The Mathematics of Mathematics Education

(Org: **Egan Chernoff** (University of Saskatchewan) and/et **Rina Zazkis** (Simon Fraser University))

REBECCA CARTER, Queen's University
Mathematical Inquiry with Concurrent Education Students

In Math 181, concurrent education students engage in mathematical inquiry throughout the semester. The course is not designed to teach a specific set of technical skills; rather, its primary objective is to explore what students can do with mathematics. The focus is on their personal experiences with inquiry-based learning and how these experiences can enhance their ability to incorporate inquiry-driven approaches into future classroom practices. This presentation will offer a "snapshot" of this process, discussing a specific task the students worked on. Additionally, preliminary findings from the research project will be discussed.

EGAN CHERNOFF, University of Saskatchewan
Popularizing the Mathematics of Mathematics Education

Many of the areas/topics/branches of mathematics are well represented in the teaching and learning of mathematics, school mathematics, curricula, and mathematics education. For example, geometry, algebra, arithmetic, calculus, topology, trigonometry, number theory, probability and statistics, and more are steadfast staples of mathematics education. The same cannot be said, however, for what I deem a crucial area/topic/branch of mathematics and mathematics education: popularization. Taking my argument a step further, I would argue that the key aspect to popularizing geometry, algebra, arithmetic, calculus, topology, trigonometry, number theory, probability and statistics would be to popularize the teaching and learning of said areas/topics/branches. However, for some reason, this popularization is not happening to the same extent in mathematics as mathematics education. Embracing, then, the mathematics of mathematics education, the purpose of this presentation is to contribute to the betterment of the popularization of mathematics through mathematics education. Popularization of mathematics education, as I will detail, should be drawing upon the popularization of the teaching and learning of mathematics, school mathematics, curricula and mathematics education, which will help wine and dine regular readers, especially those who are and who are not reluctant to reading mathematics for the masses.

SEAN CHORNEY, Simon Fraser University
Teaching Math for Social Insight: A Pedagogy of Mathematising

In this talk, I will share a pedagogical approach that seeks to improve learning in mathematics. This approach involves asking students to explore a social phenomenon using a mathematical lens. The idea is that by using mathematics, they gain a better understanding of the social issue, what it is, how it functions, and what its limitations are. My research, which follows from this pedagogy, examines how students describe the social practice in mathematical terms as well as how they argue and reason about their stance on the issue. I will share a political districting activity I created to demonstrate how students have used mathematics to make sense of the districting process.

EDWARD DOOLITTLE, First Nations University

GLEB GLEBOV, Simon Fraser University
The Non-Uniqueness of Decimal Representations and the Modified Long Division

This study investigates how students conceptualize the non-uniqueness of decimal representations of rational numbers. Prior mathematics education research has focused on repeating decimals, but this study examines students' conceptualization of a

more general concept of the non-uniqueness of decimal representations of decimal fractions. This study analyzes students' conceptualization of the non-uniqueness of decimal representations of rational numbers and relates it to their understanding of repeating decimals and long division. As part of an instructional intervention, the participants saw how to do long division in fractional notation with the intentional underestimation of the quotient. The data consisted of responses to questions, including responses to examples of using the modified long division to rewrite decimal fractions as repeating decimals. Before the instructional intervention, most participants regarded repeating decimals as infinite processes that only approximated rational numbers. After the instructional intervention, the participants began to view repeating decimals as objects rather than processes. The study proposes that the modified long division was crucial in enabling the participants to move toward this conceptual shift.

DAN KRAUSE, University of Saskatchewan
On Assigning Meanings in Mathematics Education

There are two broad categories of mathematics taught in school that differ in how meaning is assigned to them by researchers of mathematics. Mathematics that are discovered which possess inherent meaning, and mathematics that are collectively decided upon, i.e. decided meaning. Both inherent and decided meaning become the assigned meaning in the field, as determined by mathematics researchers. In contrast, researchers of mathematics education have additional factors to contend with as meanings are discovered, decided, and assigned within mathematics education. As math education researchers engage in both theoretical and empirical research within the field, particularly, external groups, organizations, and narratives have an influence on the process of assigning meaning to the discoveries and discussions in mathematics education. This talk will discuss the assignment of meaning in mathematics education and examine how some of the external influences are shaping the meaning of concepts in the field of mathematics education.

WES MACIEJEWSKI, Red Deer Polytechnic
Teaching Mathematical Practice

The rapid evolution of technology means the mathematics once valued by society has fallen into irrelevance. This is not a new trend; any curricular topic serves the learner for just a brief period of human history. Acknowledging this, I ask: what might be a curriculum centred on mathematical practices rather than on typical mathematical topics? Further, what mathematical practices are common across topics? I'll identify some of these practices, discuss how they could be taught, and call on participants to imagine a transcendental, practice-based curriculum.

AMI MAMOLO, Ontario Tech University
Mathematics in society – what is on the horizon?

Recently, the *Journal of Mathematical Behavior* published a Virtual Special Issue *Mathematics in Society: Exploring the mathematics that underpins social issues* (Eds. Mamolo and Thanheiser). The aim of the VSI was to highlight educational research into the variety of mathematical content, skills, reasoning, behaviours, and disciplinary values needed for, and used in, society. This presentation reflects on the VSI contributions and authors' interpretations of our aim, with an eye toward the mathematical horizon.

ALAN PASOS, Simon Fraser University
Coping with Coercion in Logic

The ability to make a logical inference is at the heart of mathematical experience. However, a personal reasoning does not always follow the rules of formal logic. In this study we focus on the responses of one participant to scenarios involving coercive logic (the construct will be defined and exemplified). This allows us to take a detailed look into what guides and what influences the participant's approaches to various scenarios. I will argue for the relevance of coercive logic to mathematics education, in particular, in exploring mathematical reasoning of students.

PETER TAYLOR, Queen's
Discrete Optimization for school and university

I am finding that my colleagues in the life-, social, and computer-sciences are less interested in calculus and gravitate more towards discrete processes and patterns in data. This is even reflected in the redesign of their majors—how much and exactly what math to require. That's an interesting trend which should ultimately have significant consequences for the types of problems we work with in both school and teacher education. The good news is that these topics (data-driven investigations, recursive thinking, pattern recognition) are more hands-on, more fun to work with, and support play and mathematical thinking much better than curricula whose sole purpose seems to be to prepare kids for university calculus. I will give a couple of examples.

NIA TZVETKOVA, UBC

NAHID WALJI, University of British Columbia
Incorporating student-perspective resources into a proofs course

The Mathematical Proof course at UBC is known amongst students to be a particularly challenging course, since many will have their first encounter with writing proofs. The main goal of our project was to bridge the gap between the perspective of the instructor and that of students currently in the course. This was achieved via the creative input of undergraduate student collaborators who had succeeded in the course in the past. As a team of student-faculty collaborators, we observed that the approach of building student intuition by discussing common misunderstandings and errors is sometimes underserved in mathematical materials, and we sought to redress this balance. This is a joint talk with Nia Tzvetkova.

RINA ZAZKIS, Simon Fraser University
Mathematical Incidents and resulting research

Mathematics teaching, at any level, involves some unforeseen incidents, which may include unexpected student ideas, solutions or questions. Occasionally, these serve as an inspiration for personal mathematical investigations, as well as for the development of research projects and instructional engagements. I will exemplify several of these "incidents" and describe the resulting research studies and teaching scenarios aimed at investigating and supporting students' mathematical knowledge.