

2-Day Workshop on the Network of Collaborations for Women in Science, Technology, Engineering, and Mathematics

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1 Introduction

During the COVID-19 pandemic, the Natural Sciences and Engineering Research Council Chairs for Women in Science and Engineering (NSERC - CWSE) developed a Network of Collaboration program for faculty and postdoctoral women researchers centred around building creative collaborations in science, technology, engineering, and mathematics (STEM). The purpose of the initiative was to facilitate connections and collaborations between academics from underrepresented groups from across Canada and from all career levels who were experiencing increased isolation due to the pandemic.

The workshop provided a venue for the project group members to meet and network with mathematical researchers and practitioners and the NSERC Chairs. The workshop also provided a venue for interdisciplinary researchers to work on building collaborations. This was done through interactive workshops focusing on using Mathematics as a tool, building industry partnerships, and effective communication tools for interdisciplinary teams. These workshops were complemented by plenary discussions and mentoring provided by the NSERC Chairs and other established STEM researchers.

Mathematics provides a common language for all scientific endeavours. Because of the isolation that researchers from underrepresented groups in STEM feel, it can be very hard for them to build collaborations with other researchers. Through this workshop, we have provided the first forum for such collaborations as well as taken the first steps in developing a strategy for the collaborations. There are several open problems for underrepresented groups in STEM such as:

- Providing support such as grants for interdisciplinary teams
- Providing access to resources such as mentoring, and expertise for interdisciplinary teams
- Strengthening the network of collaborations
- Developing a strategy for developing a network
- Develop an EDI strategy nationally

These open problems were discussed during the workshop and initial steps were taken toward developing a sustainable strategy for them.

2 Workshop Goals

The Network of Collaborations workshop was organized by the NSERC-CWSE with the key objective of raising the level of participation and retention of women in STEM research and providing connections between mathematics researchers and practitioners. The goals of the workshop included building connections by providing networking opportunities; providing underrepresented researchers and academics in STEM with practical tools to enhance their careers; and facilitating collaborative research. The 2-day workshop at the Banff International Research Station (BIRS) provided an opportunity for in-person collaboration for researchers that are members of equity-seeking groups in STEM from across Canada.

The overarching goal of the workshop was to foster informal discussions in safe, brave and radically open spaces on how to develop inclusive networks of collaboration. At the end of this workshop, the participants were encouraged to have done the following:

- Discussed ideas on equity, diversity, and inclusion (EDI) leadership/collaboration.
- Contributed to the development of a strategy document for how to build our network of collaborations.
- Identified distinct methods of fundraising for EDI in STEM activities.

3 Presentation Highlights

The workshop was designed based on a strategy process map which includes problem identification, strategic framing, idea generation, strategy development and barrier identification. There were three major themes identified and framed in preparation for the workshop. These themes include:

- Theme 1: Reimagining collaborative interdisciplinary research with embedded EDI principles
- Theme 2: Developing value-based research
- Theme 3: Building a culture of collaboration.

Participants were energized by hands-on exercises to flex their creativity muscles before separating into their respective breakout groups. The workshop was held in a plenary with all participants for most of the sessions with three breakout groups working on three themes during some sessions. The sessions are described briefly in the following:

Friday December 9th: To start, on the first evening, we invited participants to present 3-minute lightning talks about their work and themselves. This provided possibilities for interdisciplinary linkages and networking. An icebreaker activity centred on the themes of the workshop allowed participants to make connections.

Participants played an informal board game addressing EDI in STEM on the first evening as another networking activity, ultimately providing group problem-solving to persistent EDI challenges in STEM research. The game is called The Game of Adding Ladders and is designed to facilitate discussions on specific issues that underrepresented groups face in their career paths.

Saturday and Sunday December 10th and 11th: On the 2nd day of the workshop, the participants were introduced to a series of concepts on building a culture of creativity in research. The day started with a session on building creative capacity. The participants took part in three breakout rooms each working on the thematic sessions: collaborative interdisciplinary research, building a collaborative culture and value-based research. More information on each session is given below.

Thematic Sessions

Participants joined three separate thematic sessions with the following goals: Collaborative Interdisciplinary Research, Building a Collaborative Culture, Value-Based Research. Each of these sessions is outlined in the following sections.

Collaborative Interdisciplinary Research: The first work period was aimed at creating possibilities through creativity in forming new collaborations. Participants were asked to consider their current professional networks and to discuss where they would like to expand those networks. Participants then discussed the successful and challenging aspects of interdisciplinary research collaborations.

Following the creativity exercises in the main session, participants brainstormed topics that would lend themselves well to new interdisciplinary collaborations while considering current funding opportunities in Canada, relevance to Canadian and/or global society, and existing strengths across institutions.

In the second work period, two groups identified new scientific interdisciplinary projects and worked on the requirements that would be needed for the work and identified some tools for working together. Within this session, the entire group further developed one of these proposed projects, identifying a wide range of possible avenues for the research, e.g. beyond the scientific to sociological, economic and other impacts.

In the third period (on Sunday morning), the group worked together on narrowing down the scope of scientific projects depending on the funding scheme that could be pursued and started to develop a strategy for moving forward with this collaboration.

Building a Collaborative Culture: The values identified as core to establishing an inclusive and collaborative culture include those that foster belonging and welcome diversity of thought. This includes building a sense of community around shared values and effective communication that allows for open dialogue that connects people and allows them to express their ideas. Additionally, changing how collaboration is done requires individuals to challenge the status quo through courageous leadership. Plasticity was also identified as an important consideration to allow for outcomes to be evaluated and adjustments made as needed.

The session went on to discuss potential tools and implementation strategies that would allow for inclusive, collaborative cultures to be established in STEM. The opportunities explored include a research-based training tool that can be used by collaborative teams to establish a culture that is more inclusive of diversity.

Further work is required to develop the proposed culture of collaboration tools and subsequent implementation strategy. This includes consultations with members of various underrepresented groups in STEM and a review of the latest science related to inclusive cultures and effective collaborations.

Value-Based Research: The group discussions first focused on identifying what it means to focus on values as a researcher. Four broad areas where values and ethics must be centred were identified: research funding, open access to resources, developing research teams and people, and impacts (both positive and negative) on research. It was decided that a value-focused model of research is needed. Current research agencies tend to be discipline-specific but values-based research problems are not. Some structure is needed to gather funding which advances such projects. The idea of a values-based research hub emerged.

The long-term goal of such a hub would be to change the system to make it easier for those who are doing value-based research and interdisciplinary research to be able to get credit/funding/support for the work they are doing, and eventually change the way research is done. The group brainstormed ideas to develop a structure for the hub that would connect and support researchers both in their research and funding needs and for developing a robust values-based process to conduct research. The next steps would require identifying ways to fund and resource the hub, creating a governance structure, and recruiting researchers for a pilot program to launch the hub.

Providing Access to Resources

Following the breakout sessions, participants gathered again as a single group to share information on access to resources to support their interdisciplinary projects.

First, Dr. Kristine Bauer, University of Calgary Site Director of the Pacific Institute for the Mathematical Sciences, provided an overview of all the mathematical research centres across Canada, and the activities they support.

Second, Dr. Imogen Coe, Prof. of Biology at Toronto Metropolitan University and NSERC inaugural Scholar in Residence gave an overview of the research funding structures in Canada.

Third, Dr. Catherine Mavriplis led the group to collectively build a comprehensive list of funding opportunities, from the Tri-Council agencies to private foundations.

4 Scientific Progress Made

As a result of the workshop, a community of researchers from underrepresented groups in science and engineering was created and strengthened.

Mentoring opportunities were formalized and information and know-how for creating and funding new interdisciplinary collaborations in the research were transmitted.

Further, data was collected on solutions to persistent EDI challenges in STEM research. A new interdisciplinary research project was created and fleshed out.

Discussions were held on how to create new interdisciplinary collaborations, how to create a collaborative culture and how to frame values-based research within the current funding context in Canada. The beginnings of a framework for possible tools to support these three ventures were developed.

5 Outcomes of the Meeting

Beyond the progress described above, several concrete outcomes were realized:

- Supported and continued development of the interdisciplinary collaborative research project discussed at the workshop.
- Developed of a strategy on how to embed EDI principles and ethical values in interdisciplinary research involving STEM.
- Started new interdisciplinary research projects with the goal of submitting grant proposals in the 2023/2024 cycle.
- Established new collaboration between Drs. Jakobi and MacDonald to develop a pilot workshop on Mathematics for girls in middle school. The event is being planned in Kelowna BC and tentatively scheduled for International Day of Women and Girls in Science (Feb 11th) or Maryam Mirzakhani's Birthday (May 11).

As a follow-up to the meeting, we will:

- Consult a more diverse set of people for strategy development keep people engaged
- Develop a strategy document to be shared with the participants and other stakeholders
- Develop a pulse survey to better understand the needs of different groups and future activities
- Follow up with online events in winter
- Organize Academic Advancement workshops. The BC/Yukon and the Prairies Chair for Women in Science and Engineering will host an Academic advancement workshop in May or June 2023 to support academic transitions with a focus on promotion and tenure and reducing EDI tax. As a result of the BIRS workshop, in Ontario, participants Kim Jones (Ontario Network of Women in Engineering), Heidi-Lynn Ploeg (Queens University Chair for Women in Engineering) and Catherine Mavriplis are planning an academic advancement workshop in the coming year for early-career researchers from underrepresented groups in science and engineering.
- Formalize the research and networking hub.
- Enable the projects started through the Network of Collaboration and BIRS workshop including projects on human/robot interactions, cannabis and wastewater treatment.
- Develop a toolkit for career advancement for early-career faculty.
- Develop a value statement for the network.
- Grow activities for the Network of Collaborations.

Overall, the BIRS workshop had an enormous impact on the early-career participants by providing mentoring, and leadership development for them. In addition, it provided a forum for discussions on developing strategies for increasing our impact in EDI and making crucial connections. It also provided strategic connections with mathematicians to advance mathematical sciences and the work in this area.

This workshop also helped consolidate the work done over the previous two years to build a network of collaboration, identify new projects and collaborations, and develop the next steps for growing and resourcing the network.