted narratives from which eight themes emerged: noticing students' gaps in mathematical understanding, noticing students' needs, dialoging and discussing with and among students, noticing mistakes and opportunities to learn, questioning and broadening teachers' mathematical understanding, bringing real world applications into teaching, practicing self reflection and continuous self improvement, and noticing the emotional aspect of learning mathematics. The study attends to teachable moments as lived, relational openings that disclose new possibilities for connection, shared meaning, and pedagogical becoming.

Lisa Floyd ***Institution: Wilfrid Laurier University*** ***Supervisor: George Gandanidis***	***Mathematics and Coding in Teacher Education***

With the recent introduction of coding concepts and skills in K-12 curriculum around the world, it is important that teacher education programs prepare teachers accordingly. This study investigates how 53 preservice teachers' perspectives on coding, teaching, and learning mathematics evolved as a result of course and practice teaching experiences. The study was conducted over six years, with six cohorts of preservice teachers enrolled in a 36-hour course at an Ontario university. The study employed a constructivist theoretical framework, qualitative research methods, and reflexive thematic analysis. Four turning points were identified, which involved shifts in the preservice teachers' perspectives about teaching and learning mathematics and coding. These turning points were analyzed using the lenses of Seymour Papert's theory of constructionism and Yasmin Kafai and Quinn Burke's computational participation framework. The study presents a model for teacher education that provides insights for researchers and teacher educators.

Marja Bertrand ***Institution: King's University*** ***Supervisor: Immaculate Namukasa***	***STEAM Education: Culturally Responsive Mathematics and Computing***

Approximately one-third of the population in Canadian schools consists of ethnically, linguistically, and culturally diverse students. In response to this shift in demographics, educators should reflect on their teaching philosophies and practices to make them culturally responsive to their students' needs. This study explored the following research question: What impact do culturally responsive pedagogies (CRP)

have on the teaching and learning of mathematics through a STEAM-integrated lens? A qualitative case study interlinked with Design-Based Research (DBR) was conducted. The main findings of this study were: (i) students engaged more with the technology when applying their knowledge, remixing the code, sharing resources, prototyping, and reimaging their designs; and (ii) students had rich learning opportunities when exploring their cultural identity, sharing their personal stories, and building collaborative communities. These results have implications for educators, students, and curriculum developers, as well as for optimizing the mathematics learning experience and deepening students' overall understanding.

Chelsie Leger ***Institution: Wilfrid Laurier University*** ***Supervisor: Douglas McDougall***	***Relationship-Building in Destreamed Grade 9 Mathematics Classrooms: Exploring Best Practices and Challenges***

This presentation shares findings from a study exploring the best practices and challenges teachers faced in the Ontario Grade 9 destreamed mathematics course through the lens of relationship and community building. Guided by Tranter et al.'s (2018) relationship-based approach to student well-being and achievement, the qualitative case study examined how seven secondary teachers incorporated the eight conditions of this framework into their practices. The study highlights how these conditions were implemented by individual teachers and how they shaped their views of the destreamed course. Findings showed that community building was a central priority, engagement and meaningful learning were closely connected, and teachers required greater supports, including time, smaller classes and classroom-ready resources. In this presentation, I will discuss how these findings point to the value of intentional relationship-based practices in strengthening student success in destreamed mathematics classrooms.

Johana Thomas Zapata ***Institution: The University of British Columbia, Vancouver Campus*** ***Supervisor: Amy Roth McDuffie***	***Designing Mathematics Content Courses for Culturally Responsive Teacher Education***

This presentation examines the redesign of a mathematics content course for pre-service elementary teachers at the University of British Columbia. Grounded in culturally responsive pedagogy and Indigenous perspectives in mathematics education, the course positions teacher candidates as active participants who connect

mathematical concepts to identity, community, and lived experience. A learner-centered capstone project invited students to design lessons for their own communities, integrating conceptual understanding across the six core strands of the BC mathematics curriculum. Drawing on qualitative analysis of student narratives, lesson plans, and presentation artifacts, this study explores how engagement with culturally grounded mathematics influences teacher candidates' confidence, agency, and evolving mathematical identities. Findings highlight both the transformative potential and the pedagogical tensions of integrating Indigeneity and culturally responsive practices within university mathematics courses for future educators.

Wendy Forbes ***Institution: Mount Saint Vincent University*** ***Supervisor: Joyce Mgombelo***	***Mathematics Learning in a Computer Programming Environment: Co-Actional Phenomenon, Mathematical Significance, and Computational Thinking***

This study explored the nature of interactions between learners and their programming environment as they develop, and program Exploratory Objects (EOs) for mathematics investigations. This interaction is conceptualized as *co-action*, a reciprocal process in which learners and their environment mutually shape each other. Grounded in the enactivist concept of structural coupling and informed by the theory of stigmergy, the research reconceptualizes learning as an emergent phenomenon that arises through embodied action, sensory feedback, and evolving environmental traces. Using a qualitative phenomenological approach, data were collected from six undergraduate students enrolled in Mathematics Integrated with Computer Applications (MICA) courses at a Canadian university. Data sources included semi-structured interviews, field notes, and exploratory objects (EOs). Thematic analysis, guided by Braun and Clarke's (2006, 2020) framework, revealed six key themes: pedagogical traces, Environmental Semantics and Social Traces, learning strategies and student agency, dynamic problem-solving, emerging perspectives and psychological empowerment, and development of proficiency. Findings highlight how learners' adaptive engagement with programming tools supports the co-emergence of computational thinking, mathematical reasoning, and learner agency. The study offers theoretical and pedagogical insights for integrating computational thinking into mathematics education in ways that are flexible, inquiry-driven, and grounded in students' lived experiences.

Vincent Laurence-Rouleau ***Institution: Université de Montréal*** ***Supervisor: France Caron***	***Reflections on a Dissertation: Toward an Active Conception of Mathematical Function***

During my research in mathematics education, I proposed enriching the understanding of the notion of function by adopting what can be called an active conception, notably

by defining a function as a class of equivalent pathings whose fundamental operation is the composition (of pathings). A set of problems and computer-based exploratory tools were developed with this conception in mind and placed in the hands of Grade 9 and Grade 11 students in Québec in order to observe the mathematical activity that would emerge. With a little more than two years of hindsight since the defense of my dissertation, I will offer a reflective look at the approach used, the key findings of the analyses, and the possible avenues to pursue, both in practice and in theory.

Schinella D'Souza ***Institution: University of Toronto St. George*** ***Supervisor: Sarah Koch***	***Student Perceptions of Linear Algebra: Measuring Change Over a Semester***

This talk is based on a project for a first-year linear algebra class geared toward engineers at the University of Toronto, and is joint with Bernardo Galvão-Sousa, Sasha Gollish, and Camelia Karmianpour. Under a traditional grading structure, we seek to understand students' perception toward mathematics prior to entering the course and after course completion. Through entrance and exit surveys, we are studying how the grading structure affects students' beliefs about math, their motivation to study math, how they engage with this assessment structure, and if they perceive it as beneficial in terms of their confidence and feeling of preparedness. We will discuss preliminary results from the data collected in the Fall 2025 semester and compare students' attitudes and perception before and after the course.

Simon Crothers ***Institution: University of Calgary*** ***Supervisor: Olive Chapman***	***Psychological Needs and Participation Patterns of Postsecondary Students in an Asynchronous Mathematics Course***

This presentation investigates how postsecondary business students experience learning in an asynchronous online mathematics course by examining the psychological needs and participation patterns that shape their engagement. Using Self-Determination Theory as an analytical lens, the study explores how students perceive autonomy, competence, and relatedness within the course structure, and how these perceptions intersect with their actual patterns of participation, drawn from behavioural-log data. Findings show that students often describe considerable freedom in managing their learning and report growing confidence with mathematical tasks; however, opportunities for social connection remain limited. This imbalance highlights how asynchronous design can support autonomy and competence while inadvertently constraining relatedness. The presentation identifies design features

students found most meaningful for engagement and examines structural elements that may limit deeper involvement. Implications are offered for creating asynchronous mathematics learning environments that more effectively address students' motivational needs and foster richer patterns of participation.

**********end of program*****

Checklist:

- CMESG membership & CMESG conference registration
- Reusable Water Mug
- Lanyard for nametag