

# FAMILY MATHEMATICS AND SCIENCE DAY AT UBC FACULTY OF EDUCATION

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Despite the continuous efforts of provincial governments to revise and improve science, technology, engineering and mathematics (STEM) K-12 education, the performance of Canada's youth on international assessments, such as PISA, is gradually declining [1,2]. Moreover, many Canadian youth turn away from STEM subjects in secondary schools, thus closing doors to exciting and economically viable future career opportunities [3]. At the same time, there is ample evidence that student attitudes about STEM and their decisions to pursue STEM-related careers are shaped well before they enter post-secondary classrooms [4]. Parents and teachers play an important role in shaping student views about STEM-related fields and STEM-related careers [5, 6]. Yet many Canadian Teacher Education programs continue to produce elementary and middle school teachers who have very limited STEM knowledge and who often hold rather negative attitudes about STEM [7]. This report discusses an initiative at the University of British Columbia (UBC) that aims to engage future K-12 teachers in STEM outreach during their teacher education, thus helping them acquire positive attitudes about STEM while at the same time acquiring important STEM outreach experience.

## FAMILY MATHEMATICS AND SCIENCE DAY AT UBC FACULTY OF EDUCATION

The goal of this family-oriented one-day weekend event is to engage future K-12 teachers in STEM outreach through designing and leading hands-on STEM activities for the general public. Considering that very few of the non-STEM teacher-candidates have earned an undergraduate STEM degree, their STEM

preparation is likely to be rather limited. As a result, many British Columbia K-9 teachers struggle to engage their students in meaningful STEM learning. In order to support teacher-candidates in acquiring positive attitudes about STEM and learning how to engage children and their families in informal STEM education, in 2010 we founded the UBC Faculty of Education Family Mathematics and Science Day [8].

The organization of the event begins months in advance and consists of five stages: (1) The time, location and the program for the event is decided through the consultation with the faculty members; the website advertising the event is created and distributed to the general public via email [8]. (2) The funding for the event is solicited from the Faculty of Education, Teacher Education Office, the Department of Curriculum and Pedagogy, and UBC STEM-related institutes and organizations. While the event is run by volunteers, funds are needed for the perishable materials for the activities, food and T-shirts for the volunteers, as well as for other miscellaneous expenses. (3) All teacher-candidates are invited to present a STEM activity of their choice to the general public. Students from other Faculties and campus-wide STEM organizations, such as Let's Talk Science, are also invited. The volunteers are mentored by faculty members from the Faculties of Education and Science. Participating volunteers who are not sure what activity they can offer, are invited to discuss it with the event organizers weeks before the event. (4) On the day of the event, the volunteers come two hours prior to the guests' arrival in order to prepare their stations, set up the registration and signage, and to ensure that the place is ready for more than 350 guests attending the event annually. During this time, teacher-candidates visit the stations supervised by their peers in order to exchange teaching ideas and learn from one another. More than 60 students and faculty volunteers participate in the event every year. All the volunteers are offered breakfast and lunch, and are given an official 'thank you' letter from the Faculty of Education. (5) After the event is over, the feedback is solicited from the attendees and the volunteers via an online survey and informal face-to-face interviews. Finally, event organizers meet to discuss this feedback, reflect on their own experiences, and debate how the event can be improved the following year.

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### SUMMARY

**Family Mathematics and Science Day is a public outreach event run by faculty members and teacher-candidates at UBC Faculty of Education.**

**Key words: Science Technology Engineering and Mathematics (STEM), STEM attitudes, outreach, teacher education.**



Fig. 1 A teacher-candidate is helping young scientists to explore Bernoulli's principle.



Fig. 3 Discovering the law of reflection via using a plastic transparent screen, a ruler, and two identical candles.



Fig. 2 Exploring non-Newtonian fluids through experimenting with a mixture of cornstarch and water.



Fig. 4 Prof. Valery Milner engages families with the exploration of air pressure.

### EXAMPLES OF ACTIVITIES DURING THE FAMILY MATHEMATICS AND SCIENCE DAY

During the day of the event, teacher-candidates facilitate more than 100 different hands-on stations (Fig. 1). A few stations are supervised by teams of secondary and elementary teacher-candidates, allowing them to learn from one another. Some activities, such as exploring non-Newtonian fluids (Fig. 2) or discovering the law of reflection (Fig. 3), require careful guidance, while other activities are more self-explanatory. The activities relate to the entire K-12 STEM curriculum and are set up in multiple classrooms (biology, chemistry and physics teaching labs, two mathematics and two general science classrooms), as well as the hallways of the building. Faculty members from the Faculty of Education, as well as from the Faculty of Science help teacher-candidates to guide many of these activities, thus modeling public outreach to future teachers (Fig. 4). These faculty members also support teacher-candidates in answering visitors' questions and engaging the public in STEM-related conversations.

### FEEDBACK FROM TEACHER-CANDIDATES AND GUESTS

Based on the formal and informal feedback from the event collected via an online follow-up survey and open-ended interviews, both elementary and secondary teacher-candidates felt overwhelmingly positive about their participation in the Family Mathematics and Science Day. Many of the future elementary teachers were surprised about their own level of interest in STEM. They also learned a number of practical ideas about engaging their students in STEM learning via using simple experiments with easily available materials. Teacher-candidates communicated STEM ideas to the general public in a positive and productive manner, while also learning about hands-on activities they can implement in their own classrooms. After graduating from the teacher education program, a number of teacher-candidates contacted us to make sure their own students participate in future Family Mathematics and Science Days. We also have a few alumni volunteers at the event annually. The growth of the event

from 95 participants in 2010 to a waiting list of more than 700 enrolling a few days after the event is advertised in 2016 is a testament to its success. Lastly, in response to the requests by future teachers and parents in 2016 we started a YouTube channel for STEM teachers with science and mathematics demonstrations from the Family Mathematics and Science Day that can be performed in K-12 classrooms and at home [9]. The Mathematics & Science Education for All Channel currently hosts more than 50 short videos featuring various STEM experiments from the Family Mathematics and Science Day.

## CONCLUSIONS

This report illustrates the importance of engaging future K-12 teachers in STEM outreach. We have had six successful annual

Family Mathematics and Science Days so far and we hope that other teacher education programs across Canada will consider engaging future K-12 teachers in STEM outreach. We will be happy to support them via sharing our materials and engagement strategies, should they try to organize a similar outreach event.

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