Comparative and International Education / Éducation Comparée et Internationale

Volume 54 | Issue 1

June 2025

Decolonial STEM Education and the Integration of a Critical Global Citizenship Education Framework in an Ontario Secondary School

Kenneth Gyamerah
Ontario Tech University
kenneth.gyamerah@queensu.ca

Jane J. Mao
University of Manitoba
jj.mao@ubc.ca

Alice Johnston
St. Francis Xavier University
ajohnsto@stfx.ca

Ethan Hodges
Queen's University
21eh16@queensu.ca

Thashika Pillay
Queen's University
thashika.pillay@queensu.ca

Karen Pashby
Manchester Metropolitan University
k.pashby@mmu.ac.uk

Alana Butler
Queen's University
alana.butler@queensu.ca

Recommended Citation
Gyamerah, K., Mao, J., Johnston, A., Hodges, E., Pillay, T., Pashby, K. & Butler, A. (2025). Decolonial STEM Education and the Integration of a Critical Global Citizenship Education Framework in an Ontario Secondary School. *Comparative and International Education / Éducation Comparée et Internationale. 54*(1). 15-31. https://doi.org/10.5206/cie-eci.v54i1.19989

Decolonial STEM Education and the Integration of a Critical Global Citizenship Education Framework in an Ontario Secondary School
La décolonisation de l'enseignement des STIM et l'intégration d'une éducation à la citoyenneté mondiale critique : dans le cadre d'une école secondaire de l'Ontario

Kenneth Gyamerah, Ontario Tech University
Jane J. Mao, University of Manitoba
Alice Johnston, St. Francis Xavier University
Ethan Hodges, Queen's University
Thashika Pillay, Queen's University
Karen Pashby, Manchester Metropolitan University
Alana Butler, Queen's University

Abstract
This study examines how the HEADSUP framework supports STEM teachers in integrating anti-oppressive and critical social justice frameworks into their teaching. Using a qualitative case study approach, STEM teachers and students at an Ontario secondary school participated in weekly sessions focused on utilizing HEADSUP in their STEM courses. Data were collected through semi-structured interviews with teachers and classroom observations conducted by the research team. Findings reveal both opportunities and challenges in decolonizing STEM education through critical decolonial frameworks. Teacher interviews indicate that integrating HEADSUP into teaching amplified students' voices, promoted active engagement in lessons, and encouraged them to explore concepts beyond the standard STEM curriculum. Findings also highlight that the implementation of anti-oppressive and social justice frameworks in STEM classrooms is constrained by the current provincial high school STEM curriculum. The study discusses implications for educational policy, particularly the need for curricular reforms that support anti-oppressive approaches in STEM education.

Résumé
Cette étude examine comment les éléments du programme HEADSUP aident les enseignants en STIM à intégrer des cadres anti-oppressifs et de justice sociale critique dans leur enseignement. En utilisant une approche qualitative d'étude de cas, les enseignants et les étudiants en STIM d'une école secondaire de l'Ontario ont participé à des sessions hebdomadaires axées sur l'utilisation de HEADSUP dans leurs cours de STIM. Les données ont été recueillies au moyen d'entrevues semi-structurées avec les enseignants et d'observations en classe effectuées par l'équipe de recherche. Les résultats révèlent à la fois les opportunités et les défis de la décolonisation de l'enseignement des STIM à travers des cadres décoloniaux critiques. Les entretiens avec les enseignants indiquent que l'intégration de HEADSUP dans l'enseignement a amplifié les voix des étudiants, favorisé leur engagement actif dans les leçons et les a encouragés à explorer des concepts au-delà du programme STIM standard. Les résultats soulignent également que la mise en œuvre de cadres anti-oppressifs et de justice sociale critique dans les classes de STIM est limitée par le programme provincial actuel des STIM dans les écoles secondaires. L'étude examine les implications pour la politique éducative, en particulier la nécessité de réformer les programmes d'études qui soutiennent les approches anti-oppressives dans l'enseignement des STIM.

Keywords: STEM education, HEADSUP, decoloniality, teachers, ethical relationality
Mots-clés : Enseignement des STIM, HEADSUP, décolonialité, enseignants, relationalité éthique

Introduction

Several studies both within and outside Canada have shown that schooling spaces tend to be less responsive to the needs of students who are racialized, queer, have disabilities, or experience other forms of marginalization (Domina et. al., 2017; James & Turner, 2015). This is attributed to the fact that education tends to be grounded in White, Eurocentric, cisheteronormative, able-bodied culture as the norm (Dumas & Ross, 2016), especially in the Science, Technology, Engineering, and Mathematics (STEM) curriculum (DiAngelo & Sensoy, 2018; Takeuchi & Marin, 2022). As such, students in Ontario schools are demanding more anti-oppressive, anti-racist, and decolonial schooling spaces where they can see their intersectional identities positively reflected, affirmed, and valued (TDSB, 2021).

Coloniality operates by maintaining, solidifying, and perpetuating the idea of Western cultural superiority, magnifying the systemic and historical favoritism towards the collective interests, achievements, values, and convictions of the West, whilst simultaneously erasing other cultures and forms of knowledge (Hayes & Juárez, 2012; DiAngelo & Sensoy, 2018). Canadian education has been complicit in legitimizing coloniality through both explicit and implicit ways of centring Eurocentric ideologies and ways of knowing thereby teaching racialized and marginalized students that their lives are not worth learning about (Aronson & Meyers, 2020). Additionally, Indigenous pedagogies and epistemologies have been largely disregarded by Canadian school boards (Williams et al., 2021). The dismissal of non-Western knowledges privileges only some forms of knowledge, reinforcing hierarchies and limiting knowledge production (Dei, 2020; Lopez & Jean-Marie, 2021). STEM has been theorized to uphold coloniality through the acceptance of "othering" and devaluing diverse ways of knowing and interpreting natural phenomenon (Spivak, 2023). Unfortunately, there is limited research on how STEM perpetuates coloniality in the Canadian education system. This study provides an opportunity to bridge this gap by integrating a Critical Global Citizenship Education (CGCE) framework which serves as a pathway for students and educators to cultivate the capacity to analyze systems of oppression in local and global contexts. Interrogating the Eurocentric foundations of the STEM curriculum through a critical lens can teach students and educators to understand the systems of oppression and think through an intersectional lens.

This article explores how the existing CGCE framework HEADSUP was utilized as a medium to foster the development of critical consciousness skills to interrogate the colonial logics of STEM education. Andreotti's (2012) HEADSUP framework identifies seven historical patterns of oppression often reproduced in pedagogy and curriculum in attempts to include marginalized perspectives: hegemony, ethnocentrism, ahistoricism, depoliticisation, salvationism, uncomplicated solutions, and paternalism. Hegemony is commonly engendered by justifying and reinforcing the domination; ethnocentrism by projecting the Euro-Western worldview as universal; ahistoricism by refraining from teaching about historical legacies and complicities; depoliticization by disregarding power inequalities and ideological issues often at the root of global problems; salvationism by framing help as the burden of the fittest; uncomplicated solutions by offering students easy and simple solutions to complex problems requiring systemic change; and paternalism by infantilizing the recipients of help while positioning young people in the Global North as responsible for solving global issues (Andreotti, 2012). HEADSUP aims to "support people with the ongoing wrestling with concepts and contexts, choices and implications, that we face every day as teachers and learners working towards deeper and more ethical ways of relating to others and to the world" (Andreotti, 2012, p. 3). Collectively, thinking about issues from these seven patterns can push staff and students to deepen their pedagogy to interrogate rather than

ignore systems of oppression (Pashby & Sund, 2020). Guided by the HEADSUP framework, researcher-educators created targeted inclusive STEM programing to support critical consciousness development of students and educators in an Ontario secondary school.

Literature Review

Teachers and Anti-Oppressive Education

Directly influenced by settler-colonialism and Eurocentrism, Canada's approach to liberation and empowerment in education is poorly informed and ineffective (Akkari & Radhouane, 2022). STEM educators have been identified as especially resistant to developing inclusive pedagogies and abandoning hegemonic beliefs, values, and ways of teaching (Arvanitis, 2018; Tuters, 2015). Furthermore, the Ontario secondary school STEM curricula and supporting documents have not provided opportunities for teachers to carefully consider how to integrate diverse content and teaching approaches and not just relying on one hegemonic system (Pichette et al., 2022). In this paper, "STEM" refers specifically to K–12 Mathematics and Science in Ontario, and "supporting documents" refers to resources complementing these subjects. These resources may include policy documents, teaching frameworks, and assessment tools provided by the Ontario Ministry of Education to guide and enhance teaching and learning in these subjects. Within Ontario, research shows that teachers feel ill-equipped to teach and respond to student needs and the multiple sociocultural realities of the classroom (Nganga, 2020), such as race, gender, class, sexuality, ideology, settler-colonialism, and other intersecting processes of power (Davies, 2021; James & Turner, 2015). Teachers' attitudes towards anti-oppressive and anti-racist education are also important considerations for classroom anti-oppressive activity and curriculum implementation. Research suggests teacher views on anti-oppression, EDI, and social justice education may predict the effective implementation of these teaching foci (Krasnoff, 2016; Öngel & Tabancalı, 2022). This is to say, teachers' knowledge and comfort with anti-oppression and anti-racist education will impact student learning (Visentin, 2022).

System and Structures as Barriers

Teachers play a crucial role in breaking down oppression and hegemonic norms in schools; however, to do so, teachers require early and ongoing support to meet the diverse needs of their classroom (Goddard & Evans, 2018, Mills & Ballantyne, 2016). Even those teachers eager to integrate social justice, anti-oppressive and anti-racist education in their classes are often met with systemic and structural challenges.

Efforts to engage teachers in anti-racism and anti-oppression education include opportunities for professional development (PD). In the Ontario context, PD on anti-racism and anti-oppression education focuses on privilege, power, and bias (Carroll, 2021; Khushal, 2022; Tsang & Eizadirad, 2024). While such awareness initiatives are important for anti-oppression and anti-racism education, they come with limitations. Research suggests they fall short of providing teachers with adequate experience, knowledge, and preparedness to understand and integrate anti-oppressive pedagogies due to limited time, insufficient ongoing support, and a lack of emphasis on addressing systemic biases and power dynamics within education (Lopez & Jean-Marie, 2021; Mills & Ballantyne, 2016).

The curriculum is another barrier. Within the Ontario high school academic science curriculum, for example, under anti-discrimination instructional planning, the documents include phrases such as: "there may be cultural sensitivities for some students" and "Teachers should be open to adjusting their instruction, if feasible, when concerns are brought to their attention" (MOE,

2009, p. 37). This passive voice denotes that not all cultural matters are relevant or equally require attention in the science curriculum. These judgements have previously led to marginalized students experiencing violence in STEM classes when teachers are provided with vague instructions regarding how to create inclusive classrooms (James & Turner, 2015). Such surface level understanding of social justice and anti-oppressive education combined with the lack of supporting documents indicate the lack of teacher preparedness for integrating anti-racist and anti-oppressive education.

Theoretical Framework

STEM is complicit in reinforcing Eurocentric ways of knowing and portraying mathematics and science as depoliticized subjects, rather than spaces where power, culture, identity, and social justice converge (Leyva et al., 2023). For instance, colonial logic manifests in schools and often goes unquestioned even by well-intended education initiatives intended to benefit all learners. In this manner, unjust systems become normalized and settler complicity in these systems goes unnoticed (Karsgaard et al., 2022). While students, for instance, may learn about the history of Indigenous and racialized peoples in schools, they rarely learn about the structural systems in place that continue to marginalize the knowledges and worldviews of racialized communities (Gaudry & Lorenz, 2018). In this study, HEADSUP was used in conjunction with decoloniality and ethical relationality as theoretical frame.

Decolonial and Ethical Relationalities

The colonial matrix of power constructs Eurocentric epistemologies and ontologies as universal and superior to those belonging to subaltern groups particularly within STEM subjects (Mignolo, 2011). Accordingly, to work towards decoloniality, space must be made for suppressed knowledges that encompass multiple perspectives and relationships which challenge colonial structures (Mignolo & Walsh, 2018) to both appear in and give shape to dominant institutions, including the Canadian school system. Decoloniality unveils and challenges the various colonial structures and systems that impact school curricula and formal education (Dei et al., 2022). Decoloniality envisions possibilities to create a new future devoid of racialization, domination, subjugation, and unbalanced power relations (Ndlovu-Gatsheni, 2019) while analyzing and deconstructing the Euro-Western interpretations of modernity, globalization, knowledge, and identity within schooling (Andreotti, 2011). Within STEM, decoloniality helps to unsettle coloniality of curriculum (Fúnez-Flores, 2023) by questioning universalist notions of knowing in STEM and critiquing how STEM privileges Western ways of knowing and decentres other ways of knowing. This study challenges the notions of objectivity and cultural neutrality, which often shape STEM discourse by acknowledging the ways in which diverse histories and experiences position humans to be both in relation with each other and with the land. As such, envisioning the possibilities to create new futures, premised on the belief that it is the recognition of our relatedness that precipitates ethical behaviour (Donald, 2016) and that call for an attentiveness to the responsibilities that must be extended to those with whom we are in relationship (Karsgaard et al., 2022).

Cree scholar Willie Ermine (2007) contends that cultivating ethical space requires dialogue and a concerted effort to nurture subaltern knowledge bases. It is through dialogue that we can observe the way hidden values and intentions control our behaviours and how unnoticed cultural differences clash in ways that make reconciling ways of knowing difficult (Ermine, 2007). One way this dialoging can be promoted in schools is through co-learning, a process in which students,

teachers, researchers, or practitioners work together to construct knowledge while building community, thus ensuring that the interactions between diverse educational stakeholders are reciprocal, collective, creative, and integrative (Pohl, 2008). As such, ethical relationality encourages linkages and points of compliment between different epistemologies and ontologies and positions us to learn from one another (Pohl, 2008).

Ethical relationality can also be cultivated in the school system through the content delivered through curriculum. According to Papachace Cree scholar Dwayne Donald (2016), curricula is, in part, the compilation of stories we tell our children about the world and their relationship with it. Stories are selected as curricula because it is decided that they are worthy of telling, not because they necessarily represent the truth. An ethical and decolonial relationality, accordingly, requires questioning and challenging the stories we choose to tell through curricula and calls for stories to be told that reflect multiple perspectives and help us maintain good relations with our human and nonhuman kin as kinship relations must be extended beyond the human community to encompass nonhuman beings as well (Donald, 2016). For instance, through curricula, this takes the form of pushing back against the ways that settler colonialism has shaped our relationship to land in ways that are nonauthoritarian, non-dominating, and nonexploitative (Coulthard & Simpson, 2016). Within STEM education, ethical and decolonial relationality challenges the colonial matrix of power's Eurocentric ways of making sense of the natural world as universal, making space for historically marginalized peoples, knowledges, and perspectives and asking us to reimagine and reenvision more life-sustaining and life-affirming ways of living on and connecting to land. Thus, an ethical and decolonial relationality has the potential to push back against and challenge the colonial matrix of power.

Methodology

This research employed a qualitative case study approach to examine the experiences and understanding of STEM teachers in an Ontario secondary school using the HEADSUP framework in their classrooms. An initial meeting between the research team and the teachers and school administration allowed both groups to become acquainted with each other, while also providing a foundational understanding of the project. The research team worked with the teachers for 12 weeks. Each teacher was allotted 1–2 research assistants who worked with teachers teaching in Grade 9 destreamed classrooms to help introduce and integrate HEADSUP into their teaching and engaged in weekly and biweekly classroom workshops to integrate HEADSUP into teacher praxis. The Grade 9 curriculum in Ontario was destreamed to promote equity and inclusion in education. Previously, students entering Grade 9 were streamed into applied or academic courses—a practice that often disproportionately affected marginalized groups. Since this project was conducted in Grade 9 destreamed classrooms, students were also supported to think through the topics they learned in their respective subjects through a social justice lens. As a result, students engaged in social justice projects at the end of the 12 weeks. One such project involved a student-led research initiative on a social justice topic of the students' choosing in a Grade 9 classroom. The students worked both collaboratively to connect the STEM topics they were learning to real-world applications, exploring how these concepts could address social justice issues. The Research Assistants (RAs) created a template that guided students to engage in critical thought about the topic they had chosen. In the Grade 9 math and science classrooms, we worked with three math and four science teachers to support them in learning how to integrate HEADSUP into their teaching. Through weekly sessions in these classrooms, the students were also supported in building critical consciousness and learning how to connect their math and science topics to

address social, political, economic, and environmental challenges. Students worked together in groups to create projects to address issues that impact them and society. Data for this study was generated through semi-structured interviews with teachers and observations from the research team. The interview questions focused on participants' overall experiences with the HEADSUP framework, their prior learning, and professional development that supported them in integrating anti-oppressive pedagogies into their STEM teaching, as well as the extent of support required to continue integrating HEADSUP into their work. Observations from the research team's engagement with teachers and students enabled us to concur with or diverge from the teachers' perspectives.

This study received ethical approval (Approval 1084-21) from Queen's University General Ethics Board. Consequently, this study adhered to the General Data Protection Regulations (GDPR) for the handling of all confidential and personal data. To ensure anonymity, all participants were assigned pseudonyms, and both the research team and the data transcriber who had access to the raw data signed confidentiality agreements.

Demographics

According to the 2016 student census, 74% of the students from the school that was the site for this study were born outside of Canada, with a significant representation from East Asian, Southeast Asian, and Middle Eastern backgrounds. In terms of socioeconomic status, the school ranked among the lowest 25% of schools in the school district board. The data presented in this paper is derived from a larger study that involved teachers who taught Grade 9 English, Geography, Mathematics, Science, Grade 10 Civics, and Grade 11 and 12 Social Justice and Black Studies. However, in this paper we focus solely on the data generated from the Grade 9 mathematics and science teachers. In total, seven ($N = 7$) STEM teachers participated in the project, but only three ($n = 3$) consented to be interviewed about their experiences with integrating the HEADSUP framework. All teachers were invited to express their interest in participating in interviews after the implementation of the project. However, the four STEM teachers did not provide consent to be interviewed. Table 1 provides information on the participants.

Table 1: Participant Information

Subject area	Number of teachers integrating HEADSUP	Number of teachers who participated in interviews	Pseudonym for interviewee
Grade 9 Mathematics	3	1	Jim
Grade 9 Science	4	2	Sadar Amanda

*The names used in Table 1 above are pseudonyms.

Data Analysis

Data from the interviews were manually transcribed and edited by the research team for accuracy. Using thematic analysis (Braun & Clarke, 2006; Creswell, 2014), we individually coded the data line by line, identifying key phrases, ideas, and patterns that emerged from the participants responses. These initial codes were then grouped into broader categories. Once the initial coding was completed, the research team collaboratively reviewed them to maintain consensus. We compared individual interpretations of the data and refined the codes into three major overarching themes: (1) Bridges to Decolonizing STEM, (2) Barriers to Decolonizing STEM, and (3) Developing a Commitment to Decoloniality in STEM: Moving Beyond the Discourse of "Buying In."

The data analysis process was iterative and reflexive, with the team revisiting both the transcripts and the codes multiple times to ensure the themes accurately reflected the participants' voices. Subthemes were developed to provide further granularity and a deeper understanding of the data. For instance, within the theme of Bridges to Decolonial STEM, three subthemes were identified. The iterative approach enabled us to inductively explore patterns and relationships within the data, ensuring that our findings were robust and grounded in the participants' lived experiences.

Findings

The research identified three major themes: Bridges to Decolonizing STEM Education, with subthemes focusing on amplifying student voice, curriculum, and pedagogy as mediating factors; Barriers to Decolonizing STEM, with subthemes related to curriculum fit and time constraints; and Developing a Commitment to Decoloniality in STEM: Moving Beyond the Discourse of "Buying In" with subthemes related to collective learning, peer engagement, and teacher professional background and identities.

Theme 1: Bridges to Decolonizing STEM Education

Findings from this study demonstrate the opportunities and challenges of decolonizing STEM education in Canadian schools through the integration of anti-oppressive and critical global citizenship frameworks such as HEADSUP. Our engagement with STEM teachers through the HEADSUP project offers possibilities for building ethical and decolonial spaces within STEM classrooms to transform STEM learning.

Subtheme 1a: Amplifying Student Voice and Agency

The integration of HEADSUP emerged as a powerful catalyst for promoting student engagement strengthened by relationship building. In interviews with STEM teachers, it became evident that the project had a transformative impact on the dynamics between teachers and students, leading to heightened engagement and active classroom participation. The STEM teachers acknowledged that the project provided a unique opportunity to establish deeper connections with their students, helping centre and amplify student voices as students conducted interdisciplinary research projects that extended their learning to address social, political, economic, and cultural issues that impact students directly. Through interactive conversations, teachers and students engaged in meaningful discussions and exchanged perspectives, insights, and experiences:

> Yeah, I think what happened with the students was great, like it was really high-quality work, the kids gained a better understanding of HEADSUP as it applies to, issues in society and in our structures in society, as well as how it relates to science. (Amanda).

This collaborative learning approach empowered students and actively contributed to their STEM learning, whilst also building feelings of empathy:

> [The HEADSUP] project was empathy building. And I think that's huge for our kids. Especially in Grade 9, they're starting to really understand how other people experience the world at a deeper level. (Sadar)

Moreover, teachers also highlighted the significant impact of the HEADSUP project to create dynamic spaces that fostered interactive dialogue and collaborative activities thus facilitating a reciprocal learning process between teachers and students. Teachers revealed that integrating HEADSUP into their classrooms helped create an environment where knowledge was co-constructed and shared. The teachers in the school participated in a biweekly book club sessions in their schools to support them in integrating culturally relevant pedagogies and anti-racist education frameworks into their work. The purpose of the book club was to foster social justice and facilitate student agency. During our interviews, Amanda, a teacher, explained, "I learned more from my students and their exploration of HEADSUP in partnership than I ever did from book club."

The reflections of teachers like Sadar and Amanda demonstrate sustained efforts in providing space for student agency. Sadar demonstrates the value of an intrinsic willingness to be flexible and "show up" for their students. Similarly, Amanda's adaptability and willingness to adopt less teacher-directed approaches, created space for her marginalized students to express academic autonomy. HEADSUP offered a tool for both teachers to develop a critical knowledge foundation to create space for student growth.

Subtheme 1b: Curriculum as a Mediating Factor

The findings also showed that the HEADSUP framework enabled students to connect to the curriculum more fulsomely as HEADSUP encouraged students to explore curricular concepts beyond what is embedded in the STEM curriculum. Through inquiry-based STEM projects, students shared their perspectives and leveraged their unique cultural backgrounds and personal experiences to understand STEM phenomena from a plethora of perspectives. Teachers in this study recognized a shift in students' mindset towards becoming active cocreators of knowledge when delving deeper into sociopolitical issues that directly affected them:

> [HEADSUP] gave the kids an opportunity to dig deeper and even beyond what the curriculum would have been for Grade 9 ... it was cool seeing some of that, like the kids digging deeper into science, or even beyond what I would have expected at this grade level. (Sadar)

Teachers expressed how the application of the HEADSUP framework in STEM learning had ripple effects outwards to how students related to curriculum content in other courses. As a result of the HEADSUP framework, for instance, Sadar reflected that student learning in science class impacted how students interpreted and completed an assignment in another subject. Sadar also expressed that they appreciated the HEADSUP framework as it invited them to contextualize scientific learning in real word issues and provided multiple entry points to making STEM teaching and learning interdisciplinary. The findings demonstrate that teachers perceived the HEADSUP framework as offering opportunities for them to think beyond curricular outcomes and challenged them to integrate other ways of knowing and perspectives into their teaching which helped students to achieve beyond curricular expectations.

Subtheme 1c: Pedagogy as a Mediating Factor

The HEADSUP framework also contributed to fostering decolonial STEM education by integrating pedagogical approaches that enabled students and teachers to reconnect to the land in more reciprocal and life-affirming ways. Some teachers, for instance, were reluctant to embrace the HEADSUP framework due to fact that they had many other competing demands on their time. Amanda, in addition to all the curriculum outcomes she was trying to cover, for instance, had a large ELL population in her class. Even without the integration of the HEADSUP framework, Amanda expressed that she had difficulty integrating curriculum content as well as facilitating language learning. This dynamic also created a challenge for the Ras, who recognized that this particular class would likely struggle with the research-driven nature of the planned inquiry project as a result of student's language learning needs.

In response, both Amanda and the RAs demonstrated flexibility, shifting the focus to disrupting Eurocentrism through pedagogy. Through this process it became clear that there are multiple entry points to introducing the HEADSUP framework into learning. In this class the teacher agreed to adopt more holistic pedagogical methods germane to Indigenous groups from the local territory. This brought in a multiplicity of ways of knowing, being, doing, understanding, and relating to the natural world. Amanda shared:

> We were into a unit in science, about observations and physical properties of things and describing things, a lot of my students had difficulty describing things. And so [the RAs] suggested that we do sort of like an outdoor walkabout and try to use our senses to describe things that students saw outside, describe signs of spring ... And I thought that was really good, because it pushed what I was comfortable with doing.

This pedagogical approach shifted the Eurocentric bias in the classroom without relying on the integration of content students had difficulty understanding. It illustrated multiple ways to challenge the colonial matrix of power and introduce HEADSUP into student learning. Amanda shared:

> that might even be an easier entry point for some of these subject teachers that are teaching courses that might not find it easy ... If HEADSUP is approached as like, let's have the circle discussions, let's talk about a topic in science, for instance, instead of trying to change the content.

Amanda's pedagogical flexibility brought a multiplicity of ways of knowing, being, doing, understanding, and relating to the natural world into the teacher's STEM instruction. This approach also enabled the teacher and students to begin to foster more ethical relationships with the natural world.

Theme 2: Barriers to Decolonizing STEM Education

While the study highlights several opportunities for integrating HEADSUP into teaching practices, we also identified certain barriers that influenced how teachers perceive the integration of HEADSUP and other anti-oppressive frameworks in STEM.

Subtheme 2a: Curriculum Fit–A Square Peg in Round Holes

In the course of implementing the HEADSUP framework, a key factor for the success of the project was the constraints imposed by the provincial curriculum. Conversations with teachers conveyed a sense that the HEADSUP framework did not seamlessly align with the curriculum. Specifically, teachers revealed that while integrating the HEADSUP framework into social science learning

seemed feasible, its alignment with the STEM curriculum remained unclear and unreconcilable. Jim, a STEM teacher remarked,

> [U]sing the HEADSUP in teaching mathematics seems like putting a square peg in round holes. I do not see how it fit in mathematics but for English it is clear. Maybe it is because I have always seen mathematics from an analogical lens.

Similarly, Amanda expressed this challenge, stating,

> Yeah, I found it challenging because it definitely felt like the social science teachers had many easier points of entry into introducing HEADSUP … There's a lot of resistance from the math department. And even in the science department, like how are we going to introduce HEADSUP when we get to the physics unit?

From our conversations and in-class observations, we found that STEM teachers particularly were focused on where anti-oppressive frameworks fit in the curriculum. As a result, they missed out on understanding that integrating anti-oppressive frameworks could be seen through a pedagogical lens.

Subtheme 2b: Perceived Time Constraints

In addition to the limitations placed by the curriculum, time constraints were a key theme that emerged from our conversations with STEM teachers. During our interviews with participants, teachers perceived a lack of sufficient time to cover the demands of the mandated Ontario Grade 9 Mathematics curriculum and integrate the HEADSUP framework, which would require more time. Furthermore, there seemed to be a misunderstanding that Ontario teachers are obliged to cover all curricular outcomes but not every expectation detailed in the curriculum. As a result of the perceived time constraints, some teachers consistently cancelled planned classes with researchers and subtly emphasized time was better spent covering curriculum outcomes instead of doing anti-oppressive work. Through our observation, we found that while time constraints were a key factor in the successful implementation of HEADSUP, some teachers also used what they understood to be a lack of time as a form of resistance to anti-oppressive work.

Theme 3: Developing a Commitment to Decoloniality in STEM: Moving Beyond the Discourse of "Buying In"

Subtheme 3a: Collective Learning and Peer Engagement

Teachers in this study revealed that the HEADSUP framework emphasized the significance of working together and building authentic relationships among their peers. During our interviews with teachers, we observed that a sense of relationality and trust building can promote a climate for sustaining critical social justice work in STEM classrooms. Teachers revealed that having a learning space in their school to share ideas and informally learn from each other can increase buy-in to projects like HEADSUP and help educators effectively bring multiple ways of knowing and pedagogies into their STEM classrooms.

Sadar extended the importance of co-learning and building relationality to the way teachers who struggle with integrating culturally relevant pedagogies into their STEM classrooms can be supported. Sadar noted, for instance, that a lack of trust and relationships among STEM teachers in the school made it more difficult for those with limited capacity to learn from their colleagues effective at applying culturally responsive and anti-racist approaches. According to Sadar, approaching anti-oppressive work in a collective and communal way can help teachers find meaningful entry points to STEM and social justice:

> I think it also takes time to work with colleagues to brainstorm ideas and think of ways that can be done and then again, it was helpful for me to see how Pamela does it, for example, in her classroom first. Then I was like, Okay, I could do that. (Sadar)

Amanda also echoed the idea of working collaboratively and creating a sense of trust among teachers helping STEM teachers to learn from each other and deepen their knowledge of culturally relevant and responsive ways of teaching STEM:

> I think if there were another teacher or two other teachers within our department, that we're all kind of have the same as mindedness, then yeah, I think it would be a lot easier. … I think if you can get a cluster of a few teachers, like this hub of teachers that are willing to take it on, then it makes it easier. And again, then it's easier to bounce ideas off each other and easier to see where things are going with it. (Amanda)

These findings revealed that to effectively integrate anti-oppressive pedagogies into STEM and promote meaningful and authentic engagement of multiple knowledges, STEM teachers should be open to doing collective work and building meaningful relationships with other educators.

Subtheme 3b: Teacher Professional Background and Identities

Teacher's academic background, experiences with social justice education as well as their own identities also mediated the success of the project. In this study, there was a diverse STEM teacher background. One had no prior experience with social justice in STEM, one had a graduate degree focusing on social justice and education, and the other had extensive experience teaching in underserved schools. While prior knowledge aided in researcher-teacher relationships and content creation, an equally important mediating factor needed for the success of social justice integration into STEM was teacher enthusiasm for participation. Intrinsic feelings of excitement, willingness to adapt, and patience were key to the success of the HEADSUP project.

We found that despite Jim's extensive background working with underserved communities, he displayed little enthusiasm integrating these knowledges and experiences into STEM education. There is a clear integration of some social justice principles into his work in his other subject area, "English … just came naturally. So, I feel comfortable with that." However, his "commitment" stops at the humanities, and does not extend into his STEM classrooms. Jim marks the integration of social justice in his English course as "I've never really gone to think about math through [a social justice lens] … that was new for me." His lack of enthusiasm for integrating the HEADSUP framework in his STEM courses reflects his unwillingness to adapt to an inclusive STEM curriculum. His current math course is uncritical of the biases math carries, and he displayed limited willingness to interrogate or change.

Amanda does not have a strong social justice background but exhibits high enthusiasm. Additionally, she is a newer teacher and struggles with the density of the science curriculum, "when I first started teaching like it when it was a new course, it was just trying to wrap my head around what I had to teach in the curriculum ... Now, I don't have to worry about that stuff. I now feel comfortable, and we can now explore some of these other topics, we can talk a little bit more about social justice and social issues in science." As such, she did not previously question the STEM curriculum she was teaching and was naturally hesitant to integrate HEADSUP into her teaching, "we didn't know how we were going to approach it … And in my mind, I hadn't seen how HEADSUP could apply to a science based or math type class" (Amanda).

While there was initial reluctancy, Amanda's enthusiasm and willingness to work with the research team and student needs facilitated an environment for pedagogical decoloniality,

> The one thing that I am very thankful for HEADSUP in this experience was that it did make me do things that I normally wouldn't do in class ... And I thought that was really good because it pushed what I was comfortable with doing. It wasn't something I normally would do with my class, but we did it together. And that was really helpful. (Amanda)

Due to Amanda's lack of experience with anti-oppressive curriculum or pedagogy, having two researchers guide her development aided her students learning and her own (un)learning. Interestingly, Amanda is incredibly eager to integrate our learning exercises and create more for her future students.

Sadar brings a strong social justice background and high enthusiasm. With his background and mindset, he was open to interrogate current curriculum and practice,

> I wouldn't say I'm a science first science teacher, I would say I'm a kid-first teacher of science, if I could say it that way … also having taught in alternative programs, I taught in like expulsions and suspensions before, so I've worked with kids from marginalized backgrounds, from racialized backgrounds, and kids who are overrepresented in areas outside of regular day school … I spent a ton of time reading literature on social justice and equity and I think of some of the stuff that I read that still sticks with me. (Sadar)

Since he already was problematizing current practices, he was open and committed to integrating the HEADSUP framework into his teaching. His efforts and ideology built meaningful relationships with his students and with the research team. From here, he shows enthusiasm and commitment to continuing inclusive pedagogy. Accordingly, the study revealed that teachers with a preexisting interest in and knowledge of social justice in education issues had an easier time integrating the HEADSUP framework into their teaching practice. That said, teacher enthusiasm for the work was also an important mediating factor. For instance, despite teacher background knowledge and understanding of social justice issues, teachers who lacked enthusiasm for the project struggled to successfully integrate the HEADSUP framework into their teaching practice.

Discussion

Through decolonial theory, we understand that within Canadian society, Western perspectives are often universalized, while voices that deviate from this norm are marginalized (Maldonado-Torres, 2007; Shultz & Pillay, 2018). To dismantle colonial and neo-colonial structures within education including STEM contexts, it is essential to promote a pluriverse of voices, including those of Indigenous groups from Turtle Island, people of colour, women, newcomers, and the 2SLGBTQ+ community (Kayumova & Dou, 2022). It is important to note that decoloniality and ethical relationality do not invalidate Western ways of knowing but recognize them as one part of a broader epistemological landscape (Mignolo & Walsh, 2018). This article explored how a group of researchers aimed to foster decolonial STEM education in an Ontario secondary school using the HEADSUP framework. HEADSUP helps teachers navigate the pitfalls often found in anti-oppressive education by challenging ethnocentrism, ahistoricism, depoliticization, and other forms of coloniality (Pashby & Sund, 2020). However, findings revealed that many teachers struggled to connect the HEADSUP framework with the Ontario STEM curriculum, often citing a disconnect between the framework's emphasis on diverse epistemologies and the rigid expectations of the curriculum. This resistance was further compounded by teachers' internalized pressure to cover the prescribed curriculum content, leaving little time for the integration of social justice or decolonial approaches (Pillay et al., 2022). Despite these challenges, the study also revealed moments where the HEADSUP framework was generative and promoted co-learning and ethical

relationality (Kelly, 2021). For example, some teachers found that integrating diverse perspectives into their STEM teaching allowed them to build deeper, more meaningful relationships with their students. These interactions did not only broaden students understanding of STEM concepts but also facilitated an ongoing dialogue about broader social justice issues (Karsgaard et al., 2022). Also, teachers noted that the application of the HEADSUP framework extended beyond curriculum expectations, fostering deeper critical thinking and co-learning between students and teachers. One teacher's successful use of land-based learning illustrates the potential of integrating Indigenous ways of knowing into STEM classrooms. This teacher adapted her pedagogy to include land-based learning, which shifted the Eurocentric focus of her lessons and allowed students to connect more holistically with the material. Such an approach reinforced the importance of pedagogy in decolonizing education (Battiste, 2013). By focusing on how curriculum content is presented, teachers can foster ethical relationships with the land and the natural world, emphasizing relationality as a central tenet of decolonial education (Styres, 2020). Furthermore, as the findings have revealed, co-learning among teachers proved to be a key factor in the success of the HEADSUP framework. When teachers collaborated, sharing ideas and learning collectively, the project gained momentum and efficacy. As the findings indicate, the absence of trust and weak relational ties between teachers can negatively impact meaningful decolonial work in STEM education. Overall, while the HEADSUP framework holds significant potential for fostering ethical relationality and decoloniality in STEM education, its implementation in this study was hindered by both curricular constraints and teacher resistance. The study highlights the need for continued support, professional development, and collaborative spaces for teachers to engage with diverse epistemologies and ontologies. This approach would not only challenge the coloniality embedded within curriculum but also create a pathway towards a more inclusive and relational STEM education.

Conclusion and Implications for Policy

STEM education has gained considerable attention in recent years, as it is considered vital for the development of skills necessary for the current and future workforce (OECD, 2022). Despite this importance, research indicates that historically marginalized groups are vastly underrepresented in STEM related subjects and careers (Aikenhead, 2017; Miller & Roehrig, 2018). Furthermore, STEM educators have been identified as especially resistant to developing inclusive pedagogies where diverse perspectives, beliefs, and ways of knowing and learning can all be honoured (Arvanitis, 2018). Compounding this issue, in Canada, there is a paucity of research on STEM teachers' knowledge and understanding of decolonial and anti-oppressive pedagogies.

In response to this, this research project aimed to understand the impact of integrating a decolonial and anti-oppressive critical global citizenship education framework in Grade 9 STEM classrooms of an Ontario school (Andreotti, 2012). Results revealed that ethical relationality plays a crucial role in both the success and failure of decolonial STEM education. In other words, the success of decolonial STEM education hinges at least in part on the ability of teachers to present distinct ways of knowing, being, doing, and sensing alongside one another in ethically relational ways. Furthermore, results point to how the curriculum as well as co-learning play a significant role in generating learning spaces through ethical relationality. The interaction between co-learning and curriculum when it comes to fostering ethical relationality and decolonial STEM education points to future research areas to consider in this important work. Therefore, this study provides a starting point for policymakers in Ontario and beyond to support teachers to develop the capacity of STEM teachers in anti-oppressive and decolonial work.

References

Aikenhead, G. S. (2017). Enhancing school mathematics culturally: A path of reconciliation. *Canadian Journal of Science, Mathematics and Technology Education*, *17*(2), 73–140. https://doi.org/10.1080/14926156.2017.1308043

Akkari, A., & Radhouane, M. (2022). *Intercultural approaches to education: From theory to practice*. Springer International Publishing AG.

Andreotti, V. D. O. (2011). The political economy of global citizenship education. *Globalisation, Societies and Education*, *9*(3–4), 307–310. https://doi.org/10.1080/14767724.2011.602292

Andreotti, V. (2012). Editor's preface: HEADS UP. *Critical literacy: Theories and practices*, *6*(1), 1–3.

Aronson, B., & Meyers, L. (2020). Critical race theory and the teacher education curriculum: Challenging understandings of racism, Whiteness, and coloniality. *Whiteness and Education*, *7*(1), 32–57. https://doi.org/10.1080/23793406.2020.1812109

Arvanitis, E. (2018). Preservice teacher education: Towards a transformative and reflexive learning. *Global Studies of Childhood*, *8*(2), 114–130. https://doi.org/10.1177/2043610617734980

Battiste, M. (2013). *Decolonizing education: Nourishing the learning spirit.* Purich Publishing Limited.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101. https://doi.org/10.1191/1478088706QP063OA

Burbanks, I. V. S. M., Shockley, K. G., & LeNiles, K. (2020). The need for African centered education in STEM programs for black youth. *Journal for African American Males in Education*, *11*(2), 12–24. https://scholar.google.com/scholar_lookup

Carroll, S. M. (2021). Anti-oppressive global citizenship education theory and practice in pre-service teacher education. *Policy & Practice: A Development Education Review*, *33,* 7–27.

Coulthard, G., & Simpson, L. B. (2016). Grounded normativity/place-based solidarity. *American Quarterly*, *68*(2), 249–255.

Creswell, J. W. (2014). *Research design: Qualitative, quantitative, and mixed methods approaches* (4th ed.). SAGE Publications.

Davies, J. (2021). Opening the "can of worms": Preparing teachers to address issues relating to "race." *Frontiers in Education, 5*. https://doi.org/10.3389/feduc.2020.489407

Dei, G. J. S. (2020). Elders' cultural knowledges and African Indigeneity. In *The Palgrave handbook of African education and Indigenous knowledge* (pp. 279–301). Springer. https://link.springer.com/book/9783030842000

Dei, G. J. S., Karanja, W., & Erger, G. (2022). Land as Indigenous epistemology. In G. J. S. Dei, W. Karanja, & G. Erger (Eds.), *Elders' cultural knowledges and the question of Black/African Indigeneity in education* (pp. 113–126). Springer.

DiAngelo, R., & Sensoy, Ö. (2018**).** "Yeah, but I'm shy!": Classroom participation as a social justice issue. *Multicultural Learning and Teaching*, *14*(1), 1–16. https://doi.org/10.1515/mlt-2018-0002

Domina, T., Penner, A., & Penner, E. (2017). Categorical inequality: Schools as sorting machines. *Annual Review of Sociology*, *43*(1), 311–330.

Donald, D. (2016). Chapter three: From what does ethical relationality flow? An "Indian" act in three artifacts. *Counterpoints*, *478*, 10–16. https://www.jstor.org/stable/45157205

Dumas, M. J., & Ross, K. M. (2016). "Be real Black for me" imagining BlackCrit in education. *Urban Education*, *51*(4), 415–442. https://doi.org/10.1177/0042085916628611

Ermine, W. (2007). The ethical space of engagement. *Indigenous Law Journal*, *6*(1), 193.

Fúnez-Flores, J. I. (2023). Anibal Quijano:(Dis) entangling the geopolitics and coloniality of curriculum. *The Curriculum Journal*. https://doi.org/10.1002/curj.219

Gaudry, A., & Lorenz, D. (2018). Indigenization as inclusion, reconciliation, and decolonization: Navigating the different visions for indigenizing the Canadian academy. *AlterNative: An International Journal of Indigenous Peoples*, *14*(3), 218–227. https://doi.org/10.1177/1177180118785382

Goddard, C., & Evans, D. (2018). Primary pre-service teacher' attitudes towards inclusion across the training years. *Australian Journal of Education*, *43*(6). 122–142. 10.14221/ajte.2018v43n6.8

Hayes, C., & Juárez, B. (2012). There is no culturally responsive teaching spoken here: A critical race perspective. *Democracy & Education*, *20*(1), 1–14. http://democracyeducationjournal.org/cgi/viewcontent.cgi?article=1023&context=home

James, C. E., & Turner, T. (2015). *Fighting an uphill battle: Report on the consultations into the well-being of Black youth in Peel region*. Turner Consulting Group.

Karsgaard, C., Pillay, T., & Shultz, L. (2022). Facing colonial Canada through pedagogies of equity for First Nations: An advocacy education project. *Journal of Curriculum and Pedagogy*. https://doi.org/10.1080/15505170.2022.2134948

Kayumova, S., & Dou, R. (2022). Equity and justice in science education: Toward a pluriverse of multiple identities and onto-epistemologies. *Science Education*, *106*(5), 1097–1117. https://onlinelibrary.wiley.com/doi/abs/10.1002/sce.21750

Kelly, V. (2021). Radical acts of re-imaging ethical relationality and trans-systemic transformation. *Engaged Scholar Journal*, *7*(1), 183–202. https://doi.org/10.15402/esj.v7i1.70759CopiedAn error has occurred

Khushal, S. (2022). Anti-racist educational leadership and policy: Addressing racism in public education. https://doi.org/10.1177/17427150211050441

Krasnoff, B. (2016). *Culturally responsive teaching. A guide to evidence-based practices for teaching all students equitably*. Equity Assistant Center at Education Northwestern. https://educationnorthwest.org/sites/default/files/resources/culturally-responsive-teaching.pdf

Leyva, D., Libertus, M. E., & McGregor, R. (2023). Math intervention targeting family routines increases parental math talk and math activities. *Journal of Applied Developmental Psychology*, *89*, Article 101595. https://www.sciencedirect.com/science/article/abs/pii/S0193397323000850?via%3Dihub

Lopez, A. E., & Jean-Marie, G. (2021). Challenging anti-Black racism in everyday teaching, learning, and leading: From theory to practice. *Journal of School Leadership*, *31*(1–2), 50–65. https://journals.sagepub.com/doi/full/10.1177/1052684621993115

Maldonado-Torres, N. (2007). On the coloniality of being: Contributions to the development of a concept. *Cultural Studies*. https://doi.org/10.1080/09502380601162548

Mignolo, W. D. (2011). Geopolitics of sensing and knowing: On (de) coloniality, border thinking and epistemic disobedience. *Postcolonial Studies*. https://doi.org/10.1080/13688790.2011.613105

Mignolo, W. D., & Walsh, C. E. (2018). *On decoloniality: Concepts, analytics, praxis*. Duke University Press.

Miller, B. G., & Roehrig, G. (2018). Indigenous cultural contexts for STEM experiences: Snow snakes' impact on students and the community. *Cultural Studies of Science Education 13*(1). https://doi.org/10.1007/s11422-016-9738-4

Mills, C., & Ballantyne, J. (2016). Social justice and teacher education: A systematic review of empirical work in the field. *Journal of Teacher Education*, *67*(4), 263–276. https://doi.org/10.1177/0022487116660152

Ndlovu-Gatsheni, S. J. (2019). Provisional notes on decolonizing research methodology and undoing its dirty history. *Journal of Developing Societies*, *35*(4), 481–492. https://doi.org/10.1177/0169796X19880417

Nganga, L. (2020). Analyzing children's literature for hidden bias helps preservice teachers gain pedagogical practices in critical multicultural education. *Journal of Research in Childhood Education*, *34*(1), 93–107. https://doi-org.proxy.queensu.ca/10.1080/02568543.2019.1692109

Öngel G., & Tabancalı E. (2022). Conservatism and social justice: Why do some teachers strive harder for social justice while others do not? *International Journal of Educational Administration and Policy Studies*, *14*(1), 53–62.

Ontario Ministry of Education. (2009). *Realizing the promise of diversity: Ontario's equity and inclusion education strategy*. https://files.ontario.ca/edu-equity-inclusive-education-strategy-2009-en-2022-01-13.pdf

Organisation for Economic Co-operation and Development. (OECD). (2022). *OECD employment outlook 2022: Building back more inclusive labour markets*. OECD Publishing. https://doi.org/10.1787/1bb305a6-en

Pashby, K., & Sund, L. (2020). Decolonial options and challenges for ethical global issues pedagogy in northern Europe secondary classrooms. *Nordic Journal of Comparative and International Education*, *4*(1), 66–83. https://doi.org/10.7577/njcie.3554

Pichette, J., Effah, H., & Fritz, M. (2022). *Opportunities for distance learning for adult learners: Analysis of data on college admission applications in Ontario during the COVID-19 pandemic.* Toronto**:** Ontario Council on Quality in Higher Education.

Pillay, T., Ahn, C., Gyamerah, K., & Liu, S. (2022). Considering the role of social media:# BlackLivesMatter as a pedagogical intervention to decolonise curriculum. *London Review of Education*, *20*(1), 1–13. 10.14324/LRE.20.1.14

Pohl, C. (2008). From science to policy through transdisciplinary research. *Environmental Science & Policy*, *11*(1), 46–53. https://doi.org/10.1016/j.envsci.2007.06.001

Shultz, L., & Pillay, T. (2018). Global citizenship, common wealth, and uncommon citizenships: An introduction. In L. Shultz & T. Pillay (Eds.)*, Global citizenship, common wealth and uncommon citizenships* (pp. 1–7). Brill.

Spivak, G. C. (2023). Can the subaltern speak?. In *Imperialism* (pp. 171–219). Routledge.

Styres, S. (2020). Reconciliaction: Reconciling contestation in the academy. *Power and Education*, *12*(2), 157–172. https://doi.org/10.1177/1757743820916845

Takeuchi, M. A., & Marin, A. (2022). "Globalization," coloniality, and decolonial love in STEM education. In *Oxford Research Encyclopedia of Education*. https://oxfordre.com/education/display/10.1093/acrefore/9780190264093.001.0001/acrefore-9780190264093-e-1655

Toronto District School Board. (2021). Working towards anti-oppressive schools—Lessons from WE Charity: A critical review. https://www.tdsb.on.ca/Portals/research/docs/reports/WorkingTowardsAntiOppressiveSchoolsLessonsfromWECharity.pdf

Tsang, J., & Eizadirad, A. (2024). We are all racists: Calling out and undoing Whiteness in teacher education. In A. Kempf & K. Watts (Eds.), *Critical perspectives on White supremacy and racism in Canadian education* (pp. 81–98). Routledge.

Tuters, S. (2015). Conceptualising diversity in a rural school. *International Journal of Inclusive Education*, *19*(7), 685–696. https://doi.org/10.1080/13603116.2014.964573

Ullucci K. (2012). Knowing we are White: Narrative as critical praxis. *Teaching Education*, *23*(1), 89–107. https://doi.org/10.1080/10476210.2011.622747

Visentin, E. (2022). *Baked in like a muffin: The culture of Whiteness in Ontario elementary schools* [Master's thesis, Queen's University, Canada].

Williams, N. V., Robinson, K., Gillham, J. C., & Fetty, K. (2021). Superintendent evaluations: School boards report on criteria, procedures, and professional development. *Journal of Leadership, Accountability and Ethics*, *18*(4). https://articlearchives.co/index.php/JLAE/article/view/4030

Kenneth Gyamerah, PhD, is an assistant professor in the Mitch and Leslie Frazer Faculty of Education at Ontario Tech University in Oshawa, Canada. His major research interests focus on STEM education, African Indigeneity, curriculum and critical educational policy studies, anti-colonial education, and teacher education.

Jane J. Mao, MEd, is a medical student at the University of Manitoba in Canada. Through their research in their BScH (Psychology) and MEd, their research spans educational reform, curriculum development, gender and race identity, and minority stress theory. They hope to use their research to close gaps in medical access to marginalized communities using education and skill-sharing as tools of empowerment.

Alice Johnston, PhD, is an assistant professor in the Departments of Teacher Education and Curriculum and Leadership at St. Francis Xavier University in Canada. Her major research interests focus on decolonizing classroom assessment, land-based learning, and climate justice education.

Ethan Hodges, MEd, is a secondary school teacher in the science department in an Eastern Ontario school board in Canada. His major research interests focus on the attitudes of preservice secondary science teachers towards implementing equity, diversity, and inclusion (EDI) in secondary school science classes. In Ethan's future scholarly activities, he hopes to unpack and address the perceived barriers to implementing EDI from an upstream perspective.

Thashika Pillay, PhD, is an assistant professor of education policy in the Faculty of Education at Queen's University in Kingston, Canada. Her major research interests focus on anti-colonial/decolonial resistance and epistemic justice in formal and informal education spaces.

Karen Pashby, PhD, is professor of global citizenship education and lead for research in the School of Education in the Faculty of Health and Education at Manchester Metropolitan University in the U.K. Her major research interests focus on theoretical and participatory research into critically reflexive approaches to global citizenship education.

Alana Butler, PhD, is an associate professor in the Faculty of Education at Queen's University in Kingston, Canada. Her research interests include the academic achievement of low-socioeconomic students, race and schooling, equity and inclusion, and multicultural education.