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Les Notes pédagogiques présentent des sujets mathématiques et des articles sur l'éducation aux lecteurs de la SMC dans un format qui favorise les discussions sur différents thèmes, dont la recherche, les activités, les enjeux et les nouvelles d'intérêt pour les mathématiciens. Vos commentaires, suggestions et propositions sont les bienvenues.

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This issue marks the start of my eleventh year as a co-editor of Education Notes, including eight years with Jennifer Hyndman and continuing subsequently alongside Kseniya Garaschuk. That timeline of 2010 to the present coincides with an outreach initiative. In fact, it was in the fall of 2010 when initial funding came from the Atlantic Association for Research in the Mathematical Sciences (AARMS) to support Enhancing our Appreciation of Mathematics through Intentional Community Outreach. The outreach has taken many forms over the decade. Steady support from AARMS has been valuable in enabling the development on many levels. This piece will feature a discussion of aspects of the outreach along with some reflections on my part as to what has been important in the experiences.

Let me begin with three forms of acknowledgments. This reflects the fact that at the core of sustainable outreach has been the development of relationships with communities (especially schools) and individuals (particularly teachers and students). The acknowledgments respectively address the territory, the people and the institutions.

Acknowledgments

Territory:

We recognize and respectfully acknowledge that UNB in Fredericton is situated on the unsundered and unceded traditional lands of Wolastoqiyik (Maliseet). This territory is covered by the Treaties of Peace and Friendship which the Wolastoqiyik (Maliseet), Mi'kmaq and Passamaquoddy peoples first signed with the British Crown in 1725. The treaties did not deal with surrender of lands and resources but in fact recognized Wolastoqey (Maliseet), Mi'kmaq and Passamaquoddy title and established the rules for what was to be an ongoing relationship between nations.

People:

Many people have played a significant role in supporting the outreach initiatives over the years. First and foremost, I would like to recognize the significant contributions of Ryan Jones who has been present in numerous activities as a facilitator, teacher, and colleague over the extent of the outreach. He continues to provide support and valuable feedback through his leadership role in mathematics education. Second, there are many others who have offered valuable time to voluntarily support classroom visits, community events, or other activities. Included among these people are Kelda Smith, April Wilson, Gaelan Hanlon, Julie McFawn, Farzad Saeidi, Jean MacDonald, and Saul Hernandez.

Institutions:

As mentioned, the support of AARMS has been valuable. A pilot grant of \$1000 was followed up by a top-up of \$4000 in 2011. Since that time there has been approximately \$2000 annually provided to sustain the outreach. The supports cover basic travel costs, resources and some employment costs. Usually any employment costs cover a previous volunteer who may forego a day of supply teaching to be available for an out of town full day outreach visit, or otherwise providing offset of partial costs in conjunction with a subsidized student employment program (e.g. UNB's Work Study Program). There has been tremendous support from the Faculty of Education at UNB, particularly from the late Ann Sherman as Dean for much of this period.


Building Relationships

The essence of sustainable outreach is interaction with people. Both the human and mathematical elements figure prominently into meaningful connections. Approximately 60 different schools have been visited through outreach including many that have been visited multiple times. Initial visits to a school often stem from a personal contact with a teacher or a



request to visit. Frequently I reach out to a school and initiate a connection. Other times there is an element of randomness or proximity that makes outreach practical. For instance, while traveling to Nova Scotia it may be practical to reach out to a teacher in Moncton or Sackville. A recent visit to a Grade 5 classroom came about through simply dropping in on a rural school in northwestern New Brunswick while accompanying a colleague. In addition, an effort is made most years to get to some schools in other parts of the province. For example, a spring 2018 trip took me to Bathurst and Jacquet River.

My own professional situation is helpful to the context of understanding relationships with the community. I am a professor in the Faculty of Education with a cross-appointment to the Department of Mathematics and Statistics. Many of the students in my classes are among those who are present in the various school settings. The B.Ed. Program features school placements that carry over on Mondays through the fall semester and then continue with extended five and seven week segments in regional schools. An effort is made to get out to several of these schools and conduct outreach in locations familiar to the Education students, thus, offering an unusual opportunity to observe their teacher interacting with children in classroom settings. Further, an effort is made to actively support the outreach activities of the Department of Mathematics and Statistics via participation in math camps through offering problem sessions or basketball math, and support of the provincial mathematics contest including typically hosting a reception for accompanying teachers while the students are writing the contest on campus. In fact it was at this reception that the connection was made with teachers from Bathurst and Jacquet River, thus, leading to a visit weeks later.



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What does outreach look like?

Images and forms of outreach vary widely. An effort is made here to offer some insight into these forms beginning with classroom visits as the most familiar of them.

Classroom Visits

One-off classroom visits most often involve one of two things – a focus on recreational mathematics through hands-on engagement with logical and spatial challenges, or a more typical class dedicated to problem solving including a mix of mental mathematics. Flexibility is critical, as a teacher may wish for a focus on a particular topic such as multiplication or fractions. Generally such flexibility comes into play more with classes that are visited multiple times. Usually class times will range from 45 to 70 minutes. It should be mentioned that the outreach is largely based in elementary classrooms (mainly grades 3-5) and middle school (grades 6-8) with much less at the secondary level.

Probably about half of school visits consist of meeting a single class, and other times more than one class is involved. Combining classes is quite common in smaller schools or with split grade levels. Another form of school outreach resembles more of an event where an area is dedicated to recreational mathematics for half a day or a full day. Library spaces or a cafeteria area may be converted into a showcase of sorts with a range of games. Such events are most effective when volunteers/paid workers are available to support the facilitation. Teachers and educational assistants in some schools help out considerably especially when an event carries through the day, thus, allowing them to become familiar with many games. These events are more common outside of Fredericton having taken place in communities such as St. Stephen, Miramichi or Burt's Corner.

Supporting Community Events

An effort is made to support existing initiatives, as suggested with the math camps or contests. An annual event in the local school district is STEAM Expo. Most years it has been practical to set up a recreational mathematical exhibit at the day long event. Well over a hundred students and community members will visit the exhibit during breaks from their own presentations. Usually some families will find the space to be a gathering place over the course of hours.

A substantial collection of games has been acquired over time. One grant was provided to purchase materials that would be shared widely with schools. That is, the value of the classroom visits involving games can now be readily extended by leaving "loaner kits" consisting of several games with the teachers. These games can remain in the school for three to six weeks typically. In addition, games have been provided on loan to events like math camps or community outreach initiatives that are not mathematically focused. For instance, games have been brought to a downtown drop-in on numerous occasions.

Community spaces have collaborated as venues for outreach. Notably the Fredericton Public Library hosted two separate Saturday afternoon recreational mathematical events, each drawing over 100 participants. Further in March 2011 we held a series entitled « The Beauty of Mathematics » featuring weekly evening presentations by UNB faculty members, namely Ben Newling, Maureen Tingley, David Wagner, and myself. A recreational math exhibit was also held in a rural community library housed in a building with a local Grade 6-12 school.

The provincial Middle School Council Day in May 2020 will again be hosted at George Street Middle School in Fredericton. Arrangements have been made for the third time to place games and challenges throughout the school for this occasion. Mathematical challenges will appear on walls with displays in hallways along with various games for teachers to try.

Continuity and Traditions

Relationships have developed over the years with several teachers and schools. At the core are trust and respect. The collaborative spirit allows me to drop in to borrow some materials from a school, or to request a class to try out an idea, or reciprocally to be reached out to for a visit. Perhaps a mathematician is needed for a career fair or a collection of games would be helpful for a week. There are some teachers with whom there is an unwritten expectation of at least a classroom visit each year.

Much has been said about classroom visits and various aspects of outreach. However, one annual event captures the blend of values surrounding outreach. The focus shifts here to the annual poster presentations at Devon Middle School in Fredericton.

Poster Presentations at Devon

Students in the elementary mathematics methods course at UNB present posters at Devon Middle School each year. Typically 20 to 25 posters representing the efforts of 30 to 40 students, some individual and others in pairs, adorn the hallways and balcony space overlooking the school gymnasium for a couple of periods. Students from Grades 6 through 8 math classes visit the posters to interact with the presenters, thus, learning more about mathematics.

Ryan Jones who has been involved in assisting with this activity on numerous occasions, as well as working at Devon for a stretch, offered this list of benefits.

- An education based assignment for B.Ed. students outside their practicum and (for most) at an unfamiliar school.
- Students must create a presentation that is suitable for many audiences and contexts, as they do not have pre-knowledge of the school community.
- An opportunity for B.Ed. students to speak passionately around an area of mathematics without the parameters of assessment/traditional classroom setting/classroom management.
- An opportunity for B.Ed. students to demonstrate professional and leadership qualities.
- An outreach opportunity for students that attend the host school.

Finally he notes, "A community relationship has evolved between the university/B.Ed. program and host school, providing continuity for students that attend multiple presentations, and follow-up for teachers year to year."

The initiative began over years ago with Sandi Braun as the primary contact person who coordinated visits amongst the math teachers. Subsequently Laura Steeves assumed that role. Laura's words speak to the value of the event.

"Having the B.Ed students come in each year to present their posters has had a huge effect on some of our students here at Devon Middle School. Our population here is very diverse, and we have some very challenging students. Quite often some children that are the most disengaged in the classroom show the most engagement in these activities. Showing students that math exists beyond the plane of grades 6 to 8 curriculum gives them the opportunity to engage on their own level. John's love of outreach and meeting learners where they are is something that I look forward to each year."

The presentations are generally multidisciplinary in nature as they connect mathematics with other interests or areas. Students are encouraged to take something they care about

and look at it through a mathematical lens, or alternatively to take something mathematical and connect it to another area. Recent presentations have included mathematical connections to yoga, bungee jumping, weaving, music, and interior design. Fibonacci, the golden ratio, and historical ideas such as the concept of zero or mathematics in specific cultures (e.g. Mayan) are common subjects. This year there were two particular passions of students that brought forth novel ideas, namely, paddle boarding and scuba diving. Another memorable



Robyn and Cindy at the DMS Presentation. Photo Credit: Cindy Farrell

presentation dealt with the algorithms around photographic identification. Prospective elementary math teachers gain greater appreciation for the many facets of mathematics in addition to the curiosities of children.

Concluding Comments

Outreach takes many forms. Likewise its spinoffs are immeasurable. The development of relationships has figured prominently into who I am as an educator. Visibly seeing so many classrooms in various contexts contributes to my appreciation of the complexities of mathematics education. Professional development is a two way street, as most teachers will gain insight into both mathematical ideas and the learning of their students through observing outreach in their own classroom. Frequently the communications extend beyond the visits as our networks expand in terms of professional contacts and resources. In some cases it is the opportunity to have a conversation about mathematics before or after the class that is most valuable. Accidental encounters with math mentors or numeracy leads from the district may enrich the conversation.

It is surprising how many people are reached and the manners in which one remembers things. A particular puzzle involving the matching of holes in a piece of cheese proved to be quite challenging except that one boy who struggled in math solved it so quickly. Ever since he has introduced himself as the one who solved the cheese puzzle. That is likely to be his finest mathematical moment.

We do not know the impact that simple gestures of reaching out may have. I close here with an unedited excerpt of a letter from a grade 6 student.

Dear UNB,

Thank you for playing these wonderful fun games....

I loved the time we spent to do some little games and help build our confidence to learn and share...

People were a bit noisy exspeshally me but it was still fun...

Thank you for your time and have a good day.