

Figure 21

You can also use the random feature to choose values from within a list or distribution. Figures 22 and 23 show one such example, where a sample of 5000 random values were generated based on the specified normal distribution and then plotted as a histogram.



Figure 22

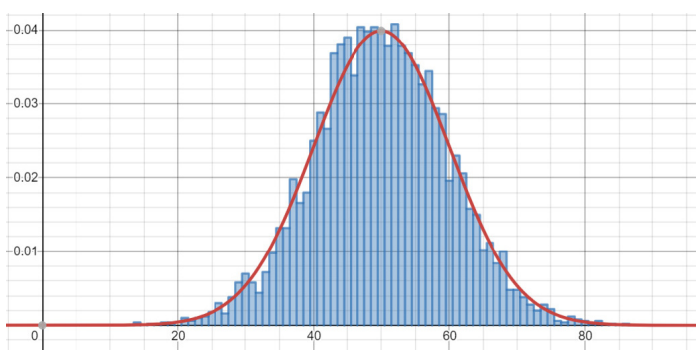
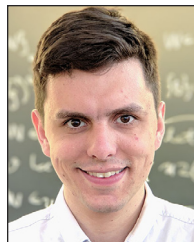


Figure 23

Studying data is both fascinating and important. We want our students to be literate in the information world we live in, and Desmos has made displaying and analyzing data simple. As always, Desmos continues to add new features, so send your requests their way! ▲

▲ REPORT: CANADIAN MATHEMATICS EDUCATION STUDY GROUP 2019 ANNUAL MEETING



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Ann Arden is a math teacher in the Ottawa-Carleton District School Board and is currently an instructional coach. She has also taught as a part-time professor in the Faculty of Education at the University of Ottawa. Ann is very interested in assessment to improve learning, especially through the use of evidence from conversations and observations. Ann is on Twitter as @annarden.



Egan J. Chernoff (@MatthewMaddux) is a Professor of Mathematics Education in the College of Education at the University of Saskatchewan. Currently, he is the English-language mathematics editor of the Canadian Journal of Science, Mathematics and Technology Education, an associate editor of the Statistics Education Research Journal, the Book Reviews editor of The Mathematics Enthusiast, and sits on the Board of Directors of For the Learning of Mathematics.

This year, the Canadian Mathematics Education Study Group (CMESG) met at St. Francis Xavier University in Antigonish, Nova Scotia from May 31 to June 4.

CMESG is a unique gathering for people working in math education. It attracts math teachers, math education specialists, and mathematicians from across Canada. The meeting is very welcoming, with many opportunities for socializing and networking. The format is refreshingly simple and stress free. There is no frantic rushing around, no deciding between a dozen parallel sessions. Often, there were only two or three choices of parallel session, each of which would appeal to a different kind of math educator. Much of the schedule is devoted to small-group discussion and working groups.

The working groups are the core of CMESG. Every morning, the working groups get together for four hours to focus on a particular issue in math education. Each group gets to hone in on a topic, and develop it over an extended period of time. This year, the working groups were:

- Problem-Based Learning in Post-Secondary Mathematics
- Teaching Primary School Mathematics. What mathematics? What avenues for teacher training?
- Humanizing Data
- Research and Practice: Learning through Collaboration
- Interdisciplinarity with Mathematics: Middle School and Beyond
- Capturing Chaos? Lenses into the K–12 Mathematics Classroom

The working group Parker attended, “Problem-Based Learning (PBL) in Post-Secondary Mathematics,” was led by Jeff Hooper (Acadia) and Laura Broley (Concordia). The PBL approach to teaching focuses on students’ experience of solving large open-ended tasks. This is not a new idea and, in fact, this year marks the 50th anniversary (!) of the first ever PBL program, which was launched at McMaster University’s School of Medicine. The CMESG working group designed a curriculum for “The Problem-Based Learning University,” which is a theoretical institution with 8000–10 000 undergraduates, 500 graduate students, with “standard” service courses, and no math program. We took a PBL approach to figure out ways of implementing problem-based learning. Working through a meta-application of PBL over several days was extremely instructive. We got to live the practice.

Parker’s take-away from the workshop was the following: “If I were to run a problem-based learning session in one of my courses, then I’d like to go through three levels of testing before trying the session with my students.”

- Try the problem on a non-mathematical friend. Is this interesting?
- Experiment with some math friends. What content might it have?
- Take the problem to a math club as a lesson plan. Where do people go with it?

Once I knew that the problem was intrinsically interesting, has some mathematical content, and wouldn’t go too wonky, then I would write it up as a lesson plan to be used in a real class.

Ann attended the “Capturing Chaos? Lenses into the K–12 Mathematics Classroom” working group, led by Darien

Allan (Collingwood School/Simon Fraser University) and Jean-François Maheux (Université du Québec à Montréal). We began by working on a task in small groups: “You are presented with a collection of coins spread out on a table, and told the number of heads that are visible face up (in this case, yellow). Is it possible (without looking) for you to divide the collection into two groups, with each group having the same number of heads face up?” The images below show Ann’s initial attempt to make sense of the problem. Figure 1 shows the case of one head, Figure 2 shows the case of two heads, and Figure 3 shows the case of three heads. It should be noted that any number of coins can (and should) be used.



Figure 1: Case of one head

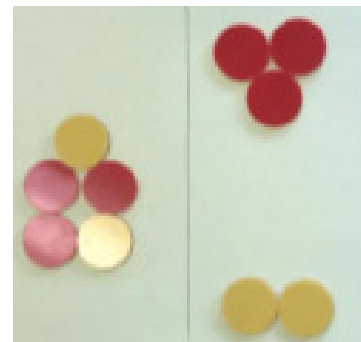


Figure 2: Case of two heads

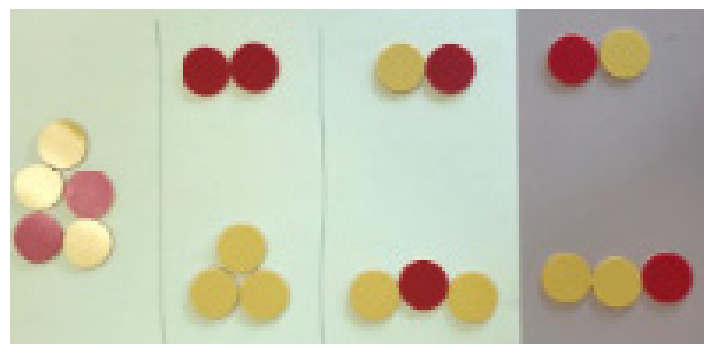


Figure 3: Case of three heads

At first, the problem seemed unsolvable, so we thought we had to break the rules that had been set out. When we finally arrived at a solution (no rules needed to be broken), it seemed to have arisen from intuition. A group member

asked questions that probed our small group's solution and built our confidence as we set out to systematically prove our solution. An interesting reflection that our small group had was that we could not trace where the ideas and intuition had come from, which made us think about methodological considerations in mathematics education research. The whole group came to agree that the problem (or any problem) exists in the system of interactions with the material, group members, text of the problem, facilitators, and other factors beyond the four walls of the room we were working in; and the chaos of the mathematics classroom exists in this system of interactions.

Some points and questions that Ann was left thinking about included the following:

- What seems chaotic to one teacher is not necessarily to another teacher.
- We wondered, with the same initial conditions, would we have ended up in the same place?
- What is the role of the teacher/facilitator? What “branches” do we break as we “walk through the forest” of a lesson? Facilitators only have partial understandings and have to make choices about what and who to attend to.
- What am I collecting as a teacher/researcher if I engage in the activity versus if I do not engage in the activity?
- People learn in different ways all the time—what are the boxes that prevent learning from happening/flowing?

Egan attended “Teaching Primary School Mathematics. What mathematics? What avenues for teacher training?,” led by Jennifer Holm and Vincent Martin. It was well attended by a diverse group who were all interested in the teaching, learning, and thinking of future elementary school teachers. It was clear, right from the very beginning, that this was a well-organized working group, and a great deal of thought was put into the activities.

There was a definite buzz in the room during the first activities, which required participants to role-play. One participant would play the student and the other would play the teacher. Not so fast, though, the task was for the participant, the one playing the student, to become familiar with a common mathematical error, and then it would be the teacher's job to help that student overcome the issue. The range of errors presented by the organizers was impressive and had quite the range.

Activities on the other days did not disappoint. Our efforts to decipher an approach to counting, which we were not intimately familiar with (ultimately rooted in bases other than

10) was met with different emotions from different people in the room. The different emotions were well handled by the leaders of the working group with the support of the rest of the room, which had been established during the earlier activities. Ultimately, this topic moved beyond discussions concerning the mathematics and branched into other topics related to future elementary school math teachers, such as anxiety, emotion, and other affective aspects.

One other activity worth mentioning, one that garnered a lot of discussion both during the working group and during other parts of the conference, involved reading excerpts from future elementary school math teachers' autobiographies. Given three very different excerpts, Jennifer and Vincent asked us a series of questions, both in our small groups and in a larger group discussion. The varying perspectives that were presented by the participants were, at times, striking to hear. It made one realize how quickly we judge teachers whom we have not even met, and that made for interesting discussions about future teachers, as well as the larger zeitgeist about online anonymity.

In addition to the working groups, there were various other activities that included two plenary speakers. The first plenary talk, “Discovering Mathematics Together with the Students,” was by Jean-Marie De Koninck (Université de Laval). Jean-Marie De Koninck is an amazing polymath. He is a prolific researcher in analytic number theory, a world-class swim coach, a math popularizer, and more! He told us about the growth and development of “Science and Math in Action.” We got to hear how a chance encounter with a TV crew at a math conference has grown into several full-time productions of theatrical math shows for elementary schools and high schools. Jean-Marie and his team developed ShowMath 1 and 2 (for high schools) and Le Petit ShowMath (for elementary schools). We also learned about the development of an online, multiplayer quiz game (mathamaze.ca), that challenges students to solve interesting math questions and puzzles developed for students by Jean-Marie's team. A screenshot from the game is included below in Figure 4. Jean-Marie's website is www.jeanmariedekoninck.mat.ulaval.ca/en/home/.

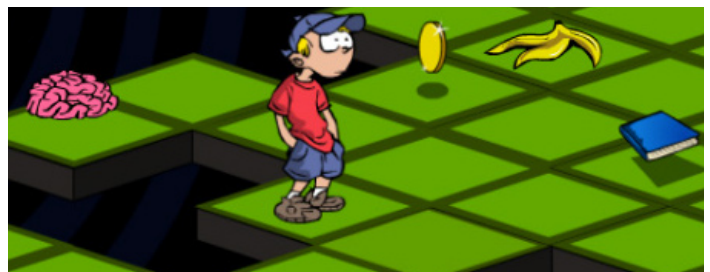


Figure 4: Opening screen in Mathamaze.ca game (Image from: <https://mathamaze.ca/index.php/about>)

The second plenary talk, “Mathematics as Dispossession: Reclaiming Mental Sovereignty by Living Mathematx,” was by Rochelle Gutiérrez (University of Illinois). Rochelle talked about her work, which focuses on issues of identity and power in mathematics education, with particular attention to how race, class, and language affect teaching and learning. Her work challenges deficit views of students who are Latinx (a gender-neutral term, instead of Latino and Latina), Black, or Indigenous, and suggests that mathematics teachers need to be prepared with much more than just content knowledge, pedagogical knowledge, or knowledge of diverse students, if they are going to be successful. They need political knowledge. At CMESG, Rochelle shared a holistic ecological approach to mathematics that she calls “mathematx” (pronounced: mathematesh). This approach values an embodied ethics-driven mathematics, and acknowledges the reciprocity inherent in all teaching and learning. This includes seeking, acknowledging, and creating patterns for problem solving and joy (including intuition, aesthetics, and meaning making), and reflecting an ecology of knowings (no universalism). She argued that current forms of mathematics do not honour the ways many nations view the work or create new knowings, and that mathematicians and math educators need to do more than apply mathematics in ethical ways. Rochelle’s website is <https://education.illinois.edu/faculty/rochelle-gutierrez>. If you are interested in learning more about Rochelle’s work on Mathematx, here is a link to a video talk, where she discusses some of this work at the Latinx in the Mathematical Sciences Conference 2018: www.youtube.com/watch?v=D266LYligS0.

Next year’s meeting of the Canadian Mathematics Education Study Group will be held at the University of Ottawa in late May or early June. The website for CMESG for information on upcoming meetings and to see the proceedings of previous meetings is www.cmesg.org. ▲



▲ OAME/NCTM REPORT: THE 2017 NCTM ANNUAL MEETING AND EXPOSITION



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The NCTM Annual Meeting and Exposition took place on April 3–6 in San Diego. The conference site encompassed the San Diego Convention Centre and the Hilton San Diego Bayfront. If you have never attended an NCTM conference (this was my NCTM rookie year too!), I would highly recommend making it a priority, if possible. How does the NCTM conference differ from other math conferences such as our own OAME/AOEM Annual Conference, and what were the highlights of NCTM 2019?

The first thing that struck me was the scale! The conference spans four days, and those days are packed with plenty to check out for the intrepid delegate. The variety of sessions offered during each time slot was impressive. There were three types of sessions offered at this year’s conference: workshops, sessions, and bursts. Workshops were intended to be interactive in nature and lasted 75 minutes. Sessions were lecture-style presentations and lasted 60 minutes. Bursts are a unique option that last 30 minutes and provide the delegate with quick learning on one specific topic. There were also exhibitor workshops offered during each session slot.

The opening plenary was delivered by Dr. Gloria Ladson-Billings, and the title of the talk was “Are We Still Solving for X? The Pedagogical Practices Limiting Students Success in Mathematics.” The opening session set the tone for what turned out to be a great few days of learning. Following the opening session, delegates were free to attend the sessions of their choosing. The sessions were streamed into different strands that included: Assessment (eliciting and using student thinking); Building on Students’ Strengths (practices that challenge, engage, and empower); Professionalism and Advocacy; Beyond the Classroom Walls (empowerment, access, and equity); Creating Inclusive Classrooms (meeting the needs of each and every student); Building Mathematical Knowledge for Teaching; Enhancing Mathematical Thinking Through Reading, Writing, Speaking, and Listening; For the Love and Joy of Mathematics; and a New Teacher strand.

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