Learning Math Through Experimentation and Exploration
Apprentissage des mathématiques par l'expérimentation et l'exploration
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AMENDA CHOW, York University
Session Debrief Discussions

Amenda will lead a debrief discussion summarizing the session. We hope these discussions will be illuminating and an opportunity for personal reflection on what was learned from the session, takeaways and future thoughts.

HANNAH CONSTANTIN, University of Toronto
"Introduction to Proofs" as an Invitation to Exploration

As mathematicians, we recognize that the pursuit of mathematics requires exploration, experimentation, and a good deal of patience, and that outcomes are often uncertain. Students, however, sometimes struggle with the preconception that when it comes to math, either you "get it or you don't." How do we manage to convey the "mathematician as explorer," rather than as automaton? More importantly, how can we help students see this path of inquiry as one that is open to them, and encourage their sense of autonomy and capability in engaging in mathematics?

In this talk, I will discuss some methods I used in an "Introduction to Proofs" class to try to address this question. These include discovery-based learning techniques in lectures and tutorials, an emphasis on the role of conjecture in mathematics, and alternative assessments. In particular, I will speak on the use of a "two-stage" midterm involving exploratory group work, and a long-term individual reflective/creative project, the "proof portfolio."

LAUREN DEDIEU, University of Calgary
Experiential Learning in Undergraduate Mathematics Courses and Outreach Initiatives

Mathematics is all about asking questions. It is a creative discipline with inquiry and discovery at its heart. Unfortunately, in my experience, many students don't view mathematics in this way. In this talk, I will outline how I work to foster a sense of excitement about mathematics and encourage students see mathematics in a new light through experiential learning activities that promote exploration and critical reflection.

SUSAN GEROFSKY, University of British Columbia
Exploring and experimenting with the mathematics of classical labyrinths

This presentation and hands-on workshop will give participants the chance to experiment with the little-known mathematics of labyrinths. After an introduction that contextualizes the Restorying Math project and something of the history of labyrinths, participants will be able to explore variations in labyrinths based on their 'seed' diagrams. We will work on small and medium embodied scales, using paper-and-pencil and whiteboards, and then at a large scale, making, walking and dancing the labyrinth we create in the extended post-talk workshop. There will be opportunities to reflect on our own processes of experimentation and exploration, and discuss how this might contribute to pedagogical design in our teaching.

Note that the large scale labyrinth making will take place in an extended hour-long workshop immediately following the 30 minute talk.

VESELIN JUNGIC, Simon Fraser University
No strangers at this party

In this presentation I will describe students' project in an upper division math class that resulted in a podcast titled "Ramsey theory: No strangers at this party."

Through their conversations with undergraduate students, some of today's most notable Ramsey theorists talk about their first experiences with mathematics, their times as undergraduate and graduate students, their views about Ramsey theory and mathematics in general, and about their research interests.

As one of the students put it: "The podcast project we did was extremely helpful. It made me realize once again the reason for liking math. Talking with great mathematicians inspired me a lot. I realized my passion is not lost."

MARIE MACDONALD, Cornell University
Using projects, workshops and inquiry to explore in Linear Algebra.

Over the past years, we have been redesigning several math courses to incorporate active learning. I will go over some of the activities that have been created with the goal to increase student engagement during class time as well as giving students a more hands-on and applicable experience in linear algebra. Both our large introductory lecture and upper-level small class have been redesigned in ways that can be easily picked up by future instructors.

DIANA SKRZYDLO, University of Waterloo
Interactive Games for Probability Models

In a third year Statistics course in Probability models, we use many theoretical models including Discrete Time Markov Chains and Brownian Motion. Sometimes it can be difficult for students to understand why and how these models come about without tangible examples, so I use games and interactive activities with coins and dice to demonstrate the development of the models. Through the games, students often discover the properties of the models themselves, before being taught them. In this talk we will actually play one or two of the many games I use, and I will share how I integrate them into my teaching.

BRETT SMITH, Yale University
Exploring calculus with stories

Calculus students frequently criticize introductory classes for being disconnected from their experience in the real world, and this disconnect can create barriers to learning.

In an attempt to combat the misconception that math is not connected to work in the real world, my colleagues and I are creating Calculus Stories: interviews with experts in applied fields who use calculus in their work. These stories highlight diverse math experiences and perspectives, focusing on who uses calculus in addition to how it is used. We ask our subjects how they came to do the work they do, what it is like to work in their field and collaborate in teams, and how they deal with frustration and failure.

By integrating our interviews into a large, coordinated calculus 2 class, we hope to affect students' motivation and mindset, encouraging exploration and redefining "success" in the course. In this talk, we will present details and examples from our Calculus Stories, as well as feedback from students and instructors who have used these materials.

ASMITA SODHI, Dalhousie University
To project or not to project: Alternative assessment in first-year linear algebra

Late March 2020, in the living room of a one-bedroom apartment which has been converted into a makeshift office. Asmita is sitting at their computer. They have just received a job offer, and now realize they have to plan a fully-online offering of first-year linear algebra within just a few weeks.

A question many of us have grappled with in the last two years is: how do we fairly evaluate students in an online, heavily computational class, where there are online calculators freely available that can do most of the work for you? To give myself an opportunity to evaluate students on work that a calculator couldn't do for them and to get students engaging with the

course material in new ways in an asynchronous class, I chose to include a final project in my class, which asked students to write about an application of linear algebra that was of interest to them. The result was a number of wonderfully creative projects, and the sense that many students had a better appreciation of linear algebra than they did before. In this talk, I'll speak about the evolution of this project, and what I (and my students) learned from it.

PETER TAYLOR, Queen's
Paradise Lost

For me the play's the thing, and I will talk about a problem from my linear algebra course that I will have been playing with in a grade 7-8 camp in late May. I will use the chance to muse on the elementary classroom paradise that is so quickly lost, and the possibilities that it can be regained in first year.

THOMAS WOLF, Brock University
Comments on a Collection of Experiential Learning Resources

In the talk a number of math experiential learning resources are described that have been created for and used by middle and high school students. These activities are in a wide range of topics: geometry, proofs, combinatorial game theory, knot theory, programming and smaller activities in other areas related to algebra, topology and graph theory. The resources range from 2 hour to 10 hour activities, some are open ended. Comments on impact are based on direct feedback from students and on counts of web access indicating how far students proceeded in these online activities.