Skills Coaching in the Mathematics Classroom
Entraînement des compétences dans les classes de mathématiques
(Org: **Tyler Pattenden** (King's University College) and/et **Andrew Skelton** (York University))

DARJA BARR, University of Manitoba
Test Anxiety: Fight or Flight?!

As more and more of our students seem to be experiencing significant anxiety during and around test times, we may be asking ourselves if there is anything that we can do. One school of thought suggests minimizing or even eliminating high stakes exams in favour of lower stakes tests and other forms of assessment. Another strategy proposes that there is a place for high stakes examinations in education, and that rather than finding ways of avoiding them, we should be focusing on equipping our students with the skills to face the challenge head-on. This talk will focus on ways to model and hone good test taking practices in the post-secondary mathematics classroom.

CARMEN BRUNI, University of Waterloo
Years in the Making - The Story of CS136L

Functioning programmers in the modern day require skills using basic productivity tools such as bash scripting, version control, IDE navigation, testing skills and debugging skills. For nearly twenty years, mathematics students at the University of Waterloo have had this material integrated into courses as content they should know but that instructors would take limited to no class time to cover. Finally, after nearly two decades, the first lab course in the Faculty of Mathematics, CS136L has been approved, created and its first offering delivered. In this talk, we describe the story of how this material was thrown around several different courses, how it eventually found its new home, what is in the course, and some of the grading principles used in the course.

MATTHEW CHEUNG, York University
Designing a Developmental Mathematics Course to Support Productive Struggle

Productive struggle can enhance the developmental mathematics classroom. Developmental mathematics is a sequence of required courses for students needing to build their knowledge in mathematics (Boylan, 1999). Calls have been made to reform developmental mathematics courses as over half of U.S. (Fong et al., 2015) and over a third of Canadian students (CSAP/PREC, 2015) fail to move on to their college programs and subsequent careers. Implanted in this "graveyard of dreams and aspirations" (Merseth, 2011, p.32) is instruction that over-relies on content-focused knowledge transmission delivery models (Bailey et al., 2015; Grubb et al., 2011), with students only able to call upon memorized rules and procedures (Stigler et al., 2010) while lacking belief that they can succeed in math (Zientek et al., 2019). Productive struggle provides an answer as students are supported in their efforts to understand mathematics that are not immediately apparent (Hiebert and Grouws, 2007; Warshauer, 2015). Supporting productive struggle requires instructors to help students consider underlying mathematical principles (Lynch et al., 2018) through collaborative tasks (Murawska, 2018) to guide and scaffold students' thinking through confusion and errors (NCTM, 2014). In doing so, instructors are required to move away from "remedial pedagogy" (Grubb, 2013, p.13), where teachers emphasize correct answers, rules, and procedures through drill and practice. Well-documented is the impact productive struggle may have on K-12 classrooms, but few (e.g., Bickerstaff and Edgecombe, 2019; Edwards and Beattie, 2016) have extended the work into developmental mathematics.

ANA DUFF, Ontario Tech University
Teaching Problem-Solving Using a Systematic Framework

Problem-solving is a quintessential skill applicable to every sphere of our lives and is a foundation of teaching mathematics. In this talk we will discuss a pedagogical approach to teaching problem-solving using a problem-solving framework that is universal

in nature. The discussion frames the problem-solving process with the focus on the problem's deliverable while addressing the inherent and specific conditions on the deliverable in a systematic way, using the dual principle of eyes-on-the-prize and just-in-time information. The framework proposed (and classroom-tested) acknowledges the importance of many skills in the problem-solving process, including but certainly not limited to literacy, recall, reflection, analysis, and focus. Teaching through this framework actively draws attention to, engages, and thus builds those skills. Mathematics, by its necessity in the art of living and its ubiquity in every education system, provides a perfect opportunity to grow these fundamental life skills through the application of the problem-solving framework we propose.

CHRIS EAGLE, University of Victoria
Simulating mathematics research in the classroom

The experience of doing mathematics in a homework or examination setting is very different from the experience of mathematical research, and students transitioning from undergraduate mathematics to a graduate program are often surprised at just how different research is from what they spent most of their time doing as an undergraduate. Undergraduate research experiences can help bridge this transition, but they are not available to all students.

In this session I will share an activity that I have used in upper-level math courses (particularly topology and measure theory, though I believe it adapts fairly easily to other settings) that aims to give students something like a taste of mathematics research within the confines of a course. The activity is designed to help develop research skills (such as clarifying the problem, formulating conjectures, and setting goals) while remaining contained to a relatively short amount of time and being focused on topics from the course at hand. The activity also contributes to developing teamwork skills and includes a significant reflective component.

I will share both my impressions of the results as well as anonymous student feedback. I will be very open to your suggestions for further improvements.

PETER HARRINGTON, University of British Columbia
Group work, reflection, and mathematical communication in a large first year calculus course

This past year, the introductory calculus course at UBC was redesigned to primarily emphasize group work, with a secondary emphasis on reflection, and clear mathematical communication. The course was designed so that one of the three contact hours a week was centred around active learning in a smaller class. Students formed persistent groups; they sat with their groups during class, and completed five challenging written group assignments together. Notably, each group assignment began with a reflection question and the grading rubric included items for clear mathematical communication.

At the end of the course we ran student focus groups and analyzed end of term surveys to determine how students experienced the different components of the course. Here we will present the relevant details of the redesign, the results of the student focus groups and surveys, and our own reflections on improving the course for next year. In particular, we comment on the challenges of doing this at scale, with over 4000 students.

BURCU TUNCER KARABINA, University of Waterloo
The Whys, Whats, and Hows of Feedback

Changing technology is disrupting the educational landscape at an alarming rate. 65 percent of today's students will graduate into jobs that do not yet exist, according to the World Economic Forum. Over 85 percent of the jobs in 2030 have not yet been invented. Hard skills tend to have a shelf life of five years. What effect will this analysis have on modern workplaces? Is it time to shift our emphasis from raising knowledge workers to raising learning workers? What are the skills needed as a result? Soft skills will gain importance. Through mathematics, students are able to acquire and master complex problem-solving, reasoning, analysis, creativity, active learning, critical thinking, and programming skills. According to Forbes (2109), 15 soft skills you need to succeed when entering the workforce are empathy, the ability to influence peers, emotional intelligence, curiosity, positivity, active listening, humility, communication skills, creative problem solving, resilience, observation skills, the ability to contextualize, willingness to ask questions, relationship building, self-awareness. How many of these are part of our

math curriculum? What soft skills can we tap into by changing the way we assess student learning and provide feedback? This talk will examine the implementation of a peer feedback mechanism in a project-based mathematics course called "Introductory Algebra for Social Sciences." We will also take a look at the history of feedback and look at how different forms of feedback have increasingly become integral to learning theories and designs.

JESSIE MEANWELL, McMaster University
Takeaways from Teacher Desmos: implementing an interactive tool to encourage visual thinking in complex analysis

In higher-level mathematics education, there is a need for exploration into pedagogical methods beyond the passive lecture and textbook approaches. I built an interactive activity for students learning complex analysis to encourage using visual representations of complex numbers and their manipulation. The aim of the activity was to help students build a strong visual understanding of the mathematics they were learning and to foster student exploration. In this session, I will share takeaways from the development of the activity (built using Teacher Desmos) as well as the evaluation of its success: via students' feeling of learning, a user experience questionnaire, and test scores. I will also talk about how this activity and its evaluation scale to other skills and topics of mathematics.

ANTON MOSUNOV, University of Waterloo
Problem Solving Sessions and Presentation of Proofs In Advanced Algebra Class

In Fall 2022 I taught a first-year Advanced Algebra course aimed at developing students' abilities to read, write and discover proofs. Understanding that collaboration and communication are among the top skills of any practicing mathematician, I organized my lectures so that each class had a group problem solving session, followed by a presentation of solutions to given problems to the entire class. In this talk I intend to outline the details of implementation of this course (semi-flipped classroom model, group assignments using Coq proof assistant, etc), reflect on course components that proved to be most beneficial for student learning, and discuss improvements that could be introduced in the future.

FABIAN PARSCH, University of Toronto
Teaching and assessing student writing in two-stage team assignments

A core learning goal of my applied math courses is improving teamwork and written communication skills. One way that I teach and assess these skills are writing-focussed team assignments. I have used such assignments over the last three years in both online and in-person classes that range from 50 to 900 students. More recently, I expanded these assignments into a two-stage process where students first receive feedback on a draft that allows them to reflect on their writing before making their final submission.

In my talk I will explain what priorities and learning goals influence the design of these assessments, how I ensure that all students in each team contribute to the assignment, what kind of rubric I use so that students can get a high writing score even if they have mathematical mistakes, and how TAs provide individual feedback to students.

Of course, no design is without fault and I will also elaborate on the challenges I am facing in the facilitation of these assignments. Two examples are dealing with tricky team dynamics, as well as effectively communicating to students that good writing is not necessarily about being mathematically correct, but instead much more about understandably verbalizing your thought process.

DIANA SKRZYDLO, University of Waterloo
Teaching and Assessing Professional Skills

There are many important life and professional skills that students need, which are often not taught or assessed in statistics and mathematics classrooms. When students enter the workplace, they will be expected to: work in teams and have accountability to their team members; communicate technical results in writing for various audiences; design and deliver presentations and field questions; give and receive meaningful feedback; and self-reflect on their goals, progress, and achievements.

Educators should provide opportunities for students to develop these skills throughout their undergraduate education. Moreover, I believe these should be integrated with their technical education, not only as a separate course.

This talk will discuss best practices for incorporating professional skills using team projects, reflective writing, and other authentic assessments. Participants will also be invited to share their own practices and will come away with tangible ideas for incorporating these skills into their classrooms and assessments.

ASMITA SODHI, University of Victoria
Developing Metacognitive Skills through Guided Reflection

Understanding how one thinks and learns, called metacognition, is an essential part of being an effective student. This is especially important in self-directed learning, where a student has an extra level of independence – but reflecting on one's learning is a skill many students haven't had a chance to practice. Working as both a math instructor and a study skills coach during the 2020-2021 academic year, it was very obvious to me that my students were struggling with their study skills (including metacognition) even more than usual, especially as many of their online courses were taught asynchronously. In this talk I will describe a weekly reflective exercise used in two condensed, asynchronous online courses in 2022, some student feedback on this exercise, and how I might evaluate the use of such a tool in future.