First Year Workshop Notes, BIRS, Banff, 8-10 February 2019
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First Year Workshop/ BIRS/ 2019 – Feb 9 (Day 1)

Morning:

Welcome and Introductions (Miroslav and Veselin):
- Introductions around the room
- 24 people in attendance, from east coast to west.
- The is a 'practical' conference, among people who have their boots on the ground.
- Goal is to emphasize teaching practice, and share actionable ideas.
- May 5 conference aimed at expanding our reach.
- Problem with the repository: it is not well-known. Thus, a bi-monthly email with newsletter is coming to share info about the repository and other teaching tidbits.
- CMEF is not continuing, but we hope that this forum, with its more narrow scope, will continue and grow.

Brian Forrest:
- Teaching First Year Mathematics: Service Courses
- Says he was chosen because he is old ☺ (but it is actually because he is an international math education idol).
- Things are changing in the math ed community across Canada, getting younger.
- Phd students are becoming more and more serious about the teaching aspects of their education as graduate students.
- Around the room: what are the service courses at your institution and what is the target audience?
  - Waterloo: 1900 students study mathematically rich subjects every year, Calculus taught for a variety of audiences.
  - U Manitoba: an example is Math in Art, target audience intended to be fine arts students but now all kinds of students who need their math credit (M-Credit requirement).
  - UBC: main service course is differential and integral calculus for science and business students (non-math majors).
  - U of A: stats is also a huge service course, demand is higher than supply. Intro to applied stats has around 4000 students. Second stat course is also very popular as a service course, particularly for Psychology. Engineers have a 3-sequence calculus course as well as linear algebra and differential equations among others. There is also a service course for education course.
  - U Regina: Calculus and stats are bread and butter, also have finite math courses geared at teachers.

- Education and mathematics had very tenuous links at Brian's graduate university (U of A) and education was not enthusiastic about linking mathematics and education as a degree option for Brian. Brian taught his first math course there (as a first year masters student at age 21) and was hooked. He started teaching at NAIT in 1982, where every math course was a service course.
- The requirement of math drives service courses.
- Who teaches service courses:
    - Young research faculty are under heavy demands and are under pressure to focus on "research first and teaching second".
    - At Waterloo a significant proportion of service courses are taught by Lecturers, many who are under contract, or post-docs or graduate students (who are not invested in development and innovation).
    - Some universities (SFU) have policies regarding research faculty cycling through first year courses.
    - At Queens, about half and half of research faculty are quite invested in service teaching.
- Class sizes vary greatly from institution to institution.
- Are students prepared to succeed?
    - How do you identify, remediate and correct background deficiencies?
    - Yale puts students through a pre-designed program to prepare them for their university mathematics education (about 8 weeks). May not be feasible on our larger scale.
    - At Waterloo, students have higher incoming grades and are better prepared as compared to some other Canadian Universities.
- How do we define 'success'? How do the departments that we serve define 'success'? How do students define 'success'? Can we bring the perspectives together?
    - Could be grasping high level ideas, could be designing proper models; it depends on the course.
    - Why should we care?
- The Students' Perspective:
    - The Good: I am here to learn… teach me.
    - The Bad: I just want a good grade, or to earn my credit (a lot of pressure from entry into competitive programs) – These guys are worth the effort!
    - The Ugly: I have no interest, don't expect any effort.
- Assessments can be a means to help students succeed.
    - There is a 'feedback loop' between lectures, online assignments (low stakes, quick and frequent, instant feedback, basic skills), and written assignments (higher stakes, more conceptual, fewer per term)
- Blended learning can work well to cover content and reach a wide variety of types of students if it fits the course and the resources are there and well developed.
- We CAN have a lasting impact on our discipline through the students that we teach, by giving them the richest experiences that we can.

Repository Overview: (Sasha and Laura)

- firstyearmath.ca
- About 360 courses in the Course Database currently
- Users can read and access information and members can request to edit the database
- Searching can be made more efficient/accurate with more standardization or a keywords field

Service Course Discussion (Captain Kseniya and Captain Andie):

- One definition of a service course is "any course that is included in a program in order to achieve the objectives of the program that is provided by a school other than the school that owns the program".
- Participants feel that this might be a bit ambiguous – what is meant by 'school', or 'objectives'? There is also a difference between service courses that are built FOR other departments, versus courses that are shared between math students and other students.
- One definition is that EVERYTHING is service except honours math courses.
- What are the most common service courses, who decides the objective and revises the courses and how?
  - Most common are Calculus, Linear Algebra and Stats.
  - Learning objectives should be a conversation and collaboration between those who need the course and those who teach the course. Ultimately, however, it is the math departments' responsibility to design and deliver a math course.
  - Professional accreditations (ie, engineering, actuarial sciences) is also a consideration.
- What does a healthy relationship between two collaborating schools look like?
  - There SHOULD be meetings and communication.
  - Could tap into resources within the department, people who collaborate or have joint appointments.
- Is it important to teach mathematics as a mental activity for critical thinking, or delivering only the mathematical content that is required?
  - Both are important, both have value, both are intertwined.
  - Too much focus on techniques can lose the focus on the concepts behind those techniques.
- Who should teach the services courses?
  - It depends on the person, and it depends who you ask.
  - Traditional disciplinary boundaries are disappearing, reinforcing the need for communication.
  - Some universities have actually hired 'outside' experts (like physicists or biologists) to teach service courses within the mathematics departments.
  - We can lose credibility if our 'application' problems are not accurate with respect to their own discipline.
  - We can standardize foundational material, and leave the rest flexible to context.

- Blended learning can be used to address the content vs concept dichotomy.

Afternoon:

Math for Education Students Working Group (Captain Barbara, Shawn, Darja, Nancy, Peter):

- The repository could help to standardize what "Math for Teachers" courses teach, which seems to vary greatly from university to university
- Math for Teacher courses are clear service courses, some are dedicated to and restricted for teachers or teacher candidates and others are open.
- At some universities the Education degree is concurrent and at others it is consecutive, which also adds difficulties.
- At some universities course is taught by dedicated person(s), at others it is taught by sessional instructors and graduate students.
- Some universities offer math courses for elementary/middle years teachers, others offer courses specifically for secondary math teachers, while at some universities secondary teachers take math courses with the general public.
- At some place there are links between the math faculty and the education faculty, at others there is not. It may depend on whether the course is restricted to education students or not. At some places there is a complicated history that plays a role, at others collaborations are rich and productive.
- There are some good examples of collaboration both in teaching math for education courses, and in other academic/administrative things like conferences and symposiums.
- Most departments teach math for education students for reasons that are not financial, but rather for the chance to affect teachers in terms of skills and attitudes.
- For some groups there is much more emphasis on portfolios, group work, presentations, investigation etc. for teachers or teacher candidates. For others, there is no change fin teaching strategy or the cohorts within the class, or between the education courses and other math students.
- Dealing with math anxiety can be done through an open discussion and acknowledgement of the common issue, creating more/multiple low stakes and scaffolded learning and assessment opportunities, clear expectations and learning objectives, and building relationships. If the students feel like we CARE about them, anxiety can be reduced. We can also help to guide them in terms of the tasks that they should be completing as the course goes on. Incorporating enthusiasm, history, stories.
- Fail rates for math for education students vary by university, and are similar to fail rates in other courses.
- Open resources for education sources can encourage critical thinking and lifelong learning. Most of us are opposed to making students purchase resources.

- One big problem is the lack of standardization of these courses across Canada. Another is the disconnect between Mathematicians and K-12 Educators.

Gerda de Vries:
- *How do address the diversity of the student population in service courses?*
- Teaching Calculus 'for the masses' and 'Science 101' – an interdisciplinary science course – at the U of A. The latter made Gerda think much more deeply about the former.
- Took 'Calculus for the Physical Sciences' out of the 'Calculus for the masses' stream.
- This course has a blended learning format (video lectures outside of class, active learning and problem solving activities in class).
- Now there is a similar format for 'Calculus for Life Sciences', and soon 'Calculus for Business Student'. These will phase out the 'Calculus for the masses' course.
- What do/should/can we teach?
  - We should have a much wider variety of courses rather than pumping everyone through Calculus.
  - Perhaps more specialized courses on abstract mathematical thinking and reasoning.
  - There is an expectation for more applied content in specialized calculus courses, yet also the expectation that these courses are interchangeable, leading to courses that are packed with content.
- How do/should/can we teach?
  - People are starting to experiment with different methods (like blended learning).
- How do/should/can we assess?
  - We need to get better at articulating what students need to be able to do when they come out of our courses.
  - Repository limits assessment categories to homework, tests and exams.
  - Most final exams are in the 50-60% range.
  - Institutions seem to be moving towards more frequent term assessments, and lower stakes final exams BUT more classes with more frequent assessments can lead to never ending assessments for students.
  - There are interesting ways to do mark breakdowns or exam regulations to combat cheating on term work.

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Working Group Reports:
- *Service Courses for Physical Sciences and Engineering*: We all do this and we all do it differently in terms of things like class size, assessments, exam formats, tutorials, etc.

Applications are desirable, but only if they are authentic, like project based applications. The idea of guest speakers was raised as a potential source to tap. Most courses try to do a combination of 'Just-In-Time' teaching of necessary skills and mathematical reasoning. There is a danger of other departments taking over these service courses, which was agreed to not be a very good thing.

- *Service Courses for Arts, Humanities and Social Sciences/Business Students*: Some universities have all of these students together, others keep them separate. There was quite a bit of diversity in approaches to service courses for these audiences, but when it came to the business classes it was uniform that the only change to these courses from the norm was the context of the examples. These examples often are not authentic. Often help center employees or TAs have trouble covering the content of these niche courses, which can be a challenge. Sharing resources throughout these courses would be very useful.
- *Service Math and Stats Courses for Life Sciences*: Course sizes and difficulties vary greatly, but all had in common that authenticity in these courses is very important. However, teaching authentically is difficult and likely not happening everywhere. There are things that can be reduced or eliminated to leave room for more authentic work. Equivalency requirements can still be retained when the 'procedural core' remains. These types of courses can put higher demands in students' language skills. There are lots of resources out there for people to share.
- *Service Courses for Mathematics Education Students*: These issues can be very political and sensitive. We agree that someone should set a minimum standard that elementary students should meet in mathematics, and that above 70% of students should be meeting those standards. However, if we use standardized tests as this measure, half of the students are not meeting those standards in Ontario. There are also math tests given to teachers in some provinces. The repository can help to standardize Math for Educators courses across Canada, because as of now there is little consensus in Math Ed course offerings. However, there is close to no collaboration with Faculties of Education happening at universities across Canada. The main issue in these courses is the weak mathematical background of the incoming students, but there are also disconnects between mathematicians and other stakeholders that create difficulties. These courses are taught by a variety of types of instructors, but perhaps we should be putting our best instructors on these courses due to the trickle-down effects that they can have.

5-minute Teaching Snapshots:
- Andie: Workshop with parents and university instructors
- Matt: Instructor support group
- Fok: Small class model with grad and undergrad teaching assistants
- Jenna: Journaling with the Aboriginal Nursing Cohort Initiative and an evening class
- Lauren: Oral and written communication in second year Linear Algebra
- Michelle: Failure rates and consistency problems in Elementary Discrete Math course
- Randall: Math in computer graphics, for an interactive arts and technology program
- Laura: Callysto basket weaving notebooks

- Patrick: Big and small number visualizations
- Gerda: Curve sketching song
- Kseniya: Problem-based approach for Calculus
- Indy: Sharing some research on courses and teaching using puzzles
- Tyler: Using courseware to isolate confusing questions and putting them on the exam
- Shawn: Using the repository to inspire departments, students, colleagues, and ourselves
- Darja: Pre-Calc to Calc transition issues
- Miroslav: Computer labs in a large, math for life sciences course

Peter Tayler:
- Integrity.
- Inspired by Dewey and other educators from the past – giving students an 'experience'.
- Working with problems that mean something to him, not worrying about covering all of the content.
- Interested in understanding and working with complex systems, and wants his students to do the same.

Shawn and Vincent:
- May in Edmonton for next First Year Meeting!