



Inclusive Science Communication Approaches Through an Equity, Diversity, Inclusion, and Social Justice (EDISJ) Lens

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Abstract

Science communication has taken center stage in Science, Technology, Engineering, and Math (STEM) disciplines in the context of public outreach and citizen science. Developing practical communication skills is imperative for all scientists to be highly successful in their careers and more so for underrepresented and Black, Indigenous, and People of Color (BIPOC) professionals in STEM. The program, led by the Engineering and Science Librarian at the University of Victoria (UVic) Libraries, aimed to equip students and early career scientists with critical communication skills by leveraging the unique voices and lived experiences of BIPOC speakers in STEM disciplines. Through this program, a unique toolkit with engaging modules consisting of 30 short videos, each three minutes long (30 x 3) by BIPOC speakers was created to provide broad foundational skills in verbal and visual communication, using an Equity, Diversity, Inclusion, and Social Justice (EDISJ) lens. A two-day conference offered networking and communication development opportunities to students and early-career scientists in

STEM disciplines by connecting them with BIPOC STEM leaders and visionaries who promote STEM advocacy. This paper will discuss the methods used in the creation of the toolkit and conference using an EDISJ lens.

Keywords: Inclusive science communication, STEM equity, Public engagement, Scientific discourse, Science libraries

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Introduction

The field of science communication has gained much attention in academia. There have been numerous journals, conferences, and workshops organized on the subject in recent years. Some of these workshops in Canada include, but are not limited to, ComSciCon, Science Odyssey, the Royal Canadian Institute of Science, the Canadian Science Policy Conference (CSPC), and the Banff Science Communications Program. Although many offer broader perspectives on science communication, most deliver practical and desirable skills for effective communication of science to the public. Despite public engagement being considered the key to science communication, it is often experienced STEM professionals who take center stage in how their research becomes relevant and seamlessly convey its meaning to the public (Kearns, 2021).

Most scientists in STEM disciplines are making public outreach efforts or facilitating programs on citizen science. However, they do not always have the time to develop effective communication skills, which are imperative for all scientists to be highly successful in their careers. They often lack formal training and hence, the focus of science communication training has mostly centered on enhancing communication skills to facilitate dialogue between scientists and the general public (Brownell et al., 2013). The repercussions of this lack of formalized training for undergraduate students, graduate students, and early career researchers, but mostly minoritized students and scientists are that they do not have “the opportunity to validate their experiences among peers and develop professional sensibilities through training” (King-Kostelac et al., 2022, p. 2). Recently, there has been renewed work on science communication that is engaging audiences and focusing on the efforts of underrepresented and Black, Indigenous, and People of Color (BIPOC) individuals. Some of the prominent conferences and symposiums include the Metcalf Institute’s Inclusive SciComm Symposium and the American Association for the Advancement of Science (AAAS) Communicating Science Seminar. This paper offers insights into creating a toolkit with modules and a conference on science communication designed using inclusive approaches to establish programs that can attract BIPOC STEM students and establish avenues for them to engage in science communication successfully. Both the conference and toolkit address the challenges and barriers faced by BIPOC students and offer them a platform to create mentorship and networking opportunities.

Literature Review

Inclusive science communication as defined by Canfield & Menezes (2020) “is a new and broad term that encompasses all efforts to engage specific audiences in conversations or activities about science, technology, engineering, mathematics, and medicine (STEMM) topics, including, but not limited to, public engagement, informal science learning, journalism, and formal science education” (2020, p. 1). As their report further states, inclusive science communication “is grounded in inclusion, equity, and intersectionality” and there is an urgency to implement “inclusive approaches” in science communication and that the following three traits, intentionality, reciprocity, and reflexivity, must exist, “concurrently” for inclusive science communication practices to be implemented (Canfield & Menezes, 2020).

Inclusive science communication allows for a broad representation of perspectives by leveraging the unique voices of underrepresented and marginalized professionals. Although there are myriad opportunities to practice communication skills in academia for scientists at conferences, classrooms, and meetings, historically marginalized professionals often face known barriers, such as a lack of formal training and opportunities to communicate with diverse audiences, as well as a lack of time to develop specialized skills (Benes, 2017; Brownell et al., 2013). When communicating frequently with the public, scientists may encounter challenges in effectively disseminating trustworthy scientific information to diverse audiences equitably that is free of bias and jargon (National Academies of Sciences et al., 2017).

Although science communication can be a powerful process for public engagement, it can portray a very Western and Eurocentric view that can erode the feelings of belonging in underrepresented and marginalized people in STEM disciplines (Canfield et al., 2020). When communicating science to diverse audiences, scientists face the challenge of conveying complex scientific pursuits to audiences with cultural beliefs, religious sentiments, and societal beliefs. Additionally, public opinion is heavily influenced by technological factors, such as social media. For scientists with Western, settler, and Eurocentric backgrounds, this can be difficult as participants from marginalized and underrepresented groups may not express their views and engage in dialogue with an individual perceived to have authority and privilege. For science communication, which largely involves public engagement, creating more opportunities to recruit scientists from marginalized and underrepresented groups is necessary.

In addition to the already known challenges scientists face, BIPOC STEM professionals face several other barriers and challenges in developing effective science communication skills in academia. Some of these challenges include social exclusion, lack of public speaking opportunities, linguistic barriers, and suppressed cultural identities (Dawson, 2014; Hwang, 2013). The lack of BIPOC STEM professionals in academia in contrast to the population of Canada has negatively impacted how information is disseminated and viewed by diverse audiences. However, this is a larger issue that faces academia, and despite the wide range of initiatives to increase representation in STEM to attract underrepresented professionals, including women and marginalized individuals, several inequities exist (Larivière et al., 2013).

There is also a larger issue of decolonizing STEM that includes acknowledging how Western centric the STEM curriculum and spaces are in institutions across Canada and making a commitment to respectfully recognize the Indigenous ways of conducting and disseminating research ([Singh & Major, 2017](#)). Bartlett et al. ([2012](#)) outline eight lessons learned in creating an integrative science program that incorporates traditional Indigenous knowledge systems into a Western science curriculum. They introduce a guiding principle of “two-eyed seeing” which “refers to learning to see from one eye with the strengths of Indigenous knowledges and ways of knowing, and from the other eye with the strengths of Western knowledges and ways of knowing, and to using both these eyes together, for the benefit of all” ([Bartlett et al., 2012, p. 235](#)). This weaving or intertwining of knowledge allows STEM to draw upon diverse voices of Indigenous elders and broadens participation from diverse Indigenous Peoples. Recruiting more BIPOC, underrepresented, marginalized, historically excluded STEM professionals can distill essential knowledge to diverse audiences, bring in a new set of perspectives, and provide effective, trustworthy scientific information, efficient mechanisms of combating misinformation of scientific theories and research, and communicate and disseminate research through storytelling and discussions ([Archer et al., 2016](#)).

Ultimately, although the goal is to ensure broad representation by recruiting and retaining professionals from historically underrepresented populations in STEM disciplines, there is considerable work needed regarding racial discrimination and bias ([Carter et al., 2021](#)). By acknowledging and reflecting on the harm done, scientists must advance Equity, Diversity, Inclusion, and Social Justice (EDISJ) efforts by embracing cultural nuances, demonstrating allyship, being mindful of racial histories, accepting inequities in the STEM profession, and engaging and amplifying the voices of underrepresented and historically marginalized STEM professionals ([Gunter et al., 2021](#)). This will engage more diverse public audiences and create a more robust community of STEM professionals who will create mentorship opportunities that promote and improve retention of BIPOC students and early career scientists.

Institutional Context

The University of Victoria (UVic), located in Victoria, British Columbia, Canada, is a globally recognized medium-sized research-intensive university, with over 22,000 students. Among the student body at UVic, more than 78% are from outside the Victoria area. This diverse population comprises 4,350 international students from 127 different nations ([University of Victoria - Undergraduate, 2023](#)).

Recent demographic data from the 2023 Middle-Years Students Survey from the Canadian University Survey Consortium (CUSC), indicated that 59% of students at UVic identified as women, 4% as Indigenous, 39% as students with a disability, and 32% as being a visible minority ([Institutional Planning and Analysis - Surveys, 2023](#)). The UVic Libraries share a unique position as a central campus hub and community anchor, promoting the notion of the libraries as a partner. Libraries too can broaden the participation of students, early-career scientists, and STEM professionals from underrepresented groups by strengthening the library’s role as a partner and important anchor to serving the institution’s initiatives in promoting science communication skills to underrepresented groups of students, early-career scientists, and researchers.

Librarians at UVic continue to work closely with students, faculty, researchers, and professional scientists on developing skill sets to engage in the collection analysis, curation, preservation, visualization, and dissemination of research and its data. The UVic libraries' workshops and programs reinforce the library's capacity to engage the community in STEM literacy, cultivate inclusive science communication practices, and find a natural place within libraries that disseminates knowledge and acts as a partner in the advancement of science to the public, especially to marginalized and underrepresented groups. Thus, the UVic Libraries is beneficial as it is "rooted in social justice thinking" making it "a natural leader and partner in social justice initiatives" on campus ([Mathuews, 2016, p. 23](#)). Involving libraries to develop initiatives that combine EDISJ with science communication is a way of building a sustainable plan toward addressing the barriers experienced by STEM professionals at the university level. Unlike initiatives at the department level focused on faculty and student inter-departmental groups, EDISJ initiatives in libraries can act as a catalyst to bring together students, researchers, and faculty to provide a safe place to learn about barriers faced by each group and discuss ways to address those barriers.

The Engineering and Science librarian at UVic Libraries plays a vital role in effectively disseminating training workshops amongst other information literacy and digital fluency skills to undergraduate and graduate students in STEM disciplines. By leveraging the expertise of librarians in building engagement across student groups and creating student and faculty centric workshops, this project aimed to dismantle the common barriers that are persistent in the recruitment and retention of BIPOC and other underrepresented groups.

The Engineering and Science Librarian received funding for this project in 2021 from The Natural Sciences and Engineering Research Council of Canada (NSERC) Science Communication Skills grant (promo). As an immigrant to Canada and a Person of Color, she faced many barriers and challenges, first as an international student but later as a professional librarian in Canada. As a result, having worked closely with students in engineering and sciences and seeing the challenges BIPOC STEM professionals face in navigating many barriers in their careers, this project was borne from an urgency to break down barriers in science communication.

To support and contribute to diversity in higher education, the librarian made a deliberate effort to advertise and hire BIPOC students to work on this project. This practice aims to raise awareness of the need for more preferential BIPOC student hiring practices at libraries as it allows the perspectives of underserved and underrepresented groups to be amplified and diversifies the workforce in libraries. In December 2021, a BIPOC female graduate student, a Ph.D. candidate, was hired as a graduate research assistant to work on this project and in January 2022, a second BIPOC graduate student, also a Ph.D. candidate was hired to work on the project.

While working collaboratively on this project, the librarian and graduate students had discussions about EDISJ. They shared similarities in the many stereotypes (race, gender, color, abilities, ethnicity, etc.) they faced as People of Color in academia while acknowledging the few avenues to safely share their lived experiences, and the challenges and barriers they faced and overcame in academia.

Program Objectives

The overall research objectives of this program were to strengthen the role of the library as a partner and promote science communication skills training to underrepresented groups of students, early-career scientists, and researchers. To this end, the authors engaged BIPOC STEM speakers to provide essential skills to BIPOC participants on efficient mechanisms of communication and disseminating research through storytelling and discussions as part of a science communication conference. The short-term goals of the project hence were to ensure participants from historically underrepresented populations in STEM disciplines receive exposure to science communication skills training through the libraries. The long term goals of this project were: a) to share perspectives and experiences on concepts of privilege and bias in STEM; b) to use the lived experiences of BIPOC STEM professionals to instill and offer best practices and guidance to cultivate a sense of belonging in BIPOC students who do not see themselves represented in academia; c) to create mentorship and networking opportunities for BIPOC STEM students; and d) to use an EDISJ lens to create a welcoming and equitable space that centers the voices of marginalized and underrepresented BIPOC professionals in STEM.

Considering the aims of the project, besides improving communication skills, it was determined that the modules and conference would be designed to provide an opportunity for participants to adapt inclusive science communication practices in their careers.

Methods

The one-year project was divided into two main phases: Phase I involved the science communication conference; and Phase II involved creating the toolkit with modules and 30 three-minute videos. For Phase I, the focus was on recruiting BIPOC students, early-career researchers, and staff from STEM disciplines within and beyond UVic who would benefit from an opportunity to engage with BIPOC STEM leaders. For Phase II, the focus shifted to UVic STEM students and faculty who would benefit immensely from the toolkit where inclusive science communication practices are discussed. This was an opportunity for students at the university level to understand the challenges faced by BIPOC individuals in STEM. For BIPOC STEM professionals this was an opportunity to mentor students and be powerful allies to empower and support future BIPOC STEM professionals.

Phase I: Inclusive Science Communication Conference

The Science Communication Conference was organized as a two-day event in March 2022. Since the main objective of the project was to amplify the voices of BIPOC science communicators, the project team created a program comprising different science communication topics of interest to students, early career researchers, faculty, and staff. This process was further driven by the motivation to recruit and invite BIPOC speakers but was the most difficult task. STEM professionals who self-identify as BIPOC in academia, industry, government, media, and other STEM disciplines are difficult to locate and are often unavailable to present ([Evangelista et al., 2020](#); [Khelifa &](#)

[Mahdjoub, 2022](#)). This is perhaps a barrier as many times BIPOC speakers bear the “invisible labor” of mentoring minoritized students, in addition to speaking engagements, and participating in EDISJ work ([Flaherty, 2019](#)). However, strategies were developed to find speakers from industry websites, science conference events, local communication brochures, academic websites, and articles published on various topics. This was an enormous task and after weeks of strategizing, a spreadsheet of prominent and well-known BIPOC local and global speakers with expertise matching the theme of the conference was developed. At the end of the conference, all speakers were compensated or provided with alternative gifts, although several individuals declined the compensation as per the NSERC grant guidelines applicable to eligible researchers in Canada. A further challenge faced early on was the implementation of the program in person.

Although the goal was to host the conference on campus, border restrictions, testing requirements, and Covid-19 related health and safety protocols, created barriers to the conference taking place in person at UVic. Hence, despite border restrictions being lifted, given the uncertainty, a decision was made to host the conference virtually. However, this limitation presented opportunities to invite renowned international speakers who were otherwise unable to present at the conference in person and ultimately resulted in broadening the scope of the topics for the conference. The two-day conference was hosted by the UVic Libraries with support from many stakeholders on campus, such as the faculties of Science and Engineering & Computer Science, which were instrumental in marketing and promoting the event to students.

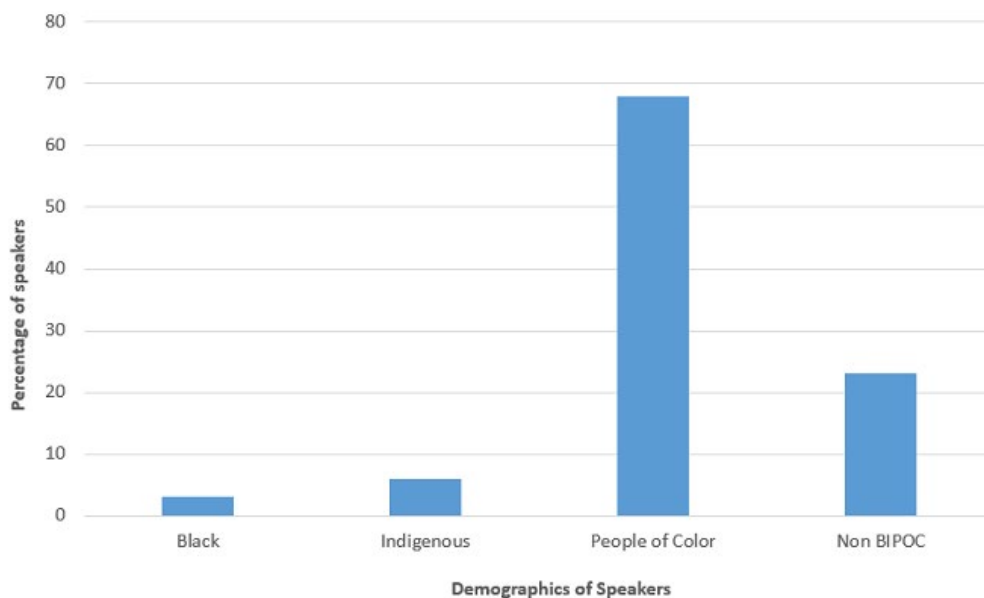


Figure 1. Demographics of speakers at the science communication conference

As seen in Figure 1, out of 34 invited speakers, 3% identified as Black, 6% identified as Indigenous, 68% as People of Color, and 23% as non-BIPOC. Although some workshops were co-moderated by non-BIPOC and BIPOC experts, plenary lectures, sessions, and panel discussions were exclusively led by BIPOC experts. In addition to ensuring that speakers were BIPOC, the final program included speakers from different disciplines,

such as academia, industry, science writers, science communication speakers, librarians, podcasters, journalists, industry personnel and leaders from all STEM professions.

With the awareness that BIPOC and other students at UVic would benefit from the conference, the event was advertised widely. Although all interested students, postdoctoral researchers, faculty, and staff, irrespective of their racial identities, were encouraged to register and attend, the conference was advertised primarily for BIPOC students. The conference was attended by a diverse group of attendees; in total 105 participants took part in the two-day event. Of that total, 53% identified as BIPOC, and 47% identified as non-BIPOC. As shown in Figure 2, the attendees were categorized based on their disciplines: Engineering (including Computer Science), Sciences, and Other (including attendees from disciplines other than engineering and sciences and participants from outside universities). Across all the disciplines, graduate students accounted for the biggest group of participants. Of the total attendees, 60% were graduate students with 43% of these from Engineering and 30% from Sciences. Of these graduate student attendees, 24% and 16% identified as BIPOC students from Engineering and Sciences, respectively.

Three BIPOC postdoctoral researchers from Engineering attended the conference. Undergraduate BIPOC students (n = 2), BIPOC staff (n = 1), non-BIPOC staff (n = 1), and non-BIPOC alumni (n=1) all identified as belonging to Engineering attended the conference. Undergraduate BIPOC students (n = 5) and non-BIPOC students (n = 4) were the second largest group of attendees from Sciences in attendance, whereas the numbers of non-BIPOC postdoctoral researchers (n = 2), alumni (n = 2), and staff (n = 1) were comparatively low. The Other category of attendees in Sciences recorded a single BIPOC attendee and two non-BIPOC attendees. Outside science and engineering disciplines, several BIPOC graduate students (n = 10), non-BIPOC graduate students (n = 7), non-BIPOC Faculty (n = 1), BIPOC Staff (n = 2), non-BIPOC Staff (n = 3), other BIPOC attendees (n = 6), and non-BIPOC professionals (n = 3) attended the conference.

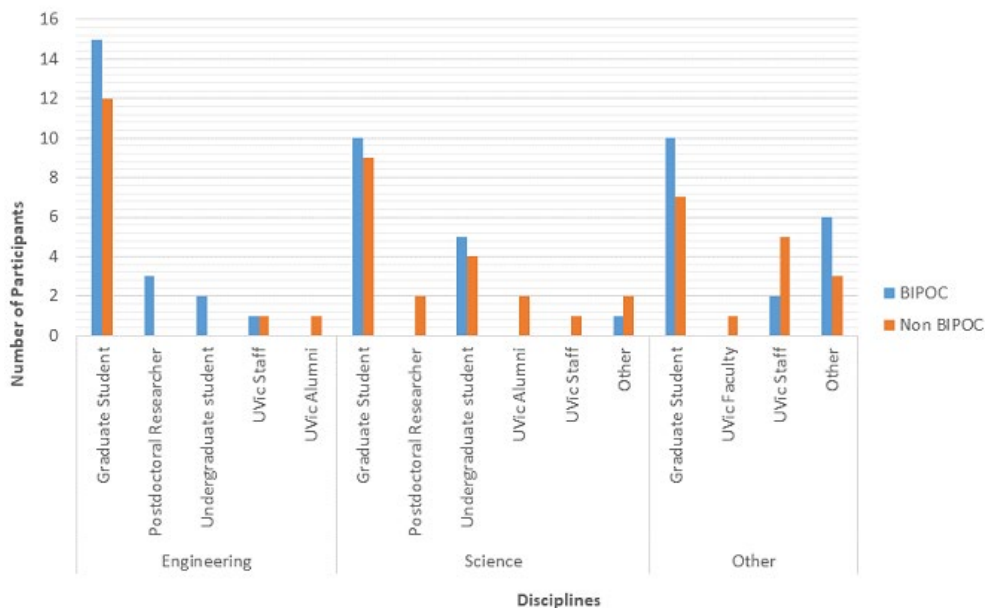


Figure 2. Number of BIPOC and non-BIPOC participants by disciplines

The conference aimed to broaden participation by allowing participants to register using a Zoom registration link. Participants wishing to attend specific events were asked to register for workshops through a self-identification questionnaire. Registration forms captured information about their disciplines and their demographic information. For simplicity, the demographics were only captured if participants were Black, Indigenous, or a Person of Color. The workshop registration form was created using SpringShare’s LibWizard software program. Registration for the main conference sessions and workshops was created using Zoom and shared widely through departmental mailing lists, student society mailing lists, graduate secretaries, the Faculty of Graduate Studies mailing list, faculty mailing lists, student interest groups, and social media using Reddit, Facebook, Twitter, and Instagram.

The conference program comprised an Indigenous Blessing ceremony, opening remarks by academic leaders, an opening keynote address, three workshops, three sessions, a research pitch competition, a career networking evening, and a panel discussion. Most workshops involved activities that allowed participants to gain an opportunity to learn, discuss, and share their experiences, challenges, and barriers they faced in STEM. Speakers shared their expertise but used their lived experiences to reflect on the challenges they faced in their careers and how they overcame those barriers and challenges. Students in many workshops had a chance to interact closely with speakers. With permission from speakers and participants, talks were recorded and made available using Brightspace. Due to privacy reasons, only some sessions were recorded.

The conference started with an opening prayer and blessing from a SELWĀN ŁTE Elder and Knowledge Keeper, followed by welcome remarks by the NSERC President, who stressed the importance of science communication skills for students. He also shared his journey in STEM. This was followed by a keynote address by a prominent Indigenous environmental justice scholar who highlighted environmental and sustainability science concepts from an Anishinaabe perspective by drawing upon their professional, research, and personal experience as an educator and practitioner. They discussed advancing Indigenous knowledge systems in achieving environmental justice.

Time	Workshop	Speakers
11:15 – 12:30 PM	Workshop 1: Science as a Story	Abeer Siddiqui
12:45 – 1:45 PM	Workshop 2: Introduction to Podcasting	Dr. Asma Bashir, Rich McCue
2:00 – 3:00 PM	Workshop 3: Effective Scientific Presentation Skills	Nancy Ami, Faria Athar

Figure 3. Workshops offered on day 1 of the conference

The keynote address was followed by an introduction to science communication by a prominent BIPOC speaker who is a mentor and advocate for inclusive science communication in Canada. This session highlighted opportunities in Canada related to science outreach, public speaking, writing, journalism, and science policy. As seen in Figure 3, several well attended workshops included a workshop facilitated by a librarian titled “Science as a Story.” Another workshop titled “Introduction to Podcasting” was facilitated by a BIPOC podcaster and non-BIPOC library staff member, and a third workshop, “Effective Science Presentation Skills,” was facilitated by a BIPOC and non-BIPOC speaker from the Centre for Academic Communication (CAC) at UVic. All these workshops explored ways to weave narrative elements into science communication, focusing on elements of podcasting and the barriers and challenges faced as women of color in STEM, or on tips and strategies for presenting scientific content most effectively. The day’s events concluded with a career networking event where participants had the opportunity to interact with funding and non-profit organizations supporting BIPOC students, industry professionals, and career counsellors. Many BIPOC industry professionals attended the sessions and offered advice as well as an opportunity to ask questions about STEM careers.

The second day of the conference started with Welcome Remarks by the deans of the faculties of Science and Engineering & Computer Science at UVic. The first plenary session was by a prominent science journalist who reflected on their journey in science communication in the UK and focused on creating science stories and their experiences working with diverse researchers. A second plenary session titled “The angel complex in academia” provided an inclusive space to examine the evidence of persistent racial bias in academia and suggested ways to ensure a culture shift in practices in STEM hiring and retention processes. This was followed by an Elevator Pitch competition on a scientific topic that allowed participants to receive interactive feedback from BIPOC professionals and a live audience. Registered students had an opportunity to pitch their ideas to a wide group of participants and judges, and to incentivize the students' participation, each of them received compensation for contributing their time for participation and a winner was chosen from the group of registrants. The day ended with a powerful panel discussion moderated by the EDI Advisor to the Dean, Faculty of Engineering & Computer Science at UVic and included five distinguished STEM leaders. The discussion sparked conversations on issues, such as marginalization, bias, power, and privilege in STEM disciplines. Panelists also offered insights and perspectives on inclusive spaces and practices in their careers in industry, research, science communication, and academia, as well as the hiring and retention of STEM professionals from marginalized and underrepresented groups.

Phase II: Toolkit with 30 Three-Minute Videos

With an aim to engage participants and instill competencies in science communication skills, Phase II of the project involved the creation of a toolkit including modules and 30 three-minute videos. After extensive research of the literature and Open Education Resource (OER) content available through the BC (British Columbia) Open Textbook Collection, OpenStax, MERLOT Education Resources, and Pressbooks for Ontario’s Postsecondary Educators platform, it was decided to adapt an open textbook titled, *Principles of Scientific Communication* by Amanda Bongers and Donal Macartney.

Adapting an OER book implies the “process of making changes to an existing work” ([Aesoph, 2016, para. 1](#)).

This textbook was selected for many reasons: (a) it aligned with the goals of this project to offer free access and resources to marginalized and underrepresented groups of students; (b) it could be easily adapted (edited) to suit the specific needs of the students at UVic; (c) the text included plain easy to read language; and (d) the chapter topics in the book mapped to topics that were easily transformed into modules in Brightspace, the internal Learning Management System (LMS).

In addition to including the chapters of the selected book, a module on EDI in STEM was created and included. The textbook was licensed under a Creative Commons Attribution-NonCommercial 4.0 International (CC BY-NC 4.0) license after consultation with the copyright office at UVic libraries to identify any issues with adapting the textbook as modules. The Engineering & Science librarian contacted the authors of the book for relevant files of the course materials that were embedded into Brightspace.

The adaptation of the textbook into Brightspace facilitated the use of Universal Design for Learning (UDL) principles. As the demand for asynchronous instructional material grows, many libraries are embedding instructional content within their LMS, allowing students to learn asynchronously at their own pace and using ways to incentivize participation ([Allen, 2017](#); [Khailova & Bernstein, 2021](#); [Tomaszewski, 2021](#)). UDL has three main principles as outlined by CAST ([2018](#)): (a) provide multiple means of engagement, (b) provide multiple means of representation, and (c) provide multiple means of action and expression. Considering these principles and acknowledging the demographics of many students, this resource was developed to ensure it was accessible, engaging, and flexible, and representative of the student groups reading the content ([CAST, 2018](#)). Many librarian researchers have used the UDL guiding principles to design their instruction and create inclusive instructional material ([Hays & Handler, 2020](#); [Tchangalova, 2019](#); [Whitver, 2020](#)). The versatility of Brightspace has made it easy to embed the 30 three-minute videos, accompanied by closed captioning generated by Echo360. Brightspace also enhances accessibility by providing users with options for downloadable transcripts for each video and allows the use of Alt Text for images.

Toolkit Modules

The toolkit modules mirror the adapted chapters of the book with additions to meet the specific needs of the institution. The toolkit consists of six modules in total on topics such as Writing, Visuals, Outreach, Presentations, and Interpersonal Communication from the original book and an additional module on EDI in Science Communication (Figure 5). The content from the original book was incrementally reviewed and revised by team members to meet the goals of the project. Some figures, illustrations, graphs and charts were revised to ensure they aligned with the local policies and content at UVic and to ensure that the modules were applicable to diverse STEM disciplines.

Each module in the toolkit provides training in both verbal and visual communication and is subdivided into three to four sections that highlight the topics and introduce and provide resources and detailed examples of how students can use the topics in their

STEM careers. To incentivize student participation, a short quiz was added to each module, allowing students to earn a digital badge on completion. The quizzes require students to answer at least 80% of the questions correctly on multiple attempts to obtain a badge. The digital badges were created using Badgr software, which is embedded in Brightspace. Digital badges provide a means of recognizing and certifying the achievement of skills and experience from curricular and co-curricular activities ([Risquez et al., 2020](#)). Badges allow students to assess their understanding of the material they have interacted with and can be added to their LinkedIn account and professional resume or curriculum vitae (CV) to highlight their skills to potential employers.

30 Three-Minute (30 x 3) Videos

Although the modules provide accessible ways to learn the basics of science communication, the 30 three-minute videos provide users with inspiring perspectives and voices of BIPOC speakers who discuss foundational knowledge of effective science communication while focusing on their experiences, concepts and implications of privilege and bias, and include techniques for creating an inclusive environment in STEM disciplines. On average five videos were included in each of the six modules.

Thirty BIPOC STEM experts from underrepresented groups were invited to record three-minute informational videos covering various topics. Experts and discipline specific leaders from a wide range of backgrounds, such as research, journalism, education, industry, non-profit organizations, and science outreach organizations, were approached to cover diverse viewpoints. Speakers who met the eligibility criteria were remunerated for their participation. Nevertheless, due to the NSERC grant guidelines for eligible researchers, several speakers were unable to receive compensation, but expressed their willingness to participate.

Based on their expertise in writing, visualization, outreach, presentations, and interpersonal communication, each of the experts was asked two to three questions to draw on their lived experiences and share compelling narratives to connect with the audience. As seen in Figure 4, 14% of speakers self-identified as Black, 21% identified as Indigenous, and 65% identified as People of Color.

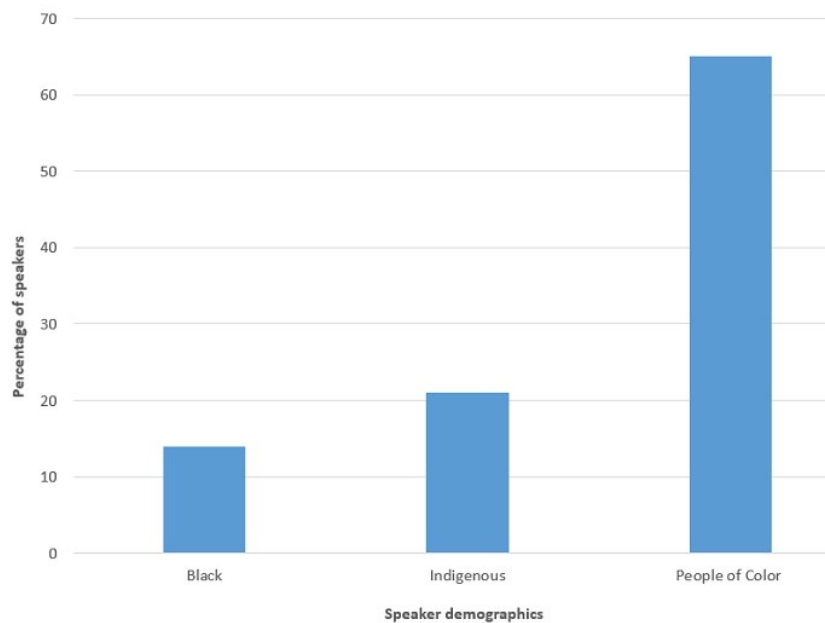


Figure 4. Demographics of speakers for 30 x 3 science communication modules

As speakers were from across North America, experts recorded and uploaded the videos to a shared drive. All experts were sent detailed criteria for recording the videos, such as audio quality, desired background, subtitles for closed captioning, duration, and video format. Once received, each video was downloaded and assessed for quality based on the criteria. Using professional video editing software, videos were edited with the speaker’s name, credentials, affiliations, and relevant acknowledgements. The videos were trimmed and stamped with the questions in written text. Finally, subtitles were added to the videos using Echo360 to ensure accessibility. After editing, the videos were uploaded and published in the relevant Brightspace modules, ensuring that subtitle transcripts were downloadable.

The videos provide foundational knowledge and address challenges and barriers that were discussed at the conference. Ways to overcome barriers in public speaking, presenting to nonscientific audiences, and communicating with potential employers or an expert were some of the topics addressed in the videos. As an example, one of the videos highlighted the perspectives of an Indigenous entrepreneur who has experience in building strategic communication and entrepreneurial skills and guided students in advancing their innovations. Similarly, a leader who hosts networking events for the BIPOC community in BC shared their perspectives to overcome challenges and approaches to building a robust professional network. Overall, the modules together with the videos create a bridge between lived experiences and theoretical knowledge of disseminating scientific information to diverse audiences more effectively.

EDI Module

EDI continues to remain a core guiding principle in STEM disciplines at the university level. It is imperative for STEM to be inclusive and equitable so scientists can engage diverse audiences. For science communication to be inclusive, outreach initiatives that advance inclusion and are designed to be relevant to students from a diverse range of

cultural and linguistic backgrounds are important. Thus, outreach initiatives in science communication need to begin by engaging BIPOC students in EDI initiatives and having an open dialogue about barriers, but also conversations to bring awareness about intersectionality, ethnicity, race, gender, sex, age, and ability.

Hence, a new module that introduces concepts of EDISJ and the importance of making EDISJ efforts in STEM fields was added to the toolkit. This module provides awareness about EDISJ in STEM fields and encompasses concepts like the power of allyship, inclusive science communication, and designing content targeting diverse audiences. The module also provided educational resources for participants to strengthen their knowledge of core EDISJ concepts and highlighted different organizations and groups advocating for EDI in STEM fields within Canada. The module includes videos from BIPOC speakers who are champions in EDISJ in STEM. They provide their perspectives on creating inclusive practices in STEM to attract, hire, train, and retain underrepresented and marginalized individuals.

Impact and Assessment

The Engineering & Science librarian and colleagues from the Centre for Academic Communication (CAC) present a workshop titled, “Effective presentation skills for engineers” to graduate students in a Mechanical Engineering course every fall semester. While the videos were being embedded into the modules, the librarian had an opportunity to introduce the modules to the students and instructor. After the instruction session, the course instructor embedded the modules into BrightSpace. This was the first instance of 60 students using the modules, although the modules were not fully developed at this stage. The course instructor provided positive feedback and the aim is to introduce the modules and components of the toolkit in future offerings of this course and other courses in the Faculty of Engineering & Computer Science as well as the Faculty of Science.

The conference was assessed in multiple ways using surveys and a social media platform, such as Padlet. Although feedback regarding the main conference was requested from participants, the program was assessed directly using a survey questionnaire created by the funding agency. Participants shared their experiences and discussed issues, challenges and barriers they faced in their STEM careers using Padlet, which is a software program used to create virtual postings collaboratively. Since all feedback was anonymous, Padlet was an effective platform for students to share their experiences after attending sessions. As seen in Figure 5, the feedback indicated it is evident that many participants felt isolated and underrepresented in academia, but the conference empowered, inspired, and provided a sense of belonging, and as one participant mentioned, their voices mattered. This is one of the major accomplishments of this project. The integration of digital badges within the modules served as an additional method of assessment, offering several benefits. These badges facilitated active student participation within the modules. Furthermore, since the badges were linked to the module's assessment criteria, they provide versatile avenues for collecting feedback in the future regarding student progress and accomplishments.

"My key takeaway from the conference is I am not alone."

"As a student attendee, I am feeling empowered and inspired to hear from the talented BIPOC leaders. The talks energized me to take action based on what I learned from the leaders."

"I am really excited to learn how I can use my experience as a BIPOC student in STEM for storytelling. I always thought storytelling was for humanists not for scientists!"

"I'm so happy to see folks like me at the event! I attended a podcasting workshop, the speaker talked about minoritized voices and how our voices do matter. Thanks for this great conference space!"

"For NSERC sponsors, I feel that continuing to fund these types of events in different institutions across Canada would speak volumes!"

"The paternalism inherent in Western/settler policymakers inviting Indigenous people into a discussion as segments of the community to be polled and served, but not as peers with important knowledge to share. A colonial mindset underlying all our interactions."

Figure 5. Highlights from conference attendee feedback collected on Padlet

Discussion and Limitations

An early challenge identified while working on the conference is that most of the championing efforts and “invisible labor” are carried out by a relatively small number of BIPOC STEM professionals ([Flaherty, 2019](#)). Although this emotional burden can fatigue these professionals, we also recognize the need for BIPOC students to have an opportunity to hear success stories that can help them avoid the “leaky pipeline” in STEM. This “leaky pipeline” has led many women in STEM to leave academia at various stages in their careers due to the lack of representation, opportunities to grow in their careers, and be recognized for their work ([Liu et al., 2019](#)). The “leaky pipeline” also affects many BIPOC individuals in academia, who do not see their work acknowledged, feel less represented, lack mentorship opportunities, and are often isolated. BIPOC students and professionals often hear the perspectives of prominent leaders at conferences or through social media; however, because of the lack of time and

professional development opportunities to network or interact closely with these speakers, the impacts of these meetings are short lived. The science communication conference and toolkit modules attempted to mitigate some of these challenges. However, although many prominent BIPOC speakers and professionals were contacted to present at the conference or record a video for the toolkit, it became evident that because of too many speaking engagements or portfolios, most of them were unavailable for further engagements. This is a considerable obstacle for any BIPOC project as there is a very small pool of BIPOC professionals who are champions in advancing EDISJ in Canada and pushing boundaries in science communication but are over capacity.

Although the conference was well attended by many BIPOC students at UVic, there were many that this project was unable to reach. Similarly to finding BIPOC speakers, it was difficult to reach BIPOC students. Many BIPOC students do not attend events like this in person because in addition to the barriers they typically face, such as the lack of time or free professional development opportunities, they fear being “informants,” criticizing a system that works well for most of the students on campus and being seen as perpetrators who negatively influence other BIPOC students or fear reliving prior trauma of events of the past ([Bird, 2021](#)). Even if they do attend, BIPOC students often find it hard to speak publicly for fear of retribution in academia. Hence, the conference strived to provide a safe, welcoming space and offered ways BIPOC students could contribute and speak anonymously. A safe space policy was implemented at the conference, and we refrained from recording all conference sessions.

The uncertainty of the COVID-19 pandemic presented a considerable challenge for this conference to take place in person. Considering the contextual barriers and aim for an accessible program, it was decided to host the conference online to attract marginalized participants who would not otherwise have had an opportunity to access and attend events like this. It is important to recognize that marginalized, racialized, and historically underrepresented participants often find it easier to speak up and have an opportunity to be heard without being seen at virtual events ([Etzion et al., 2022](#)).

The overall impact of this project is that the program reached an audience of over 100 participants in a short period and the toolkit is readily accessible to anyone in STEM disciplines. Although the modules are currently inaccessible off campus, the toolkit can be adapted by a larger audience outside the university setting. Videos that many individuals beyond UVic have inquired about are currently restricted to the UVic campus community due to privacy; however, some speakers have indicated their willingness to share content in an open access format. In the future, some content of the three-minute videos, including BIPOC speakers’ lived experiences, hardships, and struggles, will be made available in an open access format. Additionally, the contact information for the Principal Investigator (PI) will be provided, enabling librarians to reach out if needed.

Inclusive science communication has important benefits for graduate and undergraduate students. Libraries are the key to holding programs that enable BIPOC and underrepresented students and early career scientists to gain expertise directly through the programs, transforming their experiences and attitudes about public

outreach in science communication using an EDISJ lens. Informal learning spaces, such as libraries, have been shown to address learning inequities and broaden participation in STEM for students of color ([King & Pringle, 2019](#)). High-impact outreach activities that promote equitable access and participation for underrepresented BIPOC individuals are particularly valuable in addressing the issue of the “leaky pipeline” in STEM ([Stamm, 2009](#)). Weaving inclusive approaches and practices into science communication while developing programs using cross-cultural approaches and employing Two-Eyed seeing can allow underrepresented groups of students to feel a sense of belonging, feel represented, and have greater mentorship opportunities by networking with BIPOC professionals.

Research has shown that gender stereotypes have resulted in lower enrollment of women in STEM careers, and this has led to a lack of representation and mentorship of minorities in STEM ([IEEE, 2020](#)). Introducing this pilot program on campus has had a wider impact in reaching BIPOC participants and creating awareness and motivation for the STEM community to communicate their research in a meaningful and impactful manner. A wider impact of this project is the professional learning of STEM professionals to effectively share and communicate the value of their research through diverse perspectives using an EDISJ lens. This program had a strategic impact by supporting the persistence of underrepresented BIPOC students at UVic in STEM disciplines since it not only provides training and skills but also discerns barriers by fostering meaningful awareness and engagement with BIPOC professionals. The conference and toolkit modules address issues faced by BIPOC professionals, such as systemic racism, bias, and underrepresentation. They provide an avenue of perpetual learning by listening to critical conversations on EDISJ issues in the STEM profession.

Recommendations

This project has wide implications for inclusive science communication. Libraries should strive to ensure that more of their programs target BIPOC students on academic campuses. More efforts should be made at higher education institutions to increase a sense of belonging for BIPOC students from historically marginalized and underrepresented groups, dismantle barriers, and offer more science communication training and resources.

A wide implication of conferences and events targeted towards BIPOC students is that most of the invisible labor rests on the shoulders of BIPOC STEM professionals and hence to lessen this burden, institutions should create a mechanism to support and incentivize STEM professionals who can offer mentorship. Institutions should take the initiative to ensure the burden does not rest only on BIPOC STEM professionals. Creating programs and offering inclusive science communication skills training in the form of formalized programs must be available at all institutions to allow scientists and STEM professionals to learn methods and understand and overcome challenges to interact and communicate about science with diverse audiences.

From this program, it is evident that EDISJ efforts are highly significant for inclusive science communication to occur. Institutions will greatly benefit by speaking about EDISJ and identifying barriers and challenges faced by a small population of

marginalized and underrepresented students on their campuses. However, inclusive STEM communication requires support from allies. These could be faculty, staff, students, academic leaders, industry leaders, professionals, and non-profit professionals who can help BIPOC students feel empowered to speak up and participate in science communication.

Conclusion

This project is the first of its kind in Canada to provide inclusive science communication training to BIPOC students through libraries. The nuances of lived experiences of people of color can enrich marginalized and underrepresented audiences who have been silenced and excluded historically from approaches in science communication. The purpose of this project was to create an inclusive science communication conference which amplified the voices of BIPOC speakers from different STEM professions. The toolkit including modules with the integration of 30 three-minute videos, created using UDL principles, provided perspectives of inclusive practices that are meaningful to BIPOC scientists and professionals. This project highlights how libraries and librarians are in a unique position to develop programs that embed EDISJ into science communication training to make it more inclusive. With content developed through a BIPOC lens, this project aims to provide a fundamental foundation for all scientists to learn strategies to reduce barriers and eliminate systemic and biased dissemination practices.

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