



CANADIAN MATHEMATICS EDUCATION STUDY GROUP

47TH ANNUAL MEETING

JUNE 7TH TO JUNE 11TH , 2023

ANNOUNCEMENT AND PROGRAM

We are pleased to welcome you to the University of Regina for the 47th Annual Meeting of the CMESG/GCEDM, which begins at 6:30 pm on Wednesday, June 7th and ends at 12:30 pm on Sunday June 11th, with an optional pre-conference gathering being held on the evening of Tuesday, June 6th.

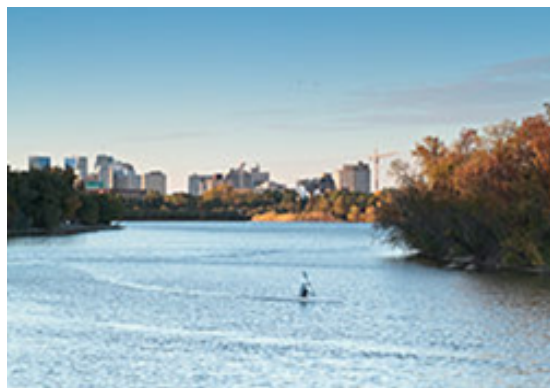
The University of Regina and its three federated colleges (Campion College, First Nations University of Canada, and Luther College) are on Treaty 4 and Treaty 6 territories — the homelands of the nêhiyawak, Anihšīnāpēk, Dakota, Lakota, Nakoda peoples, and Michif/Métis nation. As acknowledged on the university's website:

We recognize that, as an institution founded by settlers, we benefit from being on this land. We are grateful for the privilege to learn, teach, and work here. We demonstrate our commitment to reconciliation by incorporating Indigenous knowledge and world views in our research, teaching, and studies to ensure that there are increased economic, social, and creative opportunities for current and future generations. It is our responsibility to strengthen relationships with Indigenous communities and build a more inclusive future. (<https://www.uregina.ca/impact/indigenous/index.html>)

While the University of Regina has founding roots back to 1911, it became a degree-granting university in 1961 as the Regina Campus of the University of Saskatchewan. In 1974, the U of R became an autonomous university and presently has an enrollment of over 15,000 full and part-time students, offering more than 120 undergraduate and 80 graduate programs.



The University of Regina welcomes approximately 3,000 international students from nearly 100 countries to our main campus in Regina, Saskatchewan.



The University of Regina is conveniently located within Canada's largest urban park, [Wascana Centre](#)! One can enjoy exploring this beautiful park on several kilometers of walking and biking paths, directly accessible from the University of Regina campus. Regina is known for being one of Canada's sunniest cities and, while it can get pretty cold in the winter months, the [winters](#) are gorgeous. In [June](#), average maximum daytime temperatures are about 23°C, often accompanied by a gentle Prairie breeze.

WELCOME AND REGISTRATION

Registration on Wednesday will be from 2:30 pm to 6:45 pm, on the first floor of the Education Building, close to ED191 where the opening session and 1st plenary will take place. A BBQ will be held at the Atrium Rotunda at Innovation Place (10 Research Drive, Momentum Cafe on the map) 5:00 - 6:30 pm. The post-plenary reception will be held in room 215 in the College West Building (College West 215 on the map).

We will be providing you with a conference agenda that will include all of the key information that you will need to know – e.g. official schedule, phone numbers, Wi-Fi password (please note Eduroam is also available on campus). We will not be providing any mugs or water bottles.

CMESG events will primarily take place in the Education Building (ED). Lunches will take place in Rm 215 in the College West Building (CW215).

There is a map of the University of Regina campus and surrounding area on page 4 of this document. The map and guide "[CMESG in Regina](#)" is available on Apple

devices. For those with Android devices, there is a [Google map of campus](#) available.

We encourage a reuse/recycle approach to the conference so please bring your own cup for coffee/water and a lanyard for your nametag.



HOW TO GET THERE AND GET AROUND REGINA

The University of Regina is about a 15-minute drive from the Regina International Airport. Taxi, Uber, and car rental services are all available at the airport.

Driving

For those driving to Regina from the east or west, take the Trans Canada Highway (Highway 1 in Saskatchewan) to Saskatchewan Highway 6 North, which becomes Albert Street in the city. For those driving to Regina from the north (e.g., Saskatoon or Edmonton) take Saskatchewan Highway 11 South to Saskatchewan Highway 6 South (Albert Street).

Once on Albert Street, turn east from Albert Street to College Ave, then turn south from College Ave to Broad Street, which becomes Wascana Parkway. Turn east from Wascana Parkway to University Drive North to reach Kisik Tower residence. GPS systems may provide shorter and more direct routes than the ones given above.

Taxis

Taxis can be called at Coop Taxi [306-525-2727](tel:306-525-2727) and Capital Cab [306-791-2222](tel:306-791-2222). Note that other Regina cab companies may be barred from the airport, so you should check in advance before booking a cab to the airport.

Important addresses for GPS or taxi instructions

Kisik Towers Residence: 3747 Lee Gren Avenue, Regina

Education Building/Education Auditorium: 3919 University Drive South, Regina

College West Building: 3903 Wibazuka Road, Regina

Riddell Centre/Lazy Owl/UofR Student Union: 3907 Buffaloberry Way, Regina (next to the College West building)

Innovation Place/Momentum Cafe: 10 Research Drive, Regina

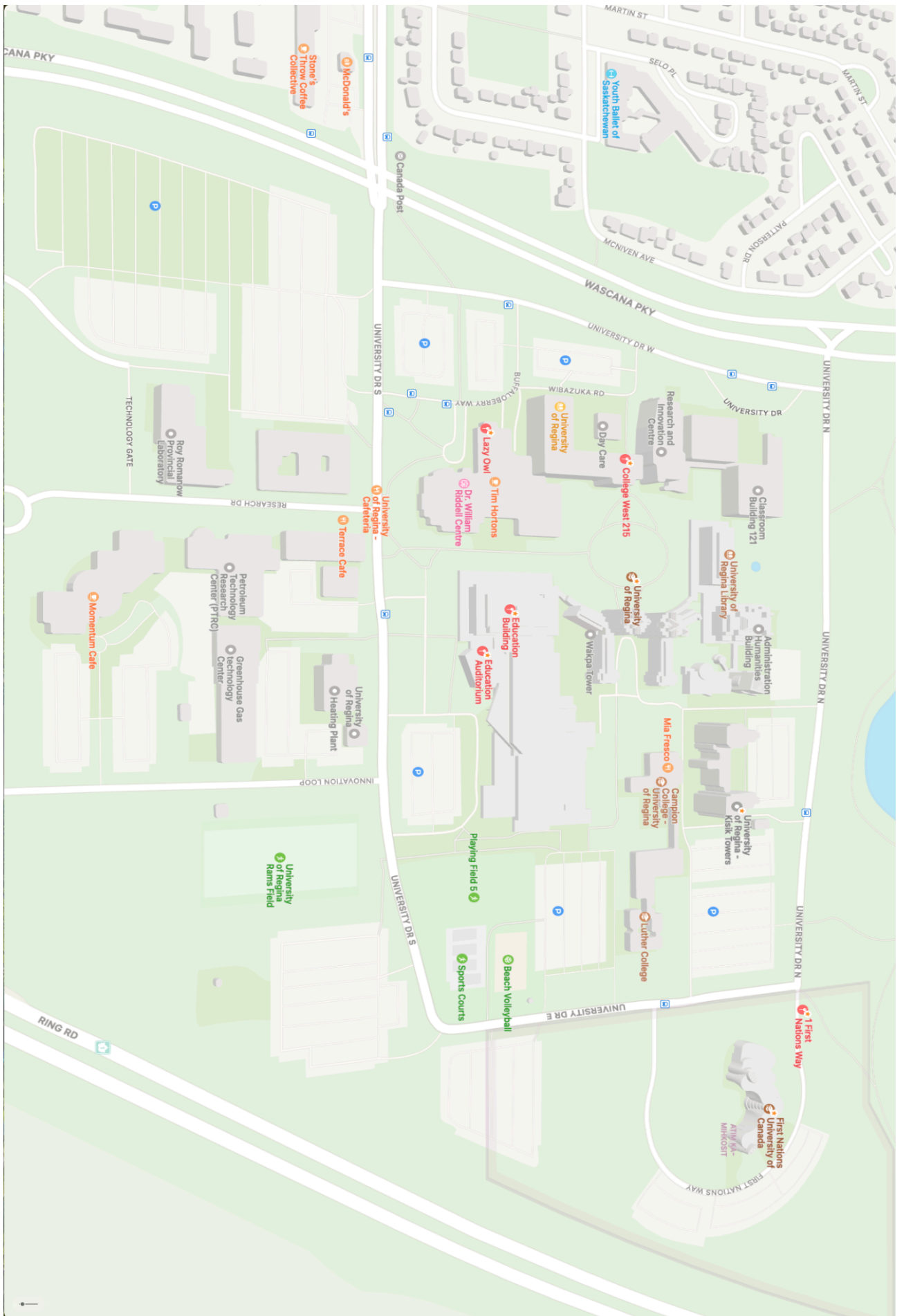
First Nations University of Canada: 1 First Nations Way, Regina

Public Transit, Bicycle, Foot

Regina has a comprehensive public transportation system

<https://www.regina.ca/transportation-roads-parking/transit/> . The fare is \$3.25 per ride (exact change). If you are going to be taking multiple trips you can purchase an R-card from the University of Regina Students Union (near the Lazy Owl on the map). There are numerous bus stops in the University of Regina, but they each service a variety of different routes, so plan your route in advance and remember to ask the driver for a transfer if necessary. <https://www.regina.ca/transportation-roads-parking/transit/schedules-routes/> .

The Wascana Centre park system is a great way to get around the city on bike or on foot. The University is about 5 km from the downtown core. Unfortunately, there is no bike rental in Regina, so you will have to bring your own bike or make other arrangements.



PARKING

Only paid parking is available. If you have a vehicle, please let a member of residence staff know you will be parking on campus when you check in. Public parking elsewhere on campus must be paid for at pay stations or with the PayByPhone app <https://www.uregina.ca/parking/Public-Parking/index.html>. M and Z parking is available only for employees and students of the University of Regina.

ACCOMMODATIONS

We have blocked rooms in Kīšik Tower, one of the residences at the University of Regina.

You can book your accommodations online:

<https://www.uregina.ca/hospitality/guest-accommodations/accom-request.html>.

Please mention in the “special request” box that you are with CMESG. You can e-mail questions to hospitality.services@uregina.ca.

For those of you wishing to stay at a hotel, there are a few options within a short drive (or even walk) from the university. ***Please ask for “University of Regina Special Rate” when you book:***

The Atlas Hotel, 4177 Albert St, Regina [2 km from U of R campus]

Web Booking Address: <https://be.synxis.com/?hotel=10124&promo=UOFR>

Phone: [306-586-3443](tel:306-586-3443)

Rate: approximately \$135/night

Days Inn by Wyndham Regina Airport West, 4899 Harbour Landing Drive, Regina [5 km from U of R campus]

Web Booking Address: <https://www.daysinnreginaairportwest.ca>

Phone: [306-584-3297](tel:306-584-3297)

Rate: approximately \$110/night

The Hotel Saskatchewan, Autograph Collection, 2125 Victoria Ave, Regina [3.5 km from U of R campus]

Web Booking Address: www.marriott.com/YORAK Reference U4R

Phone: [306-522-7691](tel:306-522-7691)

Rate: \$200-255/night

MEALS

All lunches and dinners will be taken with the group, except for dinner on Thursday (which will be dinner on your own). There are local restaurants close to the university for you to try, including a few that are within walking distance. We will be providing lists of places to eat and drink with your registration package when you arrive.

Breakfast can be purchased on campus on Thursday and Friday. There are also a number of places in the city to get a good breakfast. We will be offering a continental-style breakfast on Saturday and Sunday in ED 228.

On Friday evening we will be having dinner at a local pub, The Broken Rack. Our Saturday evening banquet and dance will be held at the Lazy Owl on the University of Regina campus.

PRE-CONFERENCE SOCIAL EVENT (JUNE 6TH) @ BUSHWAKKER BREWPUB

- An optional pre-conference ‘Brew-ha-ha’ will take place on Tuesday, June 6 for CMESG meeting participants who are in Regina early; food and beverage cost is on your own - not included in registration fees. [limit 55 people]

Where: [Bushwakker Brewpub](#), 2206 Dewdney Ave

When: Tuesday, June 6, 5:00 – 10:00 pm

What: Pizza & Pint for \$19.95 [other menu items also available]

EXCURSIONS (JUNE 9TH)

We have three excursions for you to choose from:

Excursion #1: Walk & Wine— Experience wine tasting at [Over the Hill Orchards](#) followed by a walk on [Wascana Trails](#) in the lovely Qu'Appelle Valley [limit 40 people]. Note: Minimal washroom facilities and some rough walking terrain at Wascana Trails.

Excursion #2: Moose Jaw Extravaganza— Visit the spa at [Temple Gardens Mineral Spa](#) followed by a riveting tour of the [Tunnels of Moose Jaw](#) [limit 40 people]. Note: Bring swimsuit for spa pool and walking shoes for tunnel tour.

Excursion #3: Regina Experience — visit to [RCMP Heritage Centre](#) (including movie, trolley tour & museum) followed by horse-drawn wagon ride in Wascana Park (by [Prairie Percherons](#)) [limit 40 people].

EMERGENCY

In case of emergency during the conference, you can contact URegina Campus Security at [306-585-4999](tel:306-585-4999).

FEES

The conference fee (\$210 if registration and the full payment before May 9th; \$240 thereafter) covers the cost of the reception on Wednesday, lunches on Thursday, Friday and Saturday, dinners on Wednesday, Friday and Saturday, breakfast on Saturday and Sunday, coffee breaks, the Friday 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 on Saturday afternoon 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. Drop by. Refreshments provided.

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.

PLENARY LECTURES

<p><i>Lecture I</i> Jennifer Suh George Mason University</p>	<p><i>Cultivating Joy, Wonder and Power through Community-based Math Modeling</i></p>
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Educating the hearts and minds of our youth is at the core of our work as mathematics educators. This talk focuses on an equity-centered approach to mathematics teaching using a pedagogical approach called community-based mathematical modeling. A critical skills in mathematical modeling (MM) involves posing mathematical problems in authentic real-life contexts that are relatable to students' interests, knowledge, and skills that enable students to use mathematics to help make decisions, predict, and determine meaningful solutions to the problem (COMAP & SIAM, 2016). Dr. Suh will share her current project, EQSTEMM, that focuses on introducing elementary students to Community based Math Modeling (Suh et al., 2023) as a way to engage students in rigorous mathematics while bringing awareness and taking action on social issues in their community. To advance equity and strengthen teaching of mathematical modeling, teachers enact culturally responsive mathematical practices (Zavala & Aguirre, 2021) to notice students' mathematical strengths to assign competence and position students as mathematicians. This plenary talk invites the Canadian Mathematics Education Study Group to engage in dialogue with one another in cultivating joy, wonder and power through Community-based Mathematical Modeling.

<p><i>Lecture II</i> Marième Ngom Argonne National Laboratory</p>	<p><i>Building the foundations of mathematical modelling</i></p>
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Mathematical sciences are widely used in a plethora of industry and business applications such as healthcare, finance or meteorology. With the rise of machine learning, artificial intelligence, and big data analytics, novel and innovative use of mathematics are being established. Early exposure to the concepts of computational mathematics can help students develop the skills to solve real-world problems and better understand the

mathematical principles that underlie our modern world. Moreover, learning to create and analyze mathematical models at a young age fosters critical thinking and analytical skills that can be applied across various disciplines beyond STEM. This talk will explore the importance of introducing mathematical modeling in the classroom at a young age. We will provide practical, easy to grasp examples of how educators can incorporate these concepts in their curricula.

WORKING GROUPS

<p><i>Working Group A</i> <i>Leaders: Edward Doolittle, Elder Dr. Elmer Ghostkeeper, Florence Glanfield, Elder Betty McKenna, Cynthia Nicol, & Jennifer Thom</i></p>	<p><i>Machi kis kiyih tam Uske/Nantaw ota: Iteyhtam mas kooch etikwe Apehka tam eyiniw misiwe uske kawapahtik ake ihike win ewa kiskino huma kewina / Learning from/on/with land/place: Imagining possibilities for braiding Indigenous worldviews, mathematics, and teaching</i></p>
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How might Indigenous perspectives/worldviews/knowledge systems be taken up in mathematics education? How might Indigenous knowledges and practices inform mathematics teaching? In this working group we will explore what it might mean to centre Indigenous knowledges in mathematics teaching and learning and mathematics teaching practice.

We invite each participant to bring an object or item that is of significance to them to this working group.

We aim to create a generative space where ideas such as: Relations; Listening to the Land; Art, Stories, and Storywork; Shaping and Being Shaped by Mathematics; Indigenous Statistics; Technology/ies; Relationality; Patterning; Transformation; Movement; Spirituality; Measurement; Location; Growth; and Identity can be explored within questions such as:

1. How can we re-member or navigate relationships with mathematics, community, land and place?
2. How can we unlearn sometimes problematic ways of relating to each other, our students, and mathematics from/on/with land and place?
3. What might it mean for mathematics teaching and learning if the notion of “learning from/on/with place” were central?
4. Robin Wall Kimmerer describes land as library. What might this mean for mathematics teaching and learning?

5. How can mathematics teaching and learning be informed by Indigenous principles? (e.g., Archibald's storywork principles such as responsibility, reverence, respect, and reciprocity, inter-relatedness, synergy and holism; or gratitude, care, compassion; spiritual, physical, emotional, cognitive; 7 grandfather teachings; grandmother pedagogies and/or methodologies)
6. How might we restructure our teaching practices around experiences?
7. What are ways in which teachings from/on/with the land play a role?

We invite participants to view/read these resources:

Videos:

Janine Benyus- Biologist and Innovation Consultant (2022)

On Biomimicry (3:14 min)

https://www.youtube.com/watch?v=M_5Xxy2T3kA

JC Cahill - University of Alberta Plant Biologist (2012)

Smarty Plants: Uncovering the Secret World of Plant Behaviour (44 min)

<https://curio.ca/en/video/smarty-plants-uncovering-the-secret-world-of-plant-behaviour-1443/>

Hermit Crabs (2021)

LINE UP To Swap Shells! (4:04 min)

<https://www.youtube.com/watch?v=zpjklLt1qWk>

Robin Wall Kimmerer - Teaching Professor of Environmental and Forest Biology State University of New York (2014)

Humans and nature talk. What does the Earth Ask of us? (16:56 min)

<https://www.youtube.com/watch?v=y4nUobjJEEWQ>

Suzanne Simard - UBC forest ecologist (nd)

How trees talk to each other - Ted Talk (18 min)

https://www.ted.com/talks/suzanne_simard_how_trees_talk_to_each_other

Literature:

Glanfield, F., Thom, J. S. & Ghostkeeper, E. (2020). Living landscapes, archi-text-ures, and land-gauging algo-rhythms. *Canadian Journal of Science, Mathematics, and Technology Education*, 20(2). <https://doi.org/10.1007/s42330-020-00085-8>

Ghostkeeper, E. (2007). *Spirit gifting: The concept of spiritual exchange*. 2nd Edition. Writing on Stone Press.

Kimmerer, R. W. (2013). *Braiding sweetgrass: Indigenous wisdom, scientific knowledge and the teachings of plants*. Milkweed Editions. Kimmerer, R. W. (2013). *Braiding*

sweetgrass: Indigenous wisdom, scientific knowledge and the teachings of plants. Milkweed Editions.

Styres, S. D. (2017). *Pathways for remembering and recognizing indigenous thought in education: Philosophies of iethi'nihsténha ohwentsia'kékha (land).* University of Toronto Press.

Walter, M. & Andersen, C. (2016). *Indigenous statistics: A quantitative research methodology.* Routledge.

<p>Working Group B</p> <p><i>Leaders: Amenda Chow & Eva Knoll</i></p>	<p><i>Mathematical thinking in the experience of fashioning</i></p>
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Bishop (1988) describes the practice of mathematics as embedded in the following six activity types: counting, locating, measuring, designing, playing and explaining. Barton (1998) when looking for a non-eurocentric definition, proposed quantity, relationship and space (QRS). In this working group, these theoretical ideas will serve as a starting point for developing awareness (Gattegno, 1989; Varela et al., 2003) of the role of mathematical thinking in understanding phenomena in scientific investigations or art making. To explore these ideas more deeply, participants will be engaging in both “fashioning” (using our hands to produce various artifacts) and investigating. Natural questions that we hope will arise include: when making or exploring, what kinds of mathematical reasoning occur? How aware of this are we during the activity and how can we make the math that emerges more visible in the artifacts or experiments?

A number of current perspectives focus on the mathematical activities (Theureau, 2015) of various communities of practice (Lave & Wenger, 1991). Participants will get to experience a methodology, inspired by mutual interrogation as proposed by Alangui (2010), which incorporates direct, enactive (Varela et al., 1992) involvement in the practice under investigation.

References

Alangui, W. (2010). *Stone Walls and Water Flows: Interrogating Cultural Practice and Mathematics. Unpublished doctoral dissertation, University of Auckland, Auckland, New Zealand.*

Barton, B. (1998) *Ethnomathematics and Philosophy, First International Conference on Ethnomathematics*

- Bishop, A. (1988) *Mathematical enculturation: a cultural perspective on mathematics education*, Springer.
- Gattegno, C. (1989). *The Science of Education PART 2B The Awareness of Mathematisation*, Educational Solutions, New York, Restricted Printing.
- Lave, J. and Wenger, E. (1991) *Situated Learning: Legitimate Peripheral Participation*. Cambridge University Press.
- Theureau, J. (2015). *Le cours d'action. L'enaction et l'expérience*. Toulouse : Octarès.
- Varela, F., Depraz, N., & Vermersch, P. (2003). *On becoming aware: a pragmatics of experiencing*. Varela, F., Thompson, E, Rosch, E (1992). *The embodied mind: Cognitive science and human experience*, Boston: MIT Press.

Working Group C

Leaders: Manon LeBlanc & Robyn Ruttenberg-Rozen

Evolving borders to create spaces of belonging in mathematics

Borders bound our fields of mathematics and mathematics education. Through bounding our field, borders act as tools of inclusion and exclusion. What are the borders in mathematics and mathematics education? ***Qui décide de ces limites?*** Who decides on these borders? Who do the borders include and exclude? Should the borders be permeable, or should they be rigid? ***Devrions-nous exclure?*** Should we be excluding? What are the purposes of these borders? ***Quand l'exclusion est-elle utile?*** When is excluding helpful?

The purpose of this working group is to interrogate the different kinds of borders in mathematics and the exclusionary and inclusionary practices the borders support. Our goal is not to discover “an answer” to the questions above, as there are no easy answers, but as a group to provoke us closer to ideas about belonging. Belonging moves beyond seeing and including towards a sense of community and membership (powell, 2016). ***Pour réellement développer un sens d'appartenance, les dimensions émotionnelle, sociale, participative et adaptative doivent être considérées*** (St-Amand et al., 2020). A sense of belonging is a drive to feel accepted, connected, and respected within a community (Nieminen & Pesonen, 2021, p.477). We invite people to bring their ideas, questions, and experiences to discuss spaces of belonging in mathematics, community, and membership. We hope to move beyond seeing and including so we can evolve our mathematical borders.

References

Nieminen, J. H., & Pesonen, H. V. (2021). Politicising inclusive learning environments: how to foster belonging and challenge ableism?. *Higher Education Research & Development*, 41(6), 1-14.

powell, j.a. (March 4, 2016). Otherness and belonging | john a. powell | wisdom 2.0 2016 [Video File]. YouTube. https://www.youtube.com/watch?v=W_-ux9LhkyY&t=181s

St-Amand, J., Bowen, F., Bulut, O., Cormier, D., Janosz, M., & Girard, S. (2020). Le sentiment d'appartenance à l'école: validation d'un modèle théorique prédisant l'engagement et le rendement scolaire en mathématiques d'élèves du secondaire. *Formation et profession: revue scientifique internationale en éducation*, 28(2), 89-105.

<p>Working Group D</p> <p><i>Leaders: Vincent Bouchard & Asia Matthews</i></p>	<p><i>An undergraduate curriculum based on mathematical reasoning skills (wouldn't this be awesome?)</i></p>
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Teaching should focus less on the product of mathematical thought and more on the process of mathematical thinking.
 - Skemp (1971)

This working group is about turning mathematics education inside out - focusing our teaching on core mathematical process skills, supported by content. We propose a full Major in Math curriculum based on skills [Su, OECD] as primary learning outcomes. Course titles include, Communication and Collaboration, Abstraction, Problem-Solving, Proof and Formalism, Computation. In such a curriculum, vectors could be introduced as an example of abstraction, differential equations as computation and problem-solving. We would teach students how to do math, instead of teaching them how math was done by others. Wouldn't this be awesome?

The rationale is that what we really care about, as educators and mathematicians, are the core skills of mathematical reasoning. Employers agree: they are looking for people who can solve problems, use abstraction, collaborate and communicate scientifically. Yet what we do in contemporary mathematics education does not align with our values; we teach content over skills. Let's teach the process of doing mathematics rather than the mathematical product.

We will begin by presenting a pilot version of such a curriculum, with examples of learning objectives and core knowledge in each of these courses, and then guide the participants through a discussion of three aspects: (1) Mapping core knowledge to the appropriate courses, (2) Assessing skills, and (3) Designing strategies for

implementation, either as a large-scale redesign of a math curriculum, or as smaller-scale attempts at introducing some of these ideas within our current courses.

References

- Su, F. E. (2017). Mathematics for human flourishing. *The American Mathematical Monthly*, 124(6), 483-493.
- OECD (2019). Future of Education and Skills 2030 Concept Note.
https://www.oecd.org/education/2030-project/teaching-and-learning/learning/skills/Skills_for_2030_concept_note.pdf

<i>Working Group E</i>	
<i>Leaders: Sabrina Héroux & Janelle McFeetors</i>	<i>Games for mathematical learning</i>

We would like to suggest that out of *play* as a key feature of educative experiences in mathematics, *games* provide an authentic, rich, and compelling context for students' mathematical learning (Bishop, 1988; Su, 2020). While games have long been recommended as a way for students to develop a meaningful understanding of mathematical ideas before they move toward abstractions (e.g., Diénès, 1971), more recent scholarship has investigated noticing students' mathematical activity during game play (Héroux, 2018), students' enactment of mathematical processes/competencies such as reasoning (McFeetors & Palfy, 2018), engagement in mathematical practices through redesigning games (Kim et al., 2021), etc. Our thinking is grounded in: (1) returning to Dewey's notion of *educative experiences* which emphasizes the possibility of growth through a multiplicity of interactions and continuity from processes toward content; and, (2) applying Papert's notions of *microworlds* and *objects-to-think-with* which emphasizes the spaces for learning created around a game as a mediating tool. Through experiencing a range of board games – teacher-created to instructional games to commercial games – and interpreting student data, we have many inquiries that we invite you to explore with us in our working group, including:

- What is the nature of games which sponsor mathematical thinking and engagement?
- How might we attend to and notice students' mathematical learning and thinking through game play?
- What makes games educative mathematically?
- In what ways can the role of game play elicit mathematical thinking?
- Toward what are we being intentional when incorporating games as *objects-to-think-with* in mathematics class?

- What contributions can be made to curriculum design for incorporating games in mathematics class?
- What future directions for research could legitimize and support inquiries into learning mathematics through/with game play?

We would like to encourage you to join us in imagining the playful possibilities games provide to enliven and enrich students’ learning in mathematics class and in wondering how, as mathematics educators, we both sponsor and attend to students’ playful learning through/with games.

References

- Bishop, A. J. (1988). Mathematics education in its cultural context. *Educational Studies in Mathematics*, 19(2), 179-191. <https://doi.org/10.1007/bf00751231>
- Diènés, Z. P. (1971). An example of the passage from the concrete to the manipulation of a formal system. *Educational Studies in Mathematics*, 3(3-4), 337-352. <https://doi.org/10.1007/BF00302302>
- Héroux, S. (2018). Doing mathematics playing Nine Men’s Morris. In E. Bergqvist, M. Osterholm, C. Granberg, & L. Sumpter (Eds.), *Proceedings of the 42th Conference of the International Group for the Psychology of Mathematics Education* (Vol. 5, p. 248). Psychology of Mathematics Education.
- Kim, B., Bastani, R., & Takeuchi, M. A. (2021). Embodied mathematical practices in (re)designing board games in a linguistically diverse classroom. *Pedagogies: An International Journal*, 1–22. <https://doi.org/10.1080/1554480x.2021.2013232>
- McFeetors, P. J., & Palfy, K. (2018). Educative experiences in a games context: Supporting emerging reasoning in elementary school mathematics. *Journal of Mathematical Behavior*, 50, 103-125. <https://doi.org/10.1016/j.jmathb.2018.02.003>
- Su, F. (2020). *Mathematics for human flourishing*. Yale University Press.

<p>Working Group F Leaders: Lynn McGarvey & Evan Throop-Robinson</p>	<p><i>Where’s the math? Inquiring into early years mathematics curriculum</i></p>
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For the last few decades, the number of children in early childhood settings has continued to increase, and research has emphasized the impact of early learning on children’s cognitive, social and emotional growth. As a result, mandatory early learning frameworks have sprung up in countries and jurisdictions around the world (see [ELF in Canada and Internationally](#)). Many of these documents include at least some attention to

subject-matter curricula. We wondered, “Where’s the Math?” in these curriculum frameworks. This is an interesting question given the historical tension between mathematics and early childhood. That is, common beliefs are that early mathematics should only focus on number skill development; should only be taught through play; should be integrated into all subjects rather than be stand alone; should be introduced implicitly to avoid anxiety; should emphasize concrete manipulatives and avoid abstraction; and should not take precedence over language and literacy (Balfanz, 1999; Clements & Sarama, 2018; Lee & Ginsburg, 2009). All of these ‘shoulds’ may leave little room for the mathematics.

In this working group, we will explore the many questions that arise when considering mathematics for young children. That is, what do we believe about early learners and how they come to know mathematics in the world? What are the similarities and differences in mathematical activity for early learners across curricula? What does it mean to do mathematics for a 2-year-old? Or a Kindergarten student? What are the starting points in developing mathematics curricula for early learners? How do we navigate the tensions between a play-based and integrated approach to mathematics, and the possibilities of working on specific and precise mathematical concepts with these learners? Are number concepts the dominant content? If so, what are the missing, non-existent, and “hard to find” pieces? What guidance might we provide to educators, researchers and policymakers with regard to early curriculum frameworks?

Consideration of these questions, and many others that arise through our work together, will support our inquiry into early years mathematics curriculum, and perhaps make our guiding question, "Where's the math?" easier to answer.

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Suggested Readings

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TOPIC SESSIONS

<p><i>Topic Session A</i> Nat Banting</p>	<p><i>Hot Dogs and Mathematics Education: A Career Sandwiched between Research and Practice.</i></p>
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In 2020, something unexpected happened: I—a classroom mathematics teacher—was invited to the Fields Institute to receive the 2019 Margaret Sinclair Memorial Award recognizing innovation and excellence in mathematics education.¹

Compelled to reflect, and present, on the influences from both research and practice that had led me to that moment, I eventually arrived at a single, foundational aphorism as particularly potent for designing occasions for, partaking in, and observing mathematical activity in my classroom.

In a topic session designed to be one-half participatory, one-quarter poetic, one-eighth theatrical, one-sixteenth absurd, one-thirty-second provocative, etc., etc., I discuss this guiding dictum, its humble origins, and how my mathematics classroom hinges on my ability to take it seriously.

¹ Well, two unexpected things if you count the Coronavirus pandemic.

<p><i>Topic Session B</i> <i>Elena Polotskaia, Université du Québec en Outaouais</i></p>	<p><i>Represent or not represent – Is this the question? Mathematical thinking development in elementary school.</i></p>
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Representing or using manipulatives while solving word problems is very popular in elementary school. Probably, the great majority of teachers accept that this way, the student will better understand and better learn mathematics. However, many of those teachers would be confused if asked other questions. What should be represented and why, at what moment, by whom, and how this representation can be used to foster mathematical thinking? I would like to share my thoughts and ideas about how the relational paradigm transforms the word-problem solving into a powerful teaching tool promoting the development of students' mathematical thinking.

<p><i>Topic Session C</i> Bernardo Galvão-Sousa, University of Toronto</p>	<p><i>What is an applied math problem?</i></p>
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I have been teaching applied math courses for undergraduate students for over 10 years. Over this time, my idea of what an applied math problem is has changed. So let's take a ride through my past and examine some applied math problems.

<p><i>Topic Session D</i> Annie Savard, McGill</p>	<p><i>Teaching Financial Numeracy in schools: An overview of Mathematical Practices at play</i></p>
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Financial Education is present in some recent Canadian Mathematics curricula such as Alberta, British Columbia, Ontario and Québec. However, it is not new that Mathematics Education plays an important role regarding Financial Education, because Mathematics Education has a long tradition to teach about money and to use financial contexts in problem solving tasks.

This communication will present a framework built up from the work I have done in this field since 2004: Financial Numeracy. This framework highlights the interactions between mathematics and financial education and propose different layers. Examples of these interactions in elementary and secondary schools will be presented such as learning situations, teaching practices and students' interests.

<p><i>Topic Session E</i></p>	<p><i>Pedagogical encounters and mathematical detours</i></p>
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<i>Rina Zazkis, Simon Fraser University</i>	
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In my work as a teacher educator there is a constant interplay between mathematics and pedagogy, between research and teaching. To illustrate this interplay, I will share several stories in which instructional interactions lead to my personal engagement with mathematics, to research design, and to extended mathematical investigations for my students.

I will describe the notion of scripting or scriptwriting and demonstrate how it provides a window into teachers' knowledge and how it can be used by researchers and teacher educators.

<i>Topic Session F</i>	
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<i>Edward Doolittle, First Nations University of Canada</i>	
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	<i>Better living through combinatorics</i>
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My first encounter with a combinatorial design problem was the struggle to construct a round robin tournament for my grade 8 math class. Since then, I have found some knowledge of combinatorial designs has aided me in finding balanced tournament designs for the University of Regina curling league, designs for efficient mixing of groups for my classes, and breakout sessions for conferences. I teach some combinatorial design in my MATH 101 class as a simple application of modular arithmetic, and I show how the game Spot It is designed, and how prime numbers are important in its design. As a further application, I will discuss the solution of the following International Mathematical Olympiad problem:

An $n \times n$ matrix whose entries come from the set $S = \{1, 2, \dots, 2n - 1\}$ is called a *silver matrix* if, for each $i = 1, 2, \dots, n$, the i th row and the i th column together contain all elements of S . Show that

- (a) there is no silver matrix for $n = 1997$;
- (b) silver matrices exist for infinitely many values of n

NEW PHD SESSIONS

(ABSTRACT TRANSLATIONS PROVIDED BY THE SPEAKER.)

Geneviève Barabé

Institution: UQAM

***Supervisors: Jérôme Proulx et
Hassane Squalli***

***Study of the evolution of routine tasks through their
collective investigation in mathematics classroom***

This research aims to understand how solving mathematical routine tasks can stimulate a problem solving activity in the mathematics classroom. Rooted in the enactivist theory of cognition and in works conducted in the “teaching through problem solving” field, this research especially focuses on the study of the evolution of routine tasks through their interactions with/in the collectivity, which is formed by the class. The role of mathematizing practices in the evolution of routine tasks is also examined. A video analysis of problem solving sessions carried out in elementary and high school classes (students aged 10 to 14) revealed, notably, that new mathematical problems emerge from the collective activity of solving routine tasks, allowing the collectivity to engage in an authentic mathematical problem solving activity.

Sheree Rodney

***Institution: Simon Fraser
University***

Supervisor: Nathalie Sinclair

***Embodied Curiosity in the Mathematics Classroom Through
the Affordance of The Geometer’s Sketchpad***

This research uses data collected from grade nine students (14 -15 years old) at two secondary schools in Jamaica to examine how curiosity, embodiment, and digital technology relate to the construction of mathematical meanings. In doing so, I designed a theoretical framework which I named Embodied Curiosity to illustrate how these relationships are made possible when students interact with circle geometry theorem in a dynamic geometry environment (DGE). The framework is grounded in theories of embodied cognition and draws on Pickering’s (1995) account of agency that human, material and disciplinary agents interact together in the learning process. In this research, curiosity is reconceptualized as something that is observable and a relationship that

emerges when learners engage with digital technology tools. This study highlights the significance of considering curiosity and DGEs as essential aspects of embodied learning.

<p><i>Zack Wolske</i> <i>Institution: University of Toronto</i> <i>Supervisor: Henry Kim</i></p>	<p><i>Reflective practices in a Teaching Assistant (TA) observation program</i></p>
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We ran a peer observation program focusing on undergraduate tutorials, involving about 20 observer TAs and about 150 new TAs from 2019-22. Our goals were to instill reflective practices in our new TAs, prepare our observation TAs for leadership roles as head TAs or instructors, and build up the teaching community in the department. I will discuss our methods, feedback from the observers, and all of the costs of running the program.

<p><i>Canan Güneş</i> <i>Institution: Simon Fraser University</i> <i>Supervisor: Nathalie Sinclair</i></p>	<p><i>A Triple Analysis of Thinking Multiplicatively around/with TouchTimes</i></p>
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Multiplication is important for mathematical competency. However, many students have difficulty thinking multiplicatively. Researchers attribute this difficulty to an overemphasis on using the repeated addition model when introducing learners to multiplication. In my dissertation, I explore how elementary learners’ multiplicative thinking emerges around/with TouchTimes (TT)—a gesture-based, multi-touch iPad application which enables learners to create and manipulate a multiplication model that is different from the repeated addition model. I address multiple dimensions of emergent multiplicative thinking with three separate qualitative studies which use video methods and draw on the theory of semiotic mediation and enactivism. The first study explores the semiotic potentials of TT and pencil-and-paper to engage students with multiplicative thinking. The second study examines how young children make sense of TT when they use a duo of artifacts (pencil-and-paper and TT) back-and-forth. The third study attends to two third graders’ collaborative work to structure quantities by using TT.

Sabrina Héroux

Institution: UQAM

***Supervisor: Jean-François
Maheux***

***Exploratory Study Of Mathematical Activity During Game
Sessions In The Primary School Classroom***

There is a long tradition of teaching through games, and research has shown that students can improve their mathematical knowledge through the use of games in the elementary classroom. This thesis asks what happens mathematically when a game is played in the elementary classroom. This exploratory research highlights the mathematical activity (e.g., concepts, processes and reasoning) when playing a mathematical game in the classroom, that appears to be related to different formal components of the game (e.g., purpose, mechanics) and also appears to be related to the classroom (e.g., known/new concept, anticipated/emergent mathematical process). What emerges from the analysis is the richness of what it can mean to do mathematics in the primary classroom. There are also specific avenues and questions for research on the mathematical activity that students engage in when immersed in a game in the primary classroom.

Myron A. Medina

***Institution: University of British
Columbia***

Supervisor: Susan Gerofsky

***Bringing Indigenous ways into the broader
ethnomathematics conversation **Postponed to 2024*****

This presentation is an attempt to bring Indigenous ways into the broader ethnomathematics conversation. I argue that a contextual exploration of Indigenous mathematics, ways of sensing, being, and doing through culture-based practices of Elders can challenge our notion of what constitutes mathematics, what culture defines it, and what it means to do mathematics. The goal is to shed long overdue light on the ways in which Indigenous practices can engender greater awareness of meaningful mathematical heritages. More importantly, how mathematics, far from being immaterial and disembodied, is deeply material, human, and cultural.

This presentation is by no means complete but it is my hope that it will spark deeper discussions of how to bring Indigenous ways into the broader ethnomathematics discussion. A key guiding question is: What can the practices and stories of our Elders

tell us about the limitations of our view and treatment of contemporary mathematics, and of teaching and learning?

Josh Markle

*Institution: University of
Calgary*

Supervisor: Jo Towers

Embodied Experiences of Spatial Capability

Spatial reasoning has been identified as integral to general mathematical capability and the potential for individuals to flourish in life beyond formal mathematics education. Specifically, the ability to *visualize* is an aspect of spatial reasoning that is consistently associated with achievement in mathematics. There is also a considerable literature supporting the idea that the body plays a constitutive role in developing mathematical understanding. In this work, I develop and use an enactive hermeneutic framework to describe and interpret students' embodied experiences of spatial visualization. Enactive hermeneutics draws on a theoretical framework of enactivism, in which cognition is viewed as a complex phenomenon emerging out of the interactions between an organism and the environment, and carnal hermeneutics, which posits that the body is both interpretive and interpretable. Data were generated through my work with students in grade 12 pre-calculus and calculus courses as they took part in a series of lessons designed to foreground spatial visualization in their problem posing and solving, and included video recordings of lessons, written work (e.g., problem solving and reflection), and classroom observation. Results include the development of a theoretical framework for interpreting students' experiences in the mathematics classroom.

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

Checklist:

- CMESG membership & CMESG conference registration
- Reusable Water Mug
- Lanyard for Name Tag
- Bathing Suit (if going on the Temple Gardens excursion)
- Set up Eduroam on your devices (alternatively, dedicated conference WIFI will also be available during the conference)
- Add Regina taxi phone numbers to your phone
- Bring a bicycle or arrange to borrow a bicycle (if planning to cycle in the park)

- Add University of Regina emergency phone number to your phone
- Add important addresses to your phone
- Add accommodation contact information to your phone

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