

**The Online Identity Development of Indo-Caribbean Women in
Science, Technology, Engineering, and Mathematics (STEM)**

by

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The above committee determined that the thesis is acceptable in form and content and that a satisfactory knowledge of the field covered by the thesis was demonstrated by the candidate during an oral examination. A signed copy of the Certificate of Approval is available from the School of Graduate and Postdoctoral Studies.

Abstract

The severe lack of systematically collected race-based data in Canada contributes to the Canadian field of education's failure to meet the needs of its increasingly diverse demographic of students, resulting in their continued discrimination and oppression. To contribute to the knowledge of the strategies that may be harmful in mitigating these harmful effects, this study conducts an assets-based exploration of the identity development of six Indo-Caribbean women in STEM through the theoretical frameworks of intersectionality and equity, and phenomenological, narrative, and participatory research methodologies. Findings suggest that online communities provide participants numerous educational STEM supports that their institutions failed to provide them. Findings also suggest that the incorporation of racial, cultural, and ethnic identity into STEM education is a protective factor for the participants. Participants provide many recommendations regarding STEM capital development within online communities, many of which are consistent with existing literature.

Keywords: Indo-Caribbean women; STEM identity development; intersectionality; anti-deficit; equity

Author's Declaration

I hereby declare that this thesis consists of original work of which I have authored. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

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The research work in this thesis that was performed in compliance with the regulations of Research Ethics Board/Animal Care Committee under **REB Certificate #15981**.



Keisha Ann Deoraj

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Statement of Contributions

I hereby certify that I am the sole author of this thesis and that no part of this thesis has been published or submitted for publication. I have used standard referencing practices outlined in the Publication Manual of the American Psychological Association, Seventh Edition (American Psychological Association, 2020) to acknowledge ideas, research techniques, or other materials that belong to others. Furthermore, I hereby certify that I am the sole source of the creative works and/or inventive knowledge described in this thesis.

Table of Contents

Thesis Examination Information.....	ii
Abstract.....	iii
Author’s Declaration.....	iv
Acknowledgements.....	v
Statement of Contributions.....	vii
Table of Contents.....	viii
List of Tables.....	xiii
List of Figures.....	xv
List of Abbreviations and Symbols.....	xvi
Chapter 1.0. Introduction.....	1
1.1. Overview.....	1
1.2. Researcher Positionality.....	2
1.2.1. Indian Indentured Labourers – “Coolies” – in the Caribbean.....	3
1.2.2. Indo-Caribbeans: The Creation of a New Identity.....	5
1.2.3. “Coolie Gyal”: Reclaiming the Word and Identity.....	6
1.2.4. A Note on Terminology.....	9
1.3. Previous Research and Problem Areas	10
1.4. Research Goal	13
Chapter 2.0. Literature Review.....	14
2.1. STEM Fields in the 21st Century.....	14
2.1.1. Demographics of STEM.....	15
2.1.2. Women in STEM in Canada.....	16

2.1.3. Women of Colour in STEM in Canada.....	16
2.1.4. The “Coolie Woman” Gap in STEM.....	17
2.2. STEM Identity: Definitions and Development.....	19
2.2.1. How Racial, Ethnic, and Cultural Identity Impact STEM Identity Development.....	21
2.2.2. STEM Identity Among Women of Colour.....	24
2.3. Online Communities	29
2.4. Research Questions	40
Chapter 3.0 Theoretical Framing.....	41
3.1. Anti-Deficit Thinking.....	41
3.2. Intersectionality.....	45
3.3. Equity Versus Equality.....	53
3.4. Four Dimensions of Equity in STEM Education.....	54
3.4.1. Access.....	56
3.4.2. Achievement.....	60
3.4.3. Identity.....	65
3.4.4. Power.....	72
Chapter 4.0. Methods.....	80
4.1. Research Design.....	80
4.1.1. Phenomenological Research.....	80
4.1.2. Narrative Research.....	81
4.1.3. Participatory Research.....	82
4.2. Participants.....	85
4.3. Context.....	87

4.4. Data Collection Tools	89
4.4.1. Semi-Structured Interviews	89
4.4.2. Audio and Video Recording	91
4.4.3. Researcher Notes	93
4.5. Procedure	94
4.5.1. Initial Meeting with Participants.....	94
4.5.2. Second Meeting with Participants.....	96
4.6. Data Analysis.....	100
4.6.1. Transcribing.....	100
4.6.2. Participant Verification of Transcripts and Follow-Up Interview.....	100
4.6.3. Qualitative Coding.....	102
4.6.4. Thematic Content Analysis.....	107
Chapter 5.0. Results.....	111
5.1. Identity.....	114
5.1.1. Identity Crisis: STEM Identity And/Or Coolie Identity.....	114
5.1.2. Poor Representation of Coolie Women in STEM.....	116
5.1.2.1. Poor Institutional Representation of Coolie Women in STEM..	116
5.1.2.2. A Lack of Online Representation for Indo-Caribbean Women in STEM.....	118
5.1.3. Stereotypes and Microaggressions Directed Towards Coolie Women in STEM.....	120
5.1.4. Cultural Identity as a Protective Factor for Coolie Women in STEM...	123
5.2. Community	127
5.2.1. A Perceived Lack of Community for Coolie Women in STEM.....	127
5.2.1.1. A Lack of Acceptance for Indo-Caribbean Women in STEM...	127

5.2.1.2. A Lack of Belonging for Indo-Caribbean Women in STEM....	129
5.2.1.3. A Lack of Mentorship for Indo-Caribbean Women in STEM...	132
5.2.2. Participant Reflections of Community on STEM Identity Development.....	134
5.2.2.1. The Impact of Representation on Participants’ Acceptance in STEM.....	134
5.2.2.2. The Impact of Belonging on Participants’ STEM Identity.....	136
5.2.2.3. The Impact of STEM Mentorship on Participants’ STEM Identity.....	139
5.3. Social Media	141
5.3.1. Fostering STEM Identity Development Through Online Social Media Groups.....	142
5.3.2. Increased Acceptance and Belonging in STEM Through Online Connection and Representation.....	144
5.3.3. Social Media Groups As A Means For STEM Mentorship and Persistence.....	146
5.3.4. Participants’ Recommendations for STEM Capital Development via Online Social Media Groups.....	148
5.4. Summary of Findings and Conclusions	152
5.4.1. Identity.....	153
5.4.2. Community.....	153
5.4.3. Social Media.....	154
Chapter 6.0. Discussion.....	155
6.1. A Lack of Institutional Support	156
6.2. Finding Community and Power in Online Social Media Groups	161
6.3. Ethnic, Racial, and Cultural Identity Strengthens STEM Identity.....	166
6.4. Using Online Social Media Groups as Tools for Building STEM Capital..	171
6.5. Implications and Recommendations	176

6.6. Limitations	183
6.6.1. Overall Research Design.....	183
6.6.2. Methods and Sample.....	185
6.6.3. Unanticipated Obstacles.....	187
6.7. Future Research	187
Chapter 7.0. Conclusions.....	191
Chapter 8.0. References.....	195
Appendices.....	250
Appendix A – Social Media Groups.....	250
Appendix B – Letter to Social Media Groups	251
Appendix C – Participant Recruitment Images	252
Appendix D – Pre-Planned Semi-Structured Interview Questions.....	255
Appendix E – Informed Consent Form.....	258
Appendix F – List of Community Supports and Services	265
Appendix G – Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans Course on Research Ethics (TCPS 2: CORE) Certificate....	266

List of Tables

CHAPTER 4

Table 4.1: Timeline of Study Procedures	94
Table 4.2: Relevant Codes and Code Definitions	104

CHAPTER 5

Table 5.1: Summary of Codes and Subcodes, Co-occurrences, and Themes and Subthemes.....	112
Table 5.2: Participant Perspectives Regarding their Indo-Caribbean and STEM Identities.....	115
Table 5.3: Participant Perspectives of Indo-Caribbean Women’s Representation in STEM Institutions.....	117
Table 5.4: Participant Perspectives of Indo-Caribbean Women’s Representation in STEM in Online Social Media Communities.....	119
Table 5.5: Participant Experiences of Racial and Gender Microaggressions and Stereotypes in STEM.....	121
Table 5.6: Participant Reflections on their Indo-Caribbean Identities as Strength in STEM.....	123
Table 5.7: Participant Experiences of Exclusion in STEM.....	128
Table 5.8: Participant Experiences of Alienation in STEM.....	130
Table 5.9: Participant Reflections on Limited STEM Mentorship.....	132
Table 5.10: Participants’ Desires for Increased Representation and Acceptance in STEM.....	135

Table 5.11: Participants’ Desires for Increased Belonging and STEM Identity.....	137
Table 5.12: Participants’ Desires for Increased STEM Mentorship and STEM Identity.....	139
Table 5.13: Participants’ Reflections of STEM Identity Development via Online Social Media Groups.....	143
Table 5.14: Participants’ Reflections of STEM Identity Development via Online Social Media Groups.....	145
Table 5.15: Participants’ Descriptions of STEM Mentorship and Persistence via Online Social Media Groups	147
Table 5.16: Participants’ Recommendations for STEM Capital Development via Online Social Media Groups	149

List of Figures

CHAPTER 4

Figure 4.1: Levels of Participation in Action Research	95
Figure 4.2: Codes Developed During the Deductive and Inductive Qualitative Coding Process.....	104
Figure 4.3: Themes Identified During the Process of Thematic Content Analysis.....	110

List of Abbreviations and Symbols

ACGPA	Advisory Committee for GPRA Performance Assessment
APA	American Psychological Association
BHASE	Business, Humanities, Health, Arts, Social Science, and Education
BIPOC	Black, Indigenous, People of Colour
BIWOC	Black, Indigenous, Women of Colour
CAQDAS	Computer-Aided Qualitative Data Analysis Software
CCW	Community Cultural Wealth
CMEC	Council of Ministers of Education, Canada
CS	Computer Science
DDS	Doctor of Dental Surgery
DO	Doctor of Osteopathic Medicine
DVM	Doctor of Veterinary Medicine
ICT	Internet-Enabled Information and Communication Technologies
IT	Information Technology
GPRA	Government Performance and Results Act
MD	Doctor of Medicine
NSB	National Science Board

NSF	National Science Foundation
OHRC	Ontario Human Rights Commission
POC	People of Colour
SES	Socioeconomic Status
SGM	Sexual and Gender Minority
STEM	Science, Technology, Engineering, and Mathematics
TCA	Thematic Content Analysis
U.S.	United States
U.K.	United Kingdom
WOC	Women of Colour

Chapter 1.0. Introduction

The purpose of this study is to explore the question: How has online activity supported the identity development of a group of Indo-Caribbean women in science, technology, engineering, and mathematics (STEM) fields of education in Canada? I explore the identity development of Indo-Caribbean women in STEM through the theoretical frameworks of intersectionality (Crenshaw, 1989), equity (Gutiérrez, 2007) and anti-deficit perspectives (Adiredja, 2019); and the methodologies of phenomenological (Farrell, 2020), narrative (Salkind, 2010), and participatory research (Chappell, 2000).

1.1. Overview

There is an increase in racial and cultural diversity within Canada (Brosseau & Dewing, 2018). Canada's diversity is reflected in data from a 2019 study showing that the percentage of visible minorities among the school-age population (i.e., ages five to 24), in and out of census metropolitan areas, increased 4.4% between 2011 to 2016 (i.e., 22.8 percent in 2011 to 27.2 percent in 2016). While one can assume that an increase in the proportion of visible minorities in Canada is reflected in classrooms, it is hard to say because there is a severe lack of systematically collected race-based data in Canada (Asiedu, 2020; Khan et al., 2020; Owusu-Bempah & Bernard, 2021).

An increase in diversity among the school-aged population in Canada means there is an immediate need to adapt teaching and learning to meet the varied needs of our nation's students at all levels of education (Howard, 2003). Historically, the Canadian education system has failed to meet all the diverse needs of our students. This failure has resulted in generations of systematically oppressed and marginalized people and the development of

negative stereotypes and biases (Borrero & Sanchez, 2017). Unfortunately, the oppression of and discrimination towards many marginalized people still exists today (Government of Canada, 2020), directly contradicting the Ontario Human Rights Code (i.e., Part I, Freedom from Discrimination) and the Canadian Charter of Rights and Freedoms (i.e., Section 15, Equality Rights) (Department of Justice Canada, 2022; Government of Ontario, 2022). Education systems across Canada are not immune to this (Burczycka, 2020), including Ontario (Ontario Human Rights Commission, 2017) where this study was conducted. Subsequently, it is essential to study ways to mitigate oppression and discrimination within our education systems. This study attempts to do so by addressing a specific demographic and context: Indo-Caribbean women in STEM in Canada. Specifically, this study explores the online identity development of six Indo-Caribbean women in the Canadian STEM context.

1.2. Researcher Positionality

I am an Indo-Caribbean-Canadian woman with an Honours Bachelor's Degree in Biology, Mathematics, and Chemistry, an Ontario College Advanced Diploma in Environmental Technology, and a Bachelor's Degree in Education with Basic Qualifications in Intermediate-Level and Senior-Level Biology and Mathematics. The instances of discrimination I faced based on my race, ethnic, cultural and gender identities within my post-secondary STEM education are the driving force of this project. The online community of Indo-Caribbean women I found after leaving the world of STEM brought me the solidarity, support, and strength I needed for the healing I had to do after being forced out of the world of STEM. This thesis is my opportunity to explore

these experiences more deeply in an effort to continue my individual healing and the collective healing of Indo-Caribbean women everywhere.

1.2.1. Indian Indentured Labourers – “Coolies” – in the Caribbean

Many North American dictionaries (i.e., Cambridge Dictionary and Dictionary.com) define the word *Coolie* as “a hired labourer.” The word *Coolie* has roots in South Asian languages such as Hindi and Tamil, in which the word *kuli* (the same pronunciation as *Coolie*) means “wages” (Persadie, 2020). This word became very prevalent in the English language in the 1830s when the British Empire ended the African slave trade in the Caribbean, replacing it with the indentured labour system (Roopnarine, 2006). The British transported more than one million South Asian *Coolies*, people who agreed to do work in return for *kuli* (wages) to Caribbean nations such as Jamaica, Trinidad and Tobago, Guyana (British Guiana), and Suriname (Dutch Guiana). British recruiters in India often played on the vulnerable state of those looking to escape poverty and the caste system, promising them riches and free return to India, in exchange for working five-year contracts on sugar plantations on foreign lands (Roopnarine, 2006). Of course, the promises of wealth and transportation were not honoured.

Although Chinese people were also among those recruited to indentureship in the Caribbean, the word *Coolie* became primarily associated with Indian indentured labourers and their descendants. The use of the word *Coolie* was a tool of oppression that reminded Indian indentured labourers of their foreign ancestry, their struggles, and their little value in this new land. As Gaitura Bahadur notes in her interview with National Public Radio, “[Coolie] was the bureaucratic term the British used to describe indentured laborers... But it became a highly charged slur” (NPR Staff, 2013, para. 7). *Coolies* were

shamed and associated with a low caste. They were considered dirty, uneducated, and unskilled because they agreed to perform laborious jobs for low or subsistence wages. The label of *Coolie* was also used to create racial tension in the British West Indian colonies (in the Caribbean) (Morrock, 1973). British colonizers categorized *Coolies* as different from themselves and saw *Coolies* as distinct from the former African slaves and their descendants. The British intentionally instigated problems between African slaves and Indian indentured labourers to cause a racial divide; racial tension among Indo- and Afro-Caribbean people are still palpable to this day.

Coolie women, in particular, faced many gendered hardships. Daignault (2020) explains, “what is not commonly discussed [when discussing the history of *Coolies*] is the particular exploitation and brutalization of women” (para. 6). There was an uneven ratio of *Coolie* men to women (approximately 100:40) onboard the first ships that arrived in the West Indies (Daignault, 2020). The inconsistent recruitment of women into indentureship was because women were seen as less valuable workers than men (Daignault, 2020). Not all women that boarded the ships leaving India did so consensually. Some women were kidnapped from communities across India. Assumed to be sex workers or low caste, they suffered under deeply rooted cultural discrimination and colourism while onboard the ships that took them to the West Indies (Daignault, 2020).

While on the ships, women had to build social bonds with one another quickly to protect themselves from rape and gang rape (Bissessarsingh, 2020). This abuse did not end when the ships docked in the Caribbean. Many women were subjected to horrendous abuse in the new land they called home. The women were exoticized by the former

African slaves, who viewed them as promiscuous and wild (Bissessarsingh, 2020). They were subject to sexual abuse at the hands of other Indian indentured labourers and the British colonizers. Often, *Coolie* women were sexually assaulted while they worked in the sugar cane fields (Bissessarsingh, 2020). When this happened, they carried their shame and blame alone. Over the years, this culture has continued and contributed to the high rates of domestic violence, intimate partner crimes, murder, and suicide plaguing the Caribbean and the diaspora (Mehta, 2004). Despite this, *Coolie* women have also been integral to the continuance of ethnic and cultural practices in the Caribbean. As Daignault (2020) writes:

In spite of all they endured, these women represent the crux of our culture. Deeply grounded in diverse forms of oral narrative, through story, cooking and songs, these women carried the culture from their homelands but also participated in the creation of what is now considered Caribbean culture. Their teachings, the ones they brought and the ones they made, changed the physical and non-physical landscape around them. (para. 17)

Coolie women have also been at the forefront of many activist movements in the Caribbean and across the diaspora (Outar, 2018; Roopnarine, 2006; Roopnarine 2014; Roopnarine, 2015).

1.2.2. Indo-Caribbeans: The Creation of a New Identity

It was only when *Coolie* descendants began migrating out of the Caribbean (e.g., the Windrush generation) that the identity of “Indo-Caribbean” began to take shape. Broadly, the Indo-Caribbean identity is a means to separate our identities from other diasporic Indians (Outar, 2018). Why? In the diaspora, subcontinental Indians tend to be

cold and unwelcoming to Indo-Caribbeans (Berger, 2004). Despite our common ancestry, the historical timing and conditions of our migrations drastically set us apart. For example, in the Caribbean political and economic turmoil of the 1970s and 1980s, many Indo-Caribbeans migrated to the United States and Canada. However, Indian professionals who migrated from Asia to the same places had done so in the 1960s and had not done so out of desperation because they were highly educated professionals primarily from higher castes and high socioeconomic status (Berger, 2004). The resulting class disparity between Indo-Caribbeans and subcontinental Indians in diasporic communities added to the existing negative associations that subcontinental Indians have towards Indo-Caribbeans. These stereotypes exist because it was largely India's working castes that were recruited (or stolen) into indentureship. Accordingly, the descendants of those labourers are considered low caste, too. In Indian communities, casteism is still prevalent today (Barman, 2020) and can also be witnessed in the animosity that the subcontinental community has towards the Indo-Caribbean community. As such, Indo-Caribbeans in the diaspora do not often turn to Indian diasporic communities to seek comfort (Berger, 2004). Instead, Indo-Caribbeans create their own communities, such as Richmond Hill, Queens, New York, which is lovingly referred to as *Little Guyana*. Indo-Caribbeans can find solidarity, understanding, and strength in their collective identity as *Coolie* people in these communities.

1.2.3. "Coolie Gyal": Reclaiming the Word and Identity

I am of the first generation of my Indo-Guyanese family that was born in Canada. Growing up with immigrant parents meant that I was being raised by parents who were trying to re-identify themselves within Canadian society (Gilkinson & Sauv e, 2010). As

such, there was a lot that I was not taught about my Indo-Guyanese identity. This was intentional on my parents' part; as a way to survive, they tried to fit in or assimilate (Beery & Hou, 2016) to Canadian culture as much as they could. For example, they had to change the way they speak. My parents are linguistic chameleons: speaking "proper, educated" English at work and in public spaces, and "broken" English with family and other West Indian friends. My parents always spoke to me in what they referred to as "proper, educated" English (i.e., English as spoken by white Canadians). Admittedly, my Guyanese accent makes an appearance among family or when I am angry, which is usually simultaneously! However, the "proper, educated" English our parents taught us, reinforced by Canadian culture, became our default way of speaking. Once my grandparents joined my immediate family in Canada, their "fresh off the boat" accents became a source of embarrassment for me. I was ashamed that my white Canadian friends could not understand, and made little effort to understand, my grandparents' warm greetings as they welcomed my friends into our home. It has taken many years for me to unlearn the adjective "broken" as a way to describe the beautiful dialect of English, Guyanese Creole, that my family speaks. And only recently in my life have I been able to manipulate my Guyanese accent in the way my parents can; turning it "on" among trusted friends, and in more situations than ones that enrage me.

There are countless other ways that my family had to assimilate as newcomers in Canada. However, the one thing that my parents always maintained was that I was a "*Coolie Gyal*," *gyal* being Guyanese Creole for *girl*. I had no idea what that meant for a long time, but it was the single piece of my identity that I was taught to be proud of. I held onto it, hoping that one day it would have more meaning to me. As I grew older and

started to identify the intersecting pieces of my identity, I learned the word *Coolie* had negative connotations for some people. For me, *Coolie* never meant “slave,” “unskilled,” or “uneducated.” For me, *Coolie* always meant *richness*: the richness of food, music, dance, and culture, in both the positive and negative aspects. Despite the shame that I sometimes felt for being so different from the society around me, I knew there was a richness to my *Coolie* identity that existed that I was yet to discover. Thus, for me, reclaiming the word *Coolie* is an act of resistance and defiance against the British colonial powers that did and still do wreak havoc on the lives of *Coolie* people within the Caribbean and in the Caribbean diaspora.

The *Coolie* identity begins with indentureship. Yes, we lost many things through the process of colonialism: languages, culture, and lives. However, those who survived showed extreme resiliency; they were not meek, nor were they docile. We created our own new culture, influenced by and with the new land, people, and cultures surrounding us. They fought to preserve their culture, even if that meant enduring further hardships from their oppressors. The harder the British worked to take away their identity, the more they fought for their liberation. Despite being tricked into working in the indentureship system, they still did everything they could to provide a better life for their descendants. My ancestors did not go through what they went through for me to be ashamed of who they were. The least that I could do to honour their fight for justice is to acknowledge them wholly: their hardships, rebellion, strife, resilience, and their name. Throughout this thesis, I embrace the label of *Coolie* to reclaim the power that was taken from my ancestors long ago.

As described above, the use of the word *Coolie* is very contentious. For some, such as myself, the term is laden with rich history and a positive identity that represents “reclamation and agentive potential” (Persadie, 2020, p. 62). However, for others, it is considered an oppressive label that encompasses “great anxieties, disdain, offense, and discomfort” (Persadie, 2020, p. 73). Persadie (2020) writes, “despite these reclamations, the word coolie is still deployed in postcolonial times as a marker of inferiority and draws upon this site of Indo-Caribbean injury to cause further harm, especially within battles of political and racial politics in countries with colliding histories of slavery and indenture such as Trinidad and Tobago and Guyana” (p. 73). Thus, I ask that readers who do not claim the *Coolie* identity use the term *Indo-Caribbean* when referring to the community in all contexts.

1.2.4. A Note on Terminology

Identity is complex; the language used to discuss identity can be, too. Throughout this thesis, I refer to published literature that spans several disciplines and decades. While I try my best to write from an assets-based, anti-oppressive lens, there are instances where I reflect the language used in the existing scholarly literature (i.e., direct quotes). In some cases, doing so means using language that inaccurately reflects the complexity and fluidity of identity, as well as my own personal values. For instance, when referencing a report by the Council of Ministers of Education, Canada (2021), I sometimes use the word *gender* to reflect the report's language, despite the inaccuracy of the word's usage in this context. The report presents trends in STEM graduates according to gender, but only presents information regarding *men* and *women* (i.e., sex, according to the gonadic classification). *Gender* and *sex* are not the same and, therefore, should not be

used interchangeably. However, in the case of this report, using the word *gender* in place of the word *sex*, implies that there are two genders, which we know is false (De Loof, 2018). While the report's intentions were not necessarily malicious, the misuse of language regarding sex and gender identity contributes to the erasure of trans and non-binary identities. Additionally, the use of the word *female* as compared to *woman* can be contentious. Even the use of the word *womxn*, which was the spelling that I employed at the start of this research, has a history and context to be considered. That said, while I try my best to learn about and implement anti-oppressive actions, I am fallible. I also acknowledge the reality that in the future, academics may make remarks about my writing being oppressive in some way. Should this ever be the case, I welcome it; I will always send gratitude and encouragement to those trying to make the world a more just place.

1.3. Previous Research and Problem Areas

Research examining racialized students and STEM education has identified many problems that uniquely impact racialized students. An example of one of the common problems found by analysis is the phenomenon of racialized female students underperforming in science and mathematics compared to their non-racialized counterparts (Riegle-Crumb et al., 2019). However, different demographics of students in STEM report having different issues. For example, Quinn and Cooc (2015) found that the “leaky” science pipeline (p. 337), defined as the progressive loss of competent women in STEM, may begin as early as the third grade for Black and Latinx students in America, but much later for white students (Liu et al., 2019a). Additionally, research by Pang et al. (2011) addresses the model minority narrative about Asian students, highlighting how it

is harmful to the subgroups of Asian students in the United States while simultaneously harming Black communities by perpetuating anti-Black racism. This anti-Black ideology prevents much-needed attention from research and policy on the systemic inequities experienced by students across the system (Nasir & Shah, 2011; Zavala & Hand, 2017).

These studies are critical because they bring to light the many issues needing attention across education systems globally. Identifying issues in education is the first step in creating possible solutions that could rectify or ameliorate them. However, we cannot assume that issues impacting one demographic of people exist across all demographics. For example, we cannot assume that the results of Pang et al. (2011) relating to Asian students are observed in the Indo-Caribbean community (i.e., we cannot assume that the model minority myth similarly harms Indo-Caribbeans, who are also racially classified as “Asians”). Additionally, Indo-Caribbeans in Canada report feelings of invisibility due to mistaken classifications by others based on their race (i.e., classifications as East Indian from India, Pakistan or Sri Lanka based on physical appearance) and ethnicity (i.e., perceptions of Caribbean identity are based largely on Afro-Caribbean experiences only, which negate the heterogeneity of Caribbean identities) (Birbalsingh, 1997; Plaza, 2004). Thus, more research needs to be done within specific communities and contexts to better identify and address their collective educational needs.

In conducting this research, it was difficult to locate published academic literature regarding the specific needs of the Indo-Caribbean community in Canadian STEM educational contexts. This observed lack of research is attributed to the fact that there is a shortage of research on women of Indo-Caribbean background and descent across,

generally, but specifically and more relevantly, in STEM fields. Often, Indo-Caribbean women's experiences are undermined because we get lumped into categorizations of South Asian/Indian or Caribbean peoples (Plaza, 2004). However, neither of those categorizations accurately reflect our intersectional identities, as we are both Indian and Caribbean people. Furthermore, our current geographical locations add another dimension to our identities. *Coolie* women who have migrated, and Indo-Caribbean women born in the diaspora face difficulties and discrimination based on gender *and* race, among other aspects of identity (Baboolal, 2016; Mehta, 2020). Acknowledging how our collective migration out of the Caribbean has added a layer of complexity to our collective identity is an important consideration throughout this thesis.

To reiterate Plaza's (2004) point, we cannot always assume that all racialized groups (e.g., Indo-Caribbeans and Afro-Caribbeans) are subject to the same phenomena, including but not limited to, their experiences in STEM education. Assumptions such as these do not consider the uniquely rich histories and resulting needs of each community (e.g., the Indo-Caribbean community versus the Afro-Caribbean community). And while we do have shared aspects of history and culture with many communities in the Caribbean (e.g., people of African descent and Indigenous peoples), our cultures are all "living, and hence continually evolving, realities that respond to the historical and material circumstances within each discrete country in the region" (Allahar & Varadarajan, 1994, as cited in Plaza, 2004, p. 262). In fact, I argue that by doing so, we exhibit anti-Black and anti-Indigenous behaviour by contributing to the white-washing and the erasure of these communities' histories. In solidarity with Black and Indigenous communities in the Caribbean or the Caribbean diaspora, it is important to me to be able

to write this thesis. This thesis is my way of claiming space for and with fellow Indo-Caribbeans while acknowledging that we have historically also benefited from the subordination of Afro- and Indigenous-Caribbeans; in many cases, we still do. Additionally, creating this research project with a specific focus on Indo-Caribbean women in STEM will begin to fill the gap of academic literature that exists about this demographic of people.

1.4. Research Goal

Generally, the aim of this research is to contribute to the understanding of how to support the inclusion, retention, success, and well-being of more diverse populations in STEM education. The study's context is Internet-enabled information and communication technologies (ICTs), including all online technologies and platforms, which allow for the exchange of information and media (e.g., social media platforms such as Instagram, Facebook, Twitter, TikTok, YouTube, Pinterest, Snapchat, and more) (McInroy, 2020). Specifically, this research is concerned with one specific demographic of STEM learners: Indo-Caribbean (*Coolie*) women in a Canadian STEM educational context. This research seeks to answer the question: *How has online activity supported the identity development of a group of Indo-Caribbean women in STEM?*

In this chapter, I discussed: 1) the purpose of this study; 2) my positionality as a researcher; 3) a brief overview of the previous research and problem areas related to this study; and 4) this project's research goal. In the next chapter, I discuss the areas of research that are relevant to this study and highlight the gaps identified among them. I also outline the project's specific research question and sub-questions that were created in an attempt to fill the identified gaps in the existing literature.

Chapter 2.0. Literature Review

In this chapter, I discuss the literature relevant to this study. There are three key research areas that are of importance to this project: (a) Women of Colour (WOC) in STEM; (b) STEM identity; and (c) online communities of support. A review of these research areas related to this research project follows. I also highlight the gaps identified among the research areas and outline the research questions of this project that I created to attempt to fill the identified gaps in the existing literature.

2.1. STEM Fields in the 21st Century

STEM fields are fast-growing in the United States (U.S.) and Canada (Statistics Canada, 2022a; Institute of Education Sciences, 2011). In the U.S., more than half of the projected economic growth between the years 2015 and 2025 was attributed to STEM fields and STEM-related jobs (Wladis et al., 2015). As such, large investments in research are made to determine ways to encourage growth and recruitment of diverse, talented, and innovative STEM workers to maintain national leadership and competitiveness in global STEM fields (Alkholy et al., 2015; Committee on Underrepresented Groups, 2011). In Canada, similar trends are seen. STEM-related occupations in Canada have grown faster than in any other industry since 1990 (Statistics Canada, 2022a), and they are among some of the highest-paid positions in the country (Statistics Canada, 2022b). The growth of these jobs is expected to increase, thus, so is the demand for STEM education in a post-secondary capacity (Council of Ministers of Education, Canada (CMEC), 2021).

2.1.1. Demographics of STEM

Recent trends show that the U.S. has seen an increase in STEM post-secondary enrollments (Institute of Education Sciences, 2011), reversing the declining trends observed in the past (Wladis et al., 2015). Despite the increasing enrollment, however, disparities still exist among the population groups enrolling in STEM post-secondary education (George et al., 2001; Hagedorn & Purnamasari, 2012; National Science Board (NSB), 2008). Furthermore, enrollment in STEM programs does not equate to completing a STEM program, nor does it guarantee employment in a STEM field following graduation (Wladis et al., 2015). Anderson and Kim (2006) and the National Science Board (2008) report that minority students are less likely to persist in STEM programs than their white peers, resulting in fewer minority students graduating; 11% minority student graduates versus 30% white student graduates. Following graduation, Hagedorn and Purnamasari (2012) and Beede et al. (2011) found that women are less likely to major in STEM in post-secondary education and less likely to work in a STEM field after graduating, despite an increased enrollment of women in post-secondary education.

The Canadian STEM education landscape is not very different from that of the United States. A CMEC (2021) report found that Canada's STEM graduates increased by 51 percent from 2010 to 2018. Two STEM subfields, in particular, reported the most significant increases in the number of graduates from 2010 to 2018: mathematics and computer and information sciences (89%) and engineering and engineering technology (71%) (CMEC, 2021). Despite the consistent increase in STEM graduates between 2010 and 2018, the number of graduates from business, humanities, health, arts, social science, and education (BHASE) degrees in 2018 was still higher than the overall number of

STEM graduates (CMEC, 2021). A closer examination of the number of STEM graduates published in the CMEC Report (2021) reveals that the growth observed among STEM graduates was not consistent among gender.

2.1.2. Women in STEM in Canada

Examining the observed increases of STEM graduates across gender further showcases the Canadian landscape of STEM post-secondary education. Women are still underrepresented among STEM graduates, despite the observed overall increase in STEM graduates from 2010 to 2018 (CMEC, 2021). CMEC (2021) attributes this to the fact that while the number of women graduates in STEM was increasing, particularly in the STEM sub-field of *science and science and technology*, the number of men graduates increased at a faster rate, particularly in the STEM sub-fields of *engineering and engineering technology* and *mathematics and computer and information sciences*. As a result, the gender gap in STEM graduates was 1.3% higher in 2018 than in 2010 (CMEC, 2021). Combining the STEM graduation gap among men and women reported by CMEC (2021) with the well-documented phenomenon of the wage gap among men and women, generally, but particularly in STEM (see Statistics Canada, 2017), it is clear that the Canadian landscape of STEM post-secondary education can be improved.

2.1.3. Women of Colour in STEM in Canada

The CMEC (2021) report does not consider race *and* gender in its demographic breakdown. In fact, according to Finnie and Meuller (2008), many Canadian studies do not consider intersections of race and gender at all in their STEM-related research. It is difficult to report, for example, the rates of retention and persistence of students of any demographic in any field because Canadian post-secondary education retention rate data

is sparsely collected (Finnie & Mueller, 2008). That said, it becomes even more challenging to report the retention rates and persistence of increasingly specific groups and fields (e.g., WOC in STEM) in a Canadian context. As a result, not only are WOC lacking in STEM fields, but so is research that centers them; their experiences, their strengths, their barriers, strategies to support their retention and success, and more.

This is a problem because, as argued in [Chapter 1.3. Previous Research and Problem Areas](#), it is not enough to generalize trends across populations. In other words, research conducted regarding the experiences of white women in STEM does not represent the experiences of Black women in STEM, which also does not describe the experience of Indo-Caribbean women in STEM (and so forth). The same is true regarding context. Existing American literature insufficiently considers and addresses educational issues specific to Canadian contexts because the two systems and nations are very different (Mueller, 2008). Thus, further research in Canadian contexts is needed to fully understand the landscape of STEM education for WOC and what can be done to mitigate the identified issues.

2.1.4. The “Coolie Woman” Gap in STEM

This research aims to create a space for the people erased through unidimensional analysis (i.e., anti-racists and feminists who do not consider how one another works to oppress further or marginalize each other) (Crenshaw, 1989). Singular analyses typically leave out WOC, rendering them completely invisible, or lump them together despite being markedly different. In the research that outlines why WOC are not involved in STEM, the foci are typically around Black (see Ireland et al. (2018)), Latinx (see Levya (2015)), or Indigenous women (see Jin (2021)). However, at the time of writing, limited

scholarship addresses the STEM identity experiences of Indo-Caribbean women independent from other racial/ethnic subgroups. In stating this, I do not mean to say that these groups should be given less attention; it must continue. The data around Black, Latinx and Indigenous women are fundamental in this field, exceptionally accurate in the geographical context I am writing (i.e., as a settler on Turtle Island). In addition to continuing research that centers on Black, Latinx and Indigenous women, I believe it is necessary to add other identities to the existing literature. I am choosing to address this gap by closely examining the experiences of six Indo-Caribbean women in STEM through collecting thick and rich qualitative descriptions of their experiences (Geertz, 1973). These six participants do not represent all Indo-Caribbean women because Indo-Caribbean women are not a monolith. Instead, the purpose of exploring the six participants' experiences in this study is to begin an academic conversation about Indo-Caribbean women's experiences in STEM, thereby laying the foundation for future related research to be conducted.

At the time of writing, the published research that focuses on the experiences of Coolie women in STEM is scant and hard to locate. As mentioned in [Chapter 3.2. Intersectionality](#), research on the experiences of WOC in STEM has been mainly in examining Black, Latinx, and Indigenous women. At the time of writing, my study is the first to my knowledge to focus on Indo-Caribbean women in the context of STEM; the dearth of published research is evidence enough to suggest that this study is necessary. This research should also act as a jumping-off point for other researchers who also do not see themselves represented in the literature to find a way to change that. Conducting this research puts into practice Crenshaw's (1989) definition of intersectionality as never

complete and always in progress. This project also reflects our definition of equity as a journey, not a destination. This research, having never been done with this demographic before, is not a weakness. Instead, it has served as a starting point to create literature that reflects the experiences of a group of people within the Indo-Caribbean community.

2.2. STEM Identity: Definitions and Development

STEM identity is defined as a reflection of how an individual understands, identifies with, and makes meaning of the STEM community and culture (Carlone & Johnson, 2007; Hughes & Hurtado, 2013; Rodriguez et al., 2017). The development of STEM identity can be thought of as a developmental process of “coming to be” in STEM, which enhances the way an individual identifies with and participates in STEM (Lave, 1992, p. 2; Lave, 1998). Research tells us that STEM identity is fluid, intersectional, and built on social and cultural contexts (Leggett-Robinson, 2020). That said, many factors influence STEM identity development. This includes, but is not limited to, gender, race, and ethnicity (Carlone & Johnson, 2007; Chavous & Drotar, 2016; Fries-Britt et al., 2013; Ulriksen et al., 2010).

Having a solid sense of STEM identity is essential among students because it empowers them to feel knowledgeable and comfortable in their STEM environment (Carlone & Johnson, 2007). STEM identity is solidified through the acceptance and recognition by those in the STEM community (Carlone & Johnson, 2007; Flowers & Banda, 2016; Lane, 2016; Rodriguez et al., 2017). A student’s ability to recognize themselves as STEM-inclined and feel recognized by meaningful others in the discipline encourages them to both persist within their discipline-related education and transition into a career related to their field (Burke & Stets, 2009; Carlone & Johnson, 2007;

Chemers et al., 2011; Estrada et al., 2011; Stets & Burke, 2000; Tonso, 2006; Wegner, 1998).

Since seeing themselves as the “kind of person” who participates in STEM is a protector factor for developing STEM identity (Brickhouse et al., 2000, p. 1), it is crucial to start this identity development early in a student’s education. Robinson et al. (2019) suggest that introducing strategies to foster STEM identity in introductory post-secondary level STEM classes is essential because they tend to be competitive and challenging. Research also indicates that college students’ STEM identity development is found to be primarily influenced by their peers and faculty members (Godwin et al., 2014; Strayhorn, 2010). Therefore, representing diverse identities within STEM is vital in creating interest among diverse students (Campbell et al., 2021; Collins, 2018). However, the opposite is also true: a lacking or negative representation of a student’s personal identity in STEM can be detrimental to STEM identity development (Chavous & Drotar, 2016; Kim et al., 2018; Steele, 1992; Steele, 1997). Going back to Robinson et al.’s (2019) findings regarding STEM identity development in introductory STEM courses, implementing STEM identity development strategies are not always enough to capture the interest of students who do not already have some existing level of STEM identity. The competitive and challenging nature of introductory STEM courses that Robinson et al. (2019) describes is used to “weed out” students who do not fully identify with STEM (p. 3). While on the surface, this might seem like an effective way to eliminate students based on their STEM ability and motivation, this is not necessarily true and is rooted in deficit perspectives (Rincón & Rodriguez, 2021). Considering what STEM identity development research teaches us about the development of a strong sense of STEM identity (i.e., the

contributing factors to STEM identity development; who is most likely to develop a strong sense of STEM identity; how certain students are systemically disadvantaged when it comes to STEM identity development), *weed out* practices border on discrimination: “an action or a decision that treats a person or a group badly for reasons such as their race, age or disability” (Canadian Human Rights Commission, 2021).

2.2.1. How Racial, Ethnic, and Cultural Identity Impact STEM Identity Development

Studies on STEM identity development showcase many factors that contribute to STEM identity development and related consequences (e.g., STEM persistence and retention). For example, Caxaj et al. (2018) and Chavous and Drotar (2016) show that STEM identity development, persistence, and community, are all promoted when racial and cultural identities are incorporated into STEM identity formation. This is for a number of reasons. First, when one’s race, ethnicity, or culture is associated with academic success, it becomes a source of motivation for academic success. For example, Chavous and Drotar (2016) reported that the association of academic achievement with Black students in STEM was important for Black students working to identify themselves as people who can achieve academic success in a STEM career. In other words, when Black students saw a connection between their “Black” identities and their “STEM” identities, they felt more motivated and capable in their pursuit of STEM (Chavous & Drotar, 2016). This linking of one’s personal identity (i.e., personal values, beliefs, and self-evaluations) to the role of *student* or *learner* is referred to as academic identity (Dweck, 1999; Wigfield & Wagner, 2005). The reason that this ethnic/racial connection to academic identity is an empowering connection for students is that individuals are always working towards maintaining and enriching their self-concept (Dweck, 1999). So,

engaging and persisting in tasks related to an academic identity (i.e., reading, studying, evaluations, etcetera) becomes easier to do when one's self-concept is linked to those tasks (Chavous & Drotar, 2016). In the case of Black students interested in STEM, the connection between STEM-specific tasks and their identity as Black students resulted in an academic STEM identity, thereby an increased motivation to pursue STEM. The results of Rincón and Rodriguez (2021) corroborate this finding. In their study, Rincón and Rodriguez (2021) examined STEM experiences and pathways that facilitate Latinx students' academic success. They found that Latinx students utilized their cultural assets (i.e., aspirational capital, familial capital, navigational capital, linguistic capital, resistant capital, and social capital) to develop and maintain their understandings of themselves, and at times their peers', as individuals in STEM (Rincón & Rodriguez, 2021).

A strong racial, ethnic, or cultural identity has also been shown to act as a protective factor for racialized students (Caxaj et al., 2018). Codjoe (2006), Gordon (2012), Gosine (2007), and Hernandez-Ramdwar (2009) all found that racialized students who strongly identified with their communities also had a desire to contribute to the betterment of their communities. For example, the more connected Black students felt to their identities, the more likely they were to pursue post-secondary education as a means to: (a) challenge racial stereotypes facing the Black community; (b) be role models for Black youth; and (c) put themselves in a position to improve the overall quality of life of Black Canadians (Gosine, 2007). These findings are corroborated by research suggesting that racialized graduate students seek coherence between their research and their cultural identities (Ampaw & Jaeger, 2011). For racialized students, the affinity or aversion towards a subject matter or career is analyzed through a lens of cultural identities (Haley

et al., 2014). Thus, racialized students' strong identities and community-focused aspirations can act as protective and motivating factors for their academic persistence and success (Caxaj et al., 2018).

Lastly, students with a strong racial, ethnic, or cultural identity experience greater feelings of community and belonging. Sherry et al. (2010) surveyed 104 international students in the United States. Their report found that racialized international students' ethnic community membership and positive cultural identity had significant positive impacts on their sense of self-worth and belonging in their academic spaces (i.e., on-campus environments), despite feeling largely excluded from the wider American community (Sherry et al., 2010). Furthermore, when racialized international students could commune with other international students from the same culture, their sense of belonging in their academic spaces increased as compared to when among American students (Sherry et al., 2010). A sense of belonging in STEM is important because belonging is one of the most powerful motivators for social behaviour in humans (Baumeister & Leary, 1995). As such, we are constantly monitoring our status of belonging and can subconsciously perceive when our belonging is being threatened (Kerr & Levine, 2008; Lewis et al., 2016; Wesselmann et al., 2012). When humans perceive threats to their belonging, a common occurrence for racialized people in STEM (Leggett-Robinson et al., 2018), then "their day-to-day functioning can be negatively impacted" (Leggett-Robinson, 2020, p. 58). Self-perceptions in STEM, or otherwise, are framed by intersecting personal and collective identities which are framed by upbringing and experiences (Leggett-Robinson, 2020). Therefore, students' positive identification of multiple aspects of their intersectional identities (e.g., race *and* gender) with STEM, can

enhance academic engagement, motivation, and belongingness in STEM (Leggett-Robinson, 2020).

2.2.2. STEM Identity Among Women of Colour

STEM identity development is crucial for WOC in STEM. A sense of belonging in STEM, as well as acceptance from the STEM community is vital to the development of a STEM identity of WOC in STEM and the retention of WOC in STEM (Leggett-Robinson, 2020). STEM mentorship is also important in the development of STEM identity among WOC as mentorship (a) provides students with cultural knowledge needed to navigate academic spaces (Ceglie, 2020); (b) can reduce and alleviate students' experiences with stereotype threat (Beasley & Fischer, 2012); and (c) introduces students to discipline-specific communities of practice (Ceglie, 2020). Thus, acceptance, belonging and mentorship from the STEM community all work together in a positive feedback loop to bolster WOC's STEM identity development.

The importance of STEM identity development in WOC is heightened by the fact that the culture and climate of both the STEM higher education and workforce are chilly towards WOC; they imply that WOC are unsuitable for STEM education and careers, and WOC are often systematically excluded from participation in STEM (Leggett-Robinson et al., 2018; Leggett-Robinson, 2020). There are numerous studies that examine the process of STEM identity development among WOC in STEM, which is shared below. However, at the time of writing, there is a dearth of research regarding STEM identity development among Indo-Caribbean women. Due to this gap in the literature, the following selection of the research does not focus solely on Indo-Caribbean women. Instead, I extend the research about the barriers to STEM identity development for WOC

to provide context and highlight the importance of this present study. The findings of this study will ultimately add to the existing body of literature regarding STEM identity among WOC since Indo-Caribbean women are covered by the overarching definition of WOC. Additionally, the results of this study will begin to fill the research gap that exists regarding Indo-Caribbean women's perspectives of STEM identity development.

Multiple systems of oppression work against WOC (e.g., racism and sexism) which create unique challenges for WOC to navigate (Davis et al., 2020). In STEM, these challenges include but are not limited to, stereotypes, isolation, racism, and inadequate program support (Tate & Linn, 2005, p. 483). The intersecting oppression facing WOC in STEM results in detrimental effects on WOC's social participation, construction of their disciplinary identities, and their relationships with others in their field (Carlone & Johnson, 2007; Davis et al., 2020). This has been reported in many studies. For example, Barrow (2016) found that feelings of isolation were a challenge for WOC early on in their college computer science (CS) careers. Participants attribute their isolation to their feeling a poor cultural fit between their personal identities and the CS community and a lack of opportunities to gain computer science experience (Barrow, 2016). The participants' negative experiences added to their existing perceptions of the chilly nature (Backhouse et al., 1995; Bartlett & O'Barr, 1990; Payton & White, 2003; Sandler & Hall, 1986; Soe & Yakura, 2008; Wasburn & Miller, 2006) of computer science, further exacerbating feelings of exclusion among the WOC participants (Barrow, 2016; Beyer et al., 2003; Cohoon, 2001; Katz et al., 2006; Klawe et al., 2009; Margolis, 2008). Not only do WOC struggle to identify themselves within STEM, but they are also impacted by their positioning in STEM according to others' perceptions (Ulriksen et al., 2010). For

example, minority students in Malone and Barabino's (2009) study reported struggling to integrate their scientist identity into the way they are perceived by others. In other words, minority students' tendency to struggle with their STEM identity is exacerbated by others' lack of recognition of these students as members of the STEM community (Malone & Barabino, 2009). Though it is important for WOC to see themselves as members of the STEM community, and to see others that look like them in the STEM community, it is not enough (DuBow et al., 2016). WOC must also be integrated into the STEM community through the actions (e.g., mentorship) of the STEM community.

WOC's perceptions of acceptance and belonging by the STEM community is important for WOC's STEM identity development for a number of reasons. First, science identity, just like any identity, is not created in isolation (Carlone & Johnson, 2007). Identity is what an individual feels and does, in conjunction with that individual's competence, performance, and recognition by meaningful others in the field (i.e., receiving acceptance from people whose opinions matter) (Carlone & Johnson, 2007). Exclusion of WOC from a STEM academic community impedes the development and integration of WOC's STEM identity (Malone & Barabino, 2009). The opposite is also true: the process of recognizing WOC as scientists supports the development of WOC's STEM identity development (Ulriksen et al., 2010). Secondly, the culture of STEM is narrow; it excludes a range of demographics, particularly WOC, from developing a science identity (Carlone & Johnson, 2007). WOC in STEM are constantly made to feel they are the "only one" or "the one" that is different from others in STEM settings (Malone & Barabino, 2009, p. 505). As a result, WOC are constantly being made to negotiate their identities to fit into a hegemonic culture that only privileges white and

male identities (Ulriksen et al., 2010). When this happens to WOC in STEM, they end up with “disrupted scientist identities”, which limits their engagement and persistence in STEM (Carlone & Johnson, 2007, p. 1197). Since the negative academic climate of STEM causes “interference between identities as a woman and as scientists” (Settles et al., 2016, p. 488), positive social interactions with and recognition of STEM identity from STEM peers is important for the STEM identity development and maintenance for WOC in STEM (Rodgers, 2016).

Lastly, the role of mentorship is important for WOC’s STEM identity development. Mentorship often provides students with opportunities to participate in activities and experiences (e.g., research) that further increase their sense of acceptance and belonging in STEM, thereby increasing their STEM identity. This is seen in the findings of (Hurtado et al., 2009). Hurtado et al. (2009) reported that structured research experiences can help WOC develop their science identity “whereby a student displays competence and performance in science that is affirmed by others, and this recognition is acknowledged by both the individual and their peers” (Barrow, 2016, p. 149). The increased sense of belonging and identification with STEM that results from structured research opportunities results in higher rates of retention among WOC, as compared to WOC who do not have these experiences (Hurtado et al., 2009). Tate and Linn (2005) also found that the participants in their study, WOC in engineering, were more likely to persist when they felt welcome, could form bonds with other women in STEM, and when they had access to role models and mentors. Higher levels of self-confidence and supportive interactions with technology were reported as factors contributing to participants’ persistence in STEM, both of which could be achieved through mentorship

and role model support (Tate & Linn, 2005). Mentorship generally contributes to higher grade point averages (GPAs) among WOC, leading to higher self-efficacy and lower attrition (Santos & Reigadas, 2002), which we know from the aforementioned research, is related to STEM identity. However, despite its many known positive contributions towards WOC's STEM identity, mentorship is not currently living up to its potential for WOC. This is because WOC in STEM are currently lacking relevant mentorship opportunities as compared to their STEM peers (Ruiz et al., 2019). At the time of writing, not much is known about why the state of mentoring in STEM is “inadequate” and “toxic”, however, it is understood that poor mentorship is a large contributing factor to the high attrition rate of WOC from STEM (Ruiz et al., 2019). Kaur (2020) speculates that WOC in STEM may find it challenging to obtain mentoring because WOC remain underrepresented in STEM fields and higher education. In fact, Corneille et al. (2019) found that even WOC faculty in STEM experience lack culturally responsive mentorship, an added barrier to the advancement of their careers. Another potential reason for the lack of mentorship discussed by Corneille et al. (2019) is that “WOC faculty provide a disproportionate amount of teaching and service” which place “WOC at a disadvantage for promotion and tenure because research productivity is more highly valued and associated with prestige in STEM disciplines” (p. 337). Given the many known positives of mentorship on WOC in STEM, more research is needed to understand the reasons for the bleak climate of STEM mentorship, and to equitably improve the quantity and quality of mentorship for WOC in STEM (Corneille et al., 2019; Ruiz et al., 2019; Womack et al., 2020).

In summary, the development of a robust STEM identity is important for WOC in STEM, who remain largely underrepresented (Tonso, 1999). WOC in STEM face countless barriers to their academic and career success due to the white and male culture, peers and professors that dominate the STEM discipline (Tonso, 1999; Wong, 2015). STEM identity is not formed alone; it requires acknowledgement, validation and support from peers and meaningful others within the STEM community (Carlone & Johnson, 2007; Hurtado et al., 2009; Ulriksen et al., 2010). These factors work together synergistically to strengthen WOC's STEM identity development. As such, I will return to them often throughout my investigation of the ways online communities support the development of six Indo-Caribbean women's STEM identity development.

2.3. Online Communities

Kozinets (1999) defines online communities as “affiliative groups whose online interactions are based upon shared enthusiasm for, and knowledge of, a specific consumption activity or related group of activities” (p. 254). Online communities can manifest in various platforms, such as Instagram, Facebook, Twitter, TikTok, YouTube, Tumblr, Pinterest and Reddit. Online communities are spatially located in cyberspace (Kozinets, 2010) and do not necessarily have a fixed geographical location. While the absence of a geographical area may be an abstract concept for some, Wang et al. (2002) describe online communities as “solid place[s] in [the] hearts and souls” of community insiders (pp. 410-411). Much research attempts to define this so-called “solid place” to increase non-members' understanding (Cappellini & Yen, 2015). Kozinets (2010) describes online communities as “‘places’ of belonging, information, and emotional support that people cannot do without” (p. 15). Cova and Cova (2002) and Croft (2013)

further this definition by adding that online communities can be liberatory spaces for people to challenge their traditional forms of affiliation (i.e., age, gender, ethnicity, family, profession, neighbourhood), and allow for the creation of more fluid and less localized affiliations based on their interests. Work by Breitsohl et al. (2015), Cova and Cova (2002) and Maffessoli (1996) celebrate online communities as spaces that allow people to overcome geographical differences that can cause isolation and marginalization.

There is no shortage of research showing that online communities provide many affordances (i.e., social support), particularly to those belonging to marginalized communities (Andalibi, 2016; Burke et al., 2010; Hernandez et al., 2014). However, at the time of writing, it is hard to locate published research regarding the impact of online communities on Indo-Caribbeans of any gender, in any context (e.g., STEM or BHASE). Due to this gap in the literature, the selection of the research regarding the affordances of online communities that I explore below does not focus solely on the Indo-Caribbean community. Instead, I extend the research about the role of online communities in other typically marginalized demographics to the Indo-Caribbean community, specifically, Indo-Caribbean women in STEM. Quantitatively and statistically speaking, findings are not considered generalizable across a population unless the sample size is large enough (The WAC Clearinghouse, 2022). Additionally, demographic-specific research cannot always be generalized across an entire demographic because, as mentioned above, no demographic exists as a monolith. That said, findings from one demographic do not always apply among others, either. However, conclusions from one study can and do help to provide meaning to other contexts (i.e., studies), which is my goal in outlining the

following research. Doing so allows for this research to be conducted, ultimately allowing for the contribution of research specific to the experiences of Indo-Caribbean women in STEM.

First, research shows that online communities can be spaces of sharing, mentorship and support for marginalized identities. A study by Cappellini and Yen (2015) investigated the role of an online community, “Plurk”, in the life of 11 Taiwanese mothers living in the United Kingdom (U.K.) and found that the community presented the women with many affordances. First, the participants reported feeling less isolated, more normal, and “not so strange” by being connected to other Taiwanese mothers living in the U.K. via the “Plurk” community (Cappellini & Yen, 2015, p. 1269). Second, participants viewed “Plurk” as a source of practical knowledge that solved many of the “mundane dilemmas” they faced as wives and mothers living outside of their home country (Cappellini & Yen, 2015, p. 1269). The practical knowledge the participants refer to includes but are not limited to, sharing bargains, where to find Taiwanese ingredients and food, sharing Taiwanese recipes and cooking techniques, and general information relevant to the participants’ lives (i.e., education, child tax credits, local recipes, etcetera) (Cappellini & Yen, 2015). The participants also report a sense of safety resulting from their ability to share the intimate aspects of their identities, relationships, and experiences they cannot share in their real-life contexts (i.e., their Taiwanese families, British colleagues, friends) (Cappellini & Yen, 2015). For example, one participant reported feeling more inclined to use “Plurk” than Facebook when her British mother-in-law visited, claiming “I always post things on Facebook in English. She will be able to read them then!” (p. 1275). In a similar vein, participants reported turning to “Plurk” for

information pertaining to “Taiwanese things,” especially when their Taiwanese identities became more prevalent to the issues they are facing (Cappellini & Yen, 2015). This was important for the participants because they reported feeling marginalized and excluded by their local communities, which lacked the Taiwanese cultural and ethnic capital to support the participants (Cappellini & Yen, 2015).

Similar findings were presented by Clark-Parsons’ (2018) study about the cultivation of safe space within a Philadelphia-based feminist Facebook group called “Girl Army.” Participants of that study reported the “Girl Army” space to be one of *safety from, safety for, and safety to* through members’ sharing (Clark-Parsons, 2018). For example, participants reported “Girl Army” as a safe space from the rape culture that exists broadly both on- and offline. This safe space is achieved through “members’ practice of naming the many everyday manifestations of rape culture... [enableing participants to] forge bonds of solidarity through shared experiences and coalitional ties... [drawing] a discursive boundary around ‘Girl Army’ as a safe space formed in sharp relief to rape culture,” (Clark-Parsons, 2018, p. 2135). Clark-Parsons (2018) also found that “Girl Army” provided feelings of safety for individuals who wish to reclaim the feminine identity they lost or denied while living in a masculine public sphere (Fraser, 1992) that breeds competition, not community, among women. Also, reported were feelings of safety for transgender and non-binary participants; however, this was not consistent among all trans and non-binary members (Clark-Parsons, 2018). Lastly, Clark-Parsons (2015) found that members of “Girl Army” felt safe to openly discuss and request support around topics and experiences they are unable to safely discuss in other spaces, and in ways that respect members’ personal authority and emotional wellbeing.

For example, “respect for individuals’ personal authority requires members occupying dominant sociocultural positions to step back from discussions concerning the lives of more marginalized groups,” (Clark-Parsons, 2018, p. 2139). In the case of a 2015 thread of cultural appropriation, “Girl Army” members of colour asked white members to refrain from the discussion and consult the published research of people of colour elsewhere to learn more (Clark-Parsons, 2018).

Similar to Cappellini and Yen (2015) and Clark-Parsons (2018), Lui and Wang’s (2021) study found that online mental health communities create a platform for patients living with depression to vent emotions, share experiences, obtain validation and help others (Mo & Coulson, 2014; Uden-Kraan et al., 2009; Uden-Kraan et al., 2008). The social interaction that patients experienced via their online mental health communities provided new opportunities for patient rehabilitation (Ziebland & Wyke, 2012) and the healing of self-esteem, mental and physical health for individuals with severe mental illnesses (Folsom et al., 2005; Lehman et al., 2006; Pompili et al., 2008). This is because online mental health communities have been shown to provide the same support that can be found in offline support groups: emotional support, information support, network support, respect support, and sometimes, tangible support (Coursaris & Ming, 2009; McCormack, 2009). Similar to the groups Plurk and “Girl Army”, online mental health communities include providing their members with these forms of support through the sharing of experiences, whether it be about treatment or daily life living with depression (Malik & Coulson, 2011; Uden-Kraan et al., 2008; Winzelberg, 1997). Online mental health communities have also been shown to be effective in alleviating loneliness, breaking down stigma, boosting self-empowerment, and motivating individuals to

become active and informed patients (Prescott et al., 2020); positive outcomes are all attributed to patients' online interactions with their peers (Naslund et al., 2016). Lui and Wang (2021) reported that many online mental health communities have large numbers of users, some of which are untreated and undiagnosed patients. That said, online mental health communities can be useful for implementing community interventions, such as increasing users' confidence in health awareness and disease management (Lui & Wang, 2021). This provides opportunities for even undiagnosed and untreated community members to lessen stigmatization and gain knowledge to potentially seek and receive further mental health support(s) one day (Lui & Wang, 2021). Overall, evidence suggests that marginalized demographics seek and find spaces for sharing, mentorship, and support within online communities.

Second, online communities have also been shown to offer space for marginalized identity exploration, development, and acceptance. Returning to Cappellini and Yen's (2015) study, the online community "Plurk" provided participants with many opportunities for identity development. For example, in solving the dilemmas faced as wives and mothers, participants do not only discuss ways to maintain their Taiwanese identity and culture. On the contrary, participants discuss how to navigate the sense of being "in-between" they feel as Taiwanese mothers raising their families in the U.K. (Cappellini & Yen, 2015, p. 1270). Participants grapple with the "in-betweenness" by experimenting with and creating new performances of motherhood based on their desired acculturation outcomes (i.e., "maintaining the home culture, integrating both cultures or resisting the host culture") (Cappellini & Yen, 2015, p. 1270). Participants reported "Plurk" as the platform that allowed for the experimentation of their motherly identities

and allowed them to determine how they defined their role as mothers themselves (Cappellini & Yen, 2015). This opportunity for the participants to interrupt the dominant, offline ideology typically associated with motherhood was a welcome escape for the participants and provided them with much entertainment and debate concerning parenting and gender (Davis, 2010; Madge & O'Connor, 2006; Pedersen & Smithson, 2013; Phillips & Broderick, 2014), which allowed the creation of new enactments of themselves by combining old and new understandings of motherhood (Cappellini & Yen, 2015).

In their study, McInroy and Craig (2020) explore the potential influences of media-driven online fandom communities on the identity development of sexual and gender minority (SGM) youth across the United States and Canada. They find that information and communication technologies (ICTs) play an increasingly critical role in the identity development of SGM youth as ICTs offer “access to information and resources, communities and support, and safe spaces for identity exploration” (McInroy & Craig, 2020, p. 236). Though, the extent to which individual participants reported online fandoms contributing to their identity development varied (ranging from “fundamental” to “peripheral”), overall, online fandoms were found to facilitate SGM identity development in six ways: (1) discovery and realization; (2) exploration and experimentation; (3) safety and anonymity; (4) validation and normalization; (5) authenticity and self-acceptance; and (6) sharing identity (McInroy & Craig, 2020, p. 239). Furthermore, McInroy and Craig (2020) found that the extent to which participants reported online fandoms as contributing to their identity development was based on participants' individual development trajectories, experiences, needs, and preferences. Participants who desired opportunities to explore, experiment, validate, share, and accept

their identities, actively sought out contexts where that content and activities were possible, such as online fandom communities (McInroy & Craig, 2020). Even the participants who report online fandoms being only minimally supportive of their SGM identity-development report that they still benefited from the representation, enjoyment, and communities of interest (McInroy & Craig, 2020).

Another traditionally marginalized demographic that has been found to turn to online communities for support can be found on “Autcraft”, “a community centred on a Minecraft virtual world for autistic youth” (Ringland, 2019, p. 3). Ringland (2019) reported a number of benefits for the members of “Autcraft”, namely the sense of identity with others that share the same or similar medical diagnoses. Participants reported an increase in acceptance of their identities through, for example, the creation of Autism-centric language that is used consistently throughout “Autcraft” (Ringland, 2019). Also, participants reported “Autcraft” being a community where they could battle ableist “inspirational frames”, which tend to be placed on members of “disabled” communities by non-disabled folks (Grue, 2016; Ringland, 2019; Rousso, 2013). In the “Autcraft” community, participants deal less with the reframing of the label of “Autism” or “being Autistic” for the benefit of the inspiration of outsiders to the community, but for the members of the community who are otherwise only exposed to negative language and attitudes around autism (Ringland, 2019). That said, “Autcraft” provides its members with a space to reframe their identities for themselves, often shifting their perspectives of autism as a barrier that needs to be overcome to an identity that needs to be embraced (Ringland, 2019). Ringland (2019) reported that participants in the “Autcraft” community also engage in autism education, which they report helps them solidify “what it means to

be autistic as part of the Autcraft community” (p. 7). This is important for participants because they report their autistic identities being performed in other spaces (i.e., schools, grocery stores, doctor’s offices), depending on those spaces’ expectations (Ringland, 2019). In this way, the “Autcraft” community, again, allows its members to understand and (re)define their identities, turning what are typically seen as deficits into positive identity markers (Ringland, 2019). Overall, through online communities, marginalized identities access opportunities for identity exploration, development, and acceptance that they are not usually afforded in their offline lives.

Finally, research shows how online communities aid marginalized identities to find solidarity, power and to transgress against oppressive offline narratives. Returning once again to Cappellini and Yen’s (2015) study, “Plurk” provided participants with opportunities to gain and experience power (i.e., social, economic, cultural, and symbolic; see Bourdieu (1986)) that they are not usually granted in their offline lives. For example, participants with low capital (i.e., social capital, cultural capital, ethnic capital) compared to other participants were more frequently engaged in the “Plurk” community as it provided them with a temporary escape from the challenges in their lives associated with having lower capital. Participants with lower capital frequently turned to “Plurk” to not only “obtain the support unavailable locally... but to temporarily disconnect [themselves] from the local context and to reconnect to a community where she can share the difficulties generated by her feelings of isolation and marginalization” (Cappellini & Yen, 2015, p. 1276). Through “Plurk”, these participants can have empowering spaces of solidarity with other mothers who also lack the resources to improve their social capital (Cappellini & Yen, 2015). The empowering nature of “Plurk” is also seen in that it “is a

transformative space wherein norms and practices of mothering are reshaped, combining different and often contrasting ideologies of doing mothering,” (Cappellini & Yen, 2015, p. 1278). The participants not only engage in the practice of solidarity and empowerment in their online communities; it carries through to their offline lives, as well (Cappellini & Yen, 2015).

Similar findings are seen in McInroy and Craig (2020) who find that the online construction of identity sidesteps barriers preventing SGM youth from constructing authentic identities in their offline lives. Furthermore, SGM youth who lack cultural capital in their offline lives (i.e., they are geographically isolated, or they are not exposed to representative media) often seek them in their online communities; it is within these communities that SGM youth are able to find their missing cultural capital. As well, they have access to the freedom to transgress as they can (a) authentically express themselves, (b) practice identity disclosure, and (c) foster self-acceptance, confidence, and empowerment without fear of reprisal; the reprisal they would face for the same actions in their offline lives (McInroy & Craig, 2020). Members of the “Autcraft” community also work to reshape mainstream dialogues around autism. For example, community members regularly engage in outreach designed to educate others on the variable expression of autistic identities, thereby challenging the societal narrative that all autistic people are the same (Ringland, 2019). They also host activities that include honouring victims and survivors of violence to shed light on the violence that people with autism face regularly, in both online and offline space (Ringland, 2019). Lastly, the “Autcraft” community moves beyond being a support group for the aforementioned survivors of violence. Instead, it places emphasis on reframing the label of “autism” as a medical

problem needing to be overcome, to an identity that should be embraced; “Autcraft” is a space where members can “reclaim and embrace their own autistic identities,” (Ringland, 2019, p. 141).

Underwood and Olsen’s (2019) investigation of strategies used by an online community of bodybuilders to “traverse masculine emotion ideologies that usually prevent men from expressing love and affection” found a number of interesting findings regarding the role of online communities in challenging narratives and flipping power dynamics (p. 90). Their study found that the online community surrounding the recreational bodybuilder, Zyzz, served as a platform for micro-forms of resistance and transgression where men could display affection, vulnerability, and emotion without fear of physical threat (Underwood & Olsen, 2019). The virtual nature of interactions that take place via the Zyzz fandom was found to help young men in a traditionally hyper-masculine space transcend the emotional ideologies that prevent them from displaying vulnerable emotions and affection in front of or towards one another, allowing for male relation and engagement that is not allowed in their daily lives (Underwood & Olsen, 2019). Underwood and Olsen (2019) also reported how the emotional displays between men in the online Zyzz fandom allowed for the subversion of male emotional ideologies in socially appropriate ways by recreating the association of “manliness” with certain behaviours (p. 102). For example, in making space for men to engage in subversive acts such as (a) discussing men crying, and (b) seeing other men cry, the Zyzz fandom was able to create a “version of masculinity in which emotional attachment and vulnerability are evidence of masculine status” (p. 102). Overall, marginalized identities can find solidarity, power, and opportunities for transgression through online communities.

2.4. Research Questions

At the beginning of this study, the broad question that guided my research was: How has online activity supported the identity development of a group of Indo-Caribbean women in STEM? Upon analysing the data collected for this study, I observed some themes that I wanted to discuss in relation to the results. Using these themes as a guide (Friese et al., 2018), I revamped my singular research question into four sub-questions that will guide the discussion of the results in this study. These questions are as follows:

- 1) What support do these Indo-Caribbean women in STEM receive from their post-secondary educational institutions?
- 2) How do online social media communities provide support for these Indo-Caribbean women in STEM in ways that their institutions do not?
- 3) How might incorporating racial, cultural, and ethnic identity into STEM education strengthen Indo-Caribbean women's STEM identity development?
- 4) What might online social media groups provide to Indo-Caribbean women in STEM that might increase their STEM capital?

In this chapter, I discussed the areas of literature that are relevant to this study (i.e., WOC in STEM, STEM identity, and online communities of support). I also highlighted the gaps identified among the research areas and outlined the research questions of this project that were created to address the identified gaps in the existing literature. In the next chapter, I discuss the theoretical framework used to conduct this research study. A combination of these three perspectives provided the foundation for which this study was developed and conducted.

Chapter 3.0 Theoretical Framing

In this chapter, I discuss the theoretical framework used to conduct this research study. Creswell (2003) describes theoretical frameworks as a means to “provide guidance about all facets of the study, from assessing the general philosophical ideas behind the inquiry to the detailed data collection and analysis procedures” (p. 3). He argues that the use of “an extant framework also allows researchers to lodge their plans in ideas well grounded in the literature and recognized by audiences (e.g., faculty committees) that read and support proposals for research” (p. 3). The research in this thesis was situated within Crenshaw’s (1989) framework of intersectionality and Gutiérrez’s (2007) four pillars of equity: access, achievement, identity, and power. Additionally, an overarching anti-deficit approach (Cresswell-Yeager & Whitaker, 2020; Harper, 2010; Mejia et al., 2018; Patton Davis & Museus, 2019; Williams, 2019) was applied to this research. The combination of these three perspectives provided the foundation for which this study was developed and conducted.

3.1. Anti-Deficit Thinking

This study is grounded in anti-deficit thinking, which centers on the idea that “people are not problems” (Patton Davis & Museus, 2019, para. 4). Anti-deficit thinking is an approach to thinking about and understanding achievement as it relates to the strengths, assets, and persistence that people possess, rather than the attributes and capital they are lacking, or the barriers they are facing (Cresswell-Yeager & Whitaker, 2020; Mejia et al., 2018; Patton Davis & Museus, 2019). In the context of STEM, Harper (2010) provides an anti-deficit framework that challenges how research questions are traditionally created. Rather than ask *what do students of colour need?*, for example,

Harper (2010) inverted the question to *what do students of colour have?* that allows them to acquire the STEM capital they did not have upon entry into STEM fields. By inverting the focus from what students of colour are lacking (i.e., deficit) to what students of colour possess (i.e., anti-deficit), researchers can gain a meaningful and relevant understanding of the persistence of students of colour in STEM that resists traditional scholarship (Harper, 2010; Mejia et al., 2018). Anti-deficit thinking is the opposite of deficit thinking, which blames the failures of marginalized groups on the groups' cultures and their perceived lack of values (Williams, 2019).

Deficit-based research focuses on and amplifies the perceived failures, shortfalls, and perceived detachment of the population(s) being examined (Williams, 2019). Deficit thinking is found in many institutions, including education. Valencia (2010) used the term “deficit thinking” in education, describing it as an “ongoing class and racial construct that blames underrepresented groups for their lack of academic success” (Williams, 2019, p. 22). As Valencia (2010) highlights, some researchers in academia apply deficit thinking to their work, particularly when it comes to traditionally underrepresented students (i.e., women and People of Colour (POC)) (Castro, 2014). For example, Frenette (2007) reports that students from low-income families in Canada are less likely to attend university than students from higher-income families. From a deficit perspective, the potential reason behind this trend is that low-income families are not saving money to send their children to university when they are of age. A potential solution, then, would be for low-income families to begin saving money for their children's education. A bonus would be to begin saving while the children are young so they can maximize the number of years that they are saving for their education. This

blame the victim (Williams, 2019, p. 23) line of deficit-thinking confines both the cause and solution of the problem to the individual and their community (Samuelson, 2016). In this case, there is no consideration of the institutional and systemic barriers (Harper, 2010; Samuelson, 2016; Williams, 2019), such as the high cost of post-secondary education (Schlesinger, 2019), or inequitable income distribution among families in Canada (The Conference Board of Canada, 2011). Manthei (2016) agrees that deficit thinking fails to recognize the institutional and systemic barriers that hinder the academic success of marginalized students. Deficit thinking also blames “academic failures on family structure, linguistic background, and a lack of cultural competencies” (Williams, 2019, p. 23). This positionality is problematic because it leaves the unjust system intact and further perpetuates the lack of accountability or justice in educational systems for marginalized students (Strauss, 2016).

Another example of deficit-thinking is what Frenette (2007) writes below:

An alternative explanation advanced by others (e.g., Carneiro & Heckman, 2002) suggests that youth from economically disadvantaged families are lacking in parental resources or influences, which can have a negative impact on cognitive abilities, motivation, study habits, perception of the benefits of a university education, social environments, etc. According to this view, disadvantaged youth often do not choose to attend university because they do not perform well in school, they do not have any interest in furthering their education, their friends are less likely to go on to university, etc. Even if they are able to borrow enough money, some may be averse to debt because they underestimate the economic benefits of a university education over a lifetime. (pp. 7-8)

In this example, again, people are blamed for their own problems; students from low-income backgrounds have low enrollment in post-secondary education because they come from a low-income background. This deficit-based analysis ignores the reality that people live in coercive systems that inflict harm (Strauss, 2016; Williams, 2019), for example, the lack of upward mobility from low-income to a higher income. Failing to consider this fact (i.e., that people and students do not operate outside of the systems in which they live), can lead to the development of the belief that “solutions” are needed to “fix” students and their families, which is deficit thinking (Strauss, 2016; Williams, 2019). Instead, an anti-deficit approach would seek solutions not to “fix” individual students and their families, but to “fix” the systems that leave so many students and their families with these problems needing to be addressed.

What would anti-deficit-based questions like Harper’s (2010) ask? Some examples might include: *How can low-income families support their children’s academic goals? What role, if any, do parental resources or influences play on students’ cognitive motivations? Academic motivation and attitudes? Study habits? What, if any, is the role that peers play in these same factors for post-secondary education? What role(s) and resources can educational institutions provide to students from low-income backgrounds and/or first-generation post-secondary students?* Similar to Harper’s (2010) questioning regarding underrepresented students in STEM, using an asset-based approach in this context could promote meaningful and relevant learning around the example of low-income students’ low enrollment in post-secondary education, while still challenging deficit thinking (Mejia et al., 2018).

All said, the overarching approach to this research was anti-deficit in nature, from the design of the research questions to the analysis and interpretation of the collected data. As previously mentioned, the purpose of exploring the six participants' experiences in this study is to begin an academic conversation about Indo-Caribbean women's experiences in STEM, thereby laying the foundation for future related research to be conducted. Given that this research has the potential to shape future research and more (e.g., pedagogy and instructional approaches, education and/or industry policy changes, shifts in ontology and/or epistemology), it is important to me that I exercise my power to prevent the perpetuation or creation of further harm to the participants of this study and the entire Indo-Caribbean community. Thus, I use an assets-based (i.e., anti-deficit) model to explore this study's research questions, along with the theoretical frameworks of intersectionality and equity, which I discuss below.

3.2. Intersectionality

Rooted in Black feminist thought and Critical Race Theory, intersectionality is an analytic framework used both within and outside academia (Carbado et al., 2013; Collins, 2015). Intersectionality underscores power relations that create social inequalities and injustices (Collins, 2015; Ma & Liu, 2017). Initially coined by Dr. Kimberlé Williams Crenshaw, an American lawyer and professor of law, the theory of intersectionality critiqued the problematic "tendency to treat race and gender as mutually exclusive categories of experience and analysis" (Crenshaw, 1989, p. 139). Crenshaw (1989) centred her theory of intersectionality around the experiences of Black women, whose multidimensional experiences are erased when using single-axis frameworks of analysis to address topics of race and gender. Crenshaw (1989) argues that it is not enough to

focus on the most privileged group members (i.e., white women and Black men) because it further marginalizes those who are “multiply-burdened” (p. 152). Failing to acknowledge that Black women, for example, are Black *and* women, we create a distorted view of racism and sexism, respectively; a view which only considers one small subset of either marginalized group (i.e., one group being women, and the other group being Black people) (Crenshaw, 1989). Instead, we must consider the complexities of racism and sexism simultaneously to ensure that our analyses are grounded in experiences that more accurately represent the complex phenomenon of combined discriminations (Crenshaw, 1989).

Much of the subsequent research following Crenshaw’s seminal work on intersectionality continued to focus on Black women and the struggles they faced (Brewer, 1993; Collins, 1999; James & Busia, 1993; Seiler, 2003; Settles, 2006). However, over the years, some researchers (Browne & Misra, 2003; Carbado et al., 2013; Nash, 2009) have proposed that the framework of intersectionality be expanded to consider all combinations of identities (Sparks, 2017). Collins and Chepp (2013) extend Crenshaw’s (1989) definition to include more aspects of identity. They refer to intersectionality as the critical insight that race, class, gender, sexuality, religion, ethnicity, nation, ability, and age operate not as unitary, mutually exclusive identities. Instead, intersectionality acknowledges these identities as reciprocally constructive, which shapes the complex social inequalities individuals face (Collins, 2015).

3.2.1. The Evolution of Intersectionality

There is some contention around the expanding definition of intersectionality (Cho et al., 2013; Cole, 2009; Collins, 2015; Collins & Bilge, 2016). Ireland et al. (2018)

questions, “Is intersectionality an experience, an analytic framework for conceptualizing problems, or a method of inquiry for scholarship and practical application?” (p. 230). Some argue that the origins of intersectionality should be credited to early activists who asserted in various ways that race, gender, and class are all simultaneously experienced (e.g., Combahee River Collective, 1995; hooks, 1981). Others argue that intersectionality should be credited to the explicit coining of the term “intersectionality” in its legal application (Crenshaw, 1989; Crenshaw, 1991; Winston, 1991). Scholars across all fields struggle to best apply the core tenets of intersectionality to contexts outside of the law (Cole, 2009; Collins, 2015). Therefore, researchers across all disciplines must define and conceptualize intersectionality in a way that makes sense for their contexts (Collins, 2015; Ireland et al., 2018). Intersectionality, in the context of this thesis, will be explored later in this chapter.

One theme among all conceptualizations of intersectionality is that it is an analysis-in-progress; it is never done (Collins, 2015). Take, for example, the initial work of Crenshaw (1989). She interrogated how American law historically defined sex and race discrimination through prototypical representatives, i.e., white women and Black men, respectively. She explains that by focusing on *either* identity, not *both* identities, we limit the understanding of and advocacy around racism and patriarchy. In doing so, we undermine any possibilities for sustaining meaningful solidarity by placing these resistance movements at odds with each other (Carbado et al., 2013; Crenshaw, 1989). In this particular analysis, Crenshaw (1989) necessarily limited the power structures that she discussed to patriarchy and racism. Her analysis is intentionally provisional and incomplete because no particular application of intersectionality can definitively grasp

the complete range of intersectional powers and problems that torment society. However, this work-in-progress understanding of intersectionality is not meant to be considered a weakness. Instead, it is a calling to endeavour, on an ongoing basis, to move intersectionality to unexplored places.

In their paper, Cho and McCall (2013) dispute claims suggesting that since it started as an analysis of Black women's experiences, intersectionality as a theory cannot engage other categories of power and experience. As Cho and McCall (2013) state, "race and gender intersectionality merely provided a jumping-off point to illustrate the larger point of how identity categories constitute and require political coalitions" (p. 390). Roberts and Jesudason (2013) agree, arguing that by identifying categorical differences among us, we can enhance the potential to build coalitions among movements by acknowledging our differences while promoting commonalities. A mutual acknowledgement of how structures of oppression are related and how struggles are linked is essential in building understanding and solidarity among minority groups. An intersectional lens can reveal both privilege and victimhood perspectives on a given issue and between separate identity groups, thereby creating a connection around shared experiences of discrimination, marginalization, and privilege (Roberts & Jesudason, 2013). In essence, intersectionality is not fixed to any particular social position or singular movement, nor should it be (Cho & McCall, 2013; Roberts & Jesudason, 2013); it can and does move.

In addition to considering individuals with multiple marginalized identities, intersectionality can act as a tool to link scholarly subfields, research methodologies, and topical inquiries (Carbado et al., 2013). A wealth of intersectional scholarship can now be

found globally across interdisciplinary fields as well as within more traditional disciplinary endeavours (Collins & Chepp, 2013), such as education, psychology, social science, political science, gender and sexuality studies, law, and social justice and equity (Carbado et al., 2013; Sparks, 2017). We are beginning to understand how identity can impact if and how a person engages in STEM. However, despite decades of research studies and educational interventions aimed at increasing the participation of “women and minorities” in STEM, policymakers, researchers, and educators still struggle to explain and address the gender and racial disparity in these fields (Committee on STEM Education, 2013). Treating these two groups as mutually exclusive obscures individuals’ particular experiences as members of both groups (Ireland et al., 2018), contributing to these individuals’ erasure and experiences within the STEM context. I believe that more intersectional analyses are needed to understand better why this phenomenon is occurring and what we can do to stop it.

3.2.2. Intersectionality in STEM

Using Cole’s (2009) description of intersectionality as a term used to describe the meaning and consequences of multiple categories of group membership, Ireland et al. (2018) goes on to explain it as a concept that can facilitate a critical examination of educational experiences of students in STEM fields across and within groups. Intersectionality considers the multidimensional and co-constructive factors that either promote or preclude the participation of underrepresented students in STEM fields (Ireland et al., 2018). Intersectionality can also be used as a methodological approach to STEM education research (Ireland et al., 2018). As Ireland et al. (2018) point out, it 1) provides context to obfuscate or illuminate students’ experiences across and within social

groups; 2) allows us to see how our modes of inquiry will enable us to understand the personal and social impact of investigating how identity shapes STEM experiences; and 3) enhances the rigour of the analytic approaches we take while addressing students' beliefs and behaviours around STEM education.

Ireland et al. (2018) outline three main reasons for the increasing attention placed on the status of women and racial-ethnic minorities in STEM. I extend this by arguing that attention should also be paid to those at the intersections of race and gender; those individuals being racialized women. First, there is an immediate demand for professionals to fill the STEM workforce. Workers with STEM skills are growing in need, and according to the Statistics Canada 2016 Census, the average income of a STEM graduate is higher than that of graduates of non-STEM degrees (Statistics Canada, 2017). This difference is not seen equally across gender, though. In a comparison of earnings between two genders (i.e., men and women), the median earnings for young men with a STEM degree at the bachelor's level in 2015 were 23.9% higher than the median earnings of young men with a BHASE degree (Statistics Canada, 2017). The same study reported that the difference in earnings is smaller for women (i.e., women with a STEM degree earned 11.5% more than those with a BHASE degree), showing that even with the same qualifications, men are financially compensated more than women (Statistics Canada, 2017). Racial minorities and women have made significant inroads into post-secondary institutions in recent years; women, in particular, have been obtaining bachelor's degrees at higher rates than men (Buchmann & DiPrete, 2006). However, this increase in enrollment has not necessarily been observed in STEM fields, meaning more time needs to be spent investigating the disconnect that exists (Ireland et al., 2018).

The second reason that Ireland et al. (2018) discusses is the benefit of diverse perspectives and ideas to promote STEM innovation and discovery. As Ma and Liu (2017) explain, the demographics of the American population are becoming more diverse. As such, the STEM workforce needs to catch up with American demographic changes. If the country fails to do so, it risks losing its competitive edge on a global scale. The same argument can be applied in a Canadian context. With one of the highest immigration rates globally, Canada also runs the risk of falling behind in global competition in STEM if we cannot adapt to the changing population (Statista Research Department, 2021). Diversity in STEM is vital for innovation and new approaches to scientific discovery (Advisory Committee for GPRA Performance Assessment (ACGPA), 2009; Bement, 2009). By including racialized women in STEM, we also include their unique perspectives, backgrounds, and cultural traditions, all of which shape how they experience the world (Sparks, 2017). Their worldviews are an asset to STEM because it allows them to look at scientific problems in ways that the traditional, patriarchal, and colonial perspectives of STEM could not possibly fathom (ACGPA, 2009; Bement, 2009; Sparks, 2017). Additionally, the research of Hanson (2004) and Riegle-Crumb and King (2010) has shown that women, particularly WOC, have many skills that align well with those necessary for research. WOC are also highly capable of dealing with the work environment challenges that are common in many areas of STEM (Hanson, 2004; Riegle-Crumb & King, 2010). Just as the increase of women lawyers helped to pass laws and legislation regarding sexual harassment and domestic violence, Sparks (2017) argues that WOC can do the same in STEM. Increasing the number of

BIWOC in STEM can solve problems of environmental injustice linked to racism, white supremacy, and colonialism (Taylor, 2009).

Ireland et al.'s (2018) last argument relates to the social justice imperative to ensure equity in STEM access and STEM literacy as our society advances technologically. The release of *Science and Engineering Indicators* (2016) highlights the reoccurring underrepresentation of women and non-Asian racial minorities in STEM degree attainment and the STEM labour force (Ma & Liu, 2017; NSB, 2016). This underrepresentation is a significant problem because STEM fields tend to experience more job growth and provide higher earning potential than non-STEM fields (Ma & Liu, 2017). Thus, the underrepresentation of women and people of colour in these fields contributes to the economic disparities that exist among the lines of race or gender (Ma & Liu, 2017). Presumably, the economic disparities are doubly exacerbated when considering BIWOC are discriminated against based on race *and* gender.

As Ma and Liu (2017) write, “the intersectional perspectives of race and gender can help elucidate new patterns and insights about the process of STEM degree attainment, in terms of both trajectories and contextual explanations for group disparity” (p. 2). The visibility of WOC and their experiences is vital considering how educational institutions have historically marginalized women and students of colour by privileging both whiteness and maleness (Collins & Bilge, 2016; Ladson-Billings & Tate, 1995). Lord et al. (2009) argue that many studies on engineering education literature fail to disaggregate women by race/ethnicity, therefore getting overgeneralized results that render minority women invisible. Thus, more intersectional analysis is needed to better understand the group disparity in STEM attainment.

3.3. Equity Versus Equality

Generally, equity can be hard to define. The words “equity” and “equality” are commonly and incorrectly used interchangeably (Loefler, 2006). These words are opposites. Understanding the differences between the two terms is essential for resolving issues faced by disadvantaged students. The definition of equality is as it sounds: the state of being equal. Equality among a group means that everyone has the same rights, opportunities, and resources. While beneficial, equality is not specific. Instead, it assumes that every member of that group shares similar circumstances and therefore needs (Subrahmanian, 2005). For example, amid the COVID-19 pandemic, students switching to distance learning who did not already own a device were given one by their schools. Providing a device to every single student is equality. However, the distribution of one device to each student does nothing to help students that do not have access to the internet at home. Even with equal distribution, some members of the group of learners still struggled; they lacked access to the internet that would allow for more equitable participation in learning. As a result, only aiming for equality is not enough. In the context of this example, providing resources equally does not result in a solution for all students. In order to address the students who lack internet access, for example, we need to go beyond equality. We can turn to equity (i.e., equitable practices) to find a solution.

On the other hand, equity is specific to an individual’s circumstances (Subrahmanian, 2005). As Zevenbergen (2001) states, “equity refers to the unequal treatment of students (or people more generally) in order to produce more equal outcomes. In contrast, equality means the equal treatment of students with the potential of unequal outcomes” (p. 14). Thus, practicing equity means that some individuals may

receive more than others, or more than what is considered equal (Subrahmanian, 2005). In the case of the students who do not have access to the internet at home, part of an equitable practice would ensure that those students were given internet access *in addition* to the device they received. This would help bridge the divide between students who have access to the internet and those who do not. Thus, in this example, the unequal distribution of devices and internet access specific to individual students' needs would result in an equal outcome: every student having access to the tools they need to participate in distance learning. However, equity is more nuanced than just having access to resources. For example, students may have access to the resources needed, but what if they do not know how to use them? Will there be information technology (IT) services available for students who have issues with their devices? How will students who cannot afford repairs keep up with their classes if their devices malfunction? Will all students receive software and hardware updates when needed? Are accessibility needs being met with the use of these devices? If not, what needs to be done to accommodate them? These questions briefly touch on the endless factors that may impact a student's ability to not only *participate* in distance learning but to *succeed* in distance learning. That said, there are multiple aspects of equity to consider. In the context of this study, I will examine equity specific to STEM education, using Gutiérrez's (2007) four pillars of equity to do so.

3.4. Four Dimensions of Equity in STEM Education

I use Rochelle Gutiérrez's (2007) theory of four pillars of equity to frame this study. Gutiérrez (2007) states that equity is fairness, not sameness (p. 2). Thus, achieving equity means different things in different contexts. On the most basic level, Gutiérrez

(2002) describes equity as “the inability to predict mathematics achievement and participation based solely on student characteristics such as race, class, ethnicity, sex, beliefs and proficiency in the dominant language” (p. 153). Though she speaks specifically of a mathematics context, this definition can be applied to other STEM contexts, as well. Gutiérrez asks us to look beyond the categories and associated stereotypes that we tend to group people in and recognize that these groups are not homogenous (2007, p. 1). Additionally, she asks us to consider the multiple (i.e., the sociocultural and sociopolitical) factors that can determine one’s performance in a given context (Gutiérrez, 2007, p. 1).

Gutiérrez (2007) describes four pillars of equity: access, achievement, identity, and power. Not one single pillar is more important than another, nor are any of the pillars able to work independently. We must collectively consider each of the four pillars to reach some semblance of real equity. More accurately, equity is not a destination to be reached; it is an ongoing process and must adapt with society as society changes (Singh, 2019). Furthermore, the processes by which we each strive for equity will be different because we all start in different spaces (Subrahmanian, 2005). In the following sections, I separate the pillars of equity to explain how I applied the framework to this context of my research (i.e., online identity development of Indo-Caribbean women in STEM). However, it is essential to note that the four components of equity necessarily overlap because none exists separately from the others; they are all needed to conceptualize equity as a whole (Gutiérrez, 2007).

3.4.1. Access

Access is the first pillar of equity, as described by Gutiérrez (2007). This pillar relates specifically to the resources that students have available to participate in STEM education successfully. Access includes the resources that you can expect to find in classrooms, including equipment and teaching resources (Gutiérrez, 2009). It also considers less tangible things (Grimes, 2013) such as (a) how students receive STEM education, (b) students' access to STEM educational opportunities, and (c) the perceived relevance and potential for the social impact of STEM education in students' lives.

The accessibility of STEM education is hindered for some students by the way STEM education is delivered (i.e., instructional approaches in STEM education). For example, some students are prevented from developing a genuine interest in STEM when teaching approaches mainly rely on teacher-centred frontal instruction (Ogunkola & Samuel, 2011; Robnett et al., 2020). In this approach, the teacher is the primary deliverer of all instruction and, typically, assessments are *of learning* rather than assessment *as learning* (Ontario Ministry of Education, 2010). There is little to no room for students to practice inquiry in this instructional style, which Bybee (2008) believes cultivates students' interests in science. According to Ogunkola and Samuel (2011), teacher-centred frontal instruction in STEM education can be challenging for some teachers. This is due largely to two factors. First, educators are responsible for teaching science curricula that are overloaded with abstract concepts while not always having the necessary time, resources, or pedagogical knowledge to present the content concretely (Ogunkola & Samuel, 2011). Secondly, teachers struggle to present STEM content to students in ways that are interesting to the students (Ogunkola & Samuel, 2011). As a result, student

participants in Ogunkola and Samuel's (2011) study reported finding the teaching strategies (i.e., teacher-centred, frontal instruction) traditionally used in STEM classes to be boring. Students also reported feeling that teachers put minimal effort into presenting the STEM curriculum in a relevant and exciting way to their lives, which they attributed to overall disinterest towards STEM subjects (Ogunkola & Samuel, 2011). This traditional teaching approach can be a barrier to some students, particularly among students who already have faltering or negative attitudes towards STEM (Wong, 2016). Thus, it is imperative that additional instructional strategies be implemented within STEM education to increase the students' interest levels in STEM education (Ogunkola & Samuel, 2011). Educational research shows that instructional strategies such as collaborative and interactive inquiry-based teaching and learning are effective in increasing students' interest and engagement (Johnson et al., 2017; Ogunkola & Samuel, 2011). In the context of STEM education, collaborative and interactive inquiry-based teaching and learning has the potential to make critical impacts on students' STEM interests, attitudes, and academic achievement (Ogunkola & Samuel, 2011). Considering that much of students' career aspirations and interests in science are formed mainly by the age of 13, increasing the accessibility of STEM education from an instructional strategy standpoint in the early years is a protective factor for students' interests in STEM (Lindahl, 2007).

Another potential barrier to the accessibility of STEM is individual students' access to the out-of-classroom events and experiences (i.e., field trips, STEM camps, research or laboratory experience, office hours) that contribute to developing a scientific interest (Archer et al., 2015; Ceglie, 2020). These resources are important for students to

access because they have been shown to have many benefits, such as an increased likelihood of developing a STEM identity and gaining STEM capital (Archer et al., 2014; Wong, 2015) (see [Chapter 3.4.3. Identity](#) and [Chapter 3.4.4. Power](#)). However, access to these resources is not the same across demographics, especially among BIPOC (Pinder, 2012; Williams et al., 2016). Due to the many structural oppressions that govern North American society (e.g., racism, colonialism, white supremacy), BIPOC are statistically more likely to live within lower socioeconomic brackets (Pinder, 2012; Williams et al., 2016). As a result, BIPOC families do not always have the same financial ability to access certain STEM resources as families from higher socioeconomic brackets (Pinder, 2012) (see [Chapter 3.4.2. Achievement](#)). As a result, teachers become solely responsible for providing educational experiences and career planning guidance; privileges that BIPOC students are not receiving elsewhere (Admuti-Trache & Andres, 2008). Thus, students' lack of access to STEM experiences due to systemic barriers (i.e., socioeconomic status) is an issue of equity.

Another barrier to access to STEM education is the perceived relevance of STEM education in students' lives, and the perceived ability for STEM to be a pathway for social change in students' lives. Concerns about students' attitudes towards STEM are not new, as seen in the literature by Dainton (1968) about the phenomenon referred to as the "swing away from science" (as cited in Osborne et al., 2003, p. 1050). The same "swing" is also seen in data from recent years, as several studies show that worldwide interests in or attitudes towards science decline during students' secondary school years (Jenkins & Pell, 2006; Ogunkola & Samuel, 2011; Osborne et al., 2003; Schmidt, 2000). The fall of interest in STEM is not consistent among all groups, though. For example,

Krapp (2002) identified a significant decrease in interest in physics, chemistry, and mathematics throughout high school among girls, but not among boys. Similar trends are seen when considering race, as research has shown that certain racial and ethnic groups lose interest in STEM at higher rates than others (Ogunkola & Samuel, 2011; Ong, 2005; Wong, 2016). What is causing this lack of interest in science? Students' reception to STEM may be hindered by their perceptions of the relevance of STEM education in their lives. There are a number of reasons for this, one of which is that many racialized students perceive STEM as irrelevant in their lives (Ogunkola, 2012). Shaikh (2000) attributes this to the elitist and eurocentric focus of STEM fields that rarely represent racialized students, therefore making STEM education less interesting and less accessible to racialized students.

Furthermore, the competitive culture of STEM typically lacks sociocultural and sociopolitical awareness (Blickenstaff, 2005). Blickenstaff (2005) found that many students filter out of the STEM pipeline because of unappealing hyper-masculine and positivist views of science that conflict with the ways of knowing and being of many cultures outside of the dominant culture. This disproportionately impacts racialized students as Riegle-Crumb et al. (2019) found that racialized students are more likely to drop out of STEM education to pursue fields they feel will allow them to make more of an impact in communities to which they belong. Participants attribute their program changes to the experiences of exclusion caused by micro-aggressions and a lack of support and inclusion by their institutions (Riegle-Crumb et al., 2019). Participants explained that they had a solid connection and a strong sense of agency to their communities (Riegle-Crumb et al., 2019). As a result, they chose to actively pursue

degrees they perceived would align more closely with their priorities of social responsibility, which they deemed incompatible with STEM fields (Rielge-Crumb et al., 2019). The extent to which these groups can participate in this STEM culture is limited because it functions to force its participants to choose between either objectivity and profit, or situatedness and social impact (Blickenstaff, 2005). In essence, the culture of STEM is what makes it perceived as irrelevant and unimportant in the lives of racialized students who feel they must compromise their responsibility towards social change for success in a STEM career, contributing to racialized students' low participation and achievement rates in STEM subjects (Ogunkola, 2012).

In summary, access is an important consideration of equity. There are many ways that students can be barred access to STEM, which prevents them from successfully participating in STEM education. The discussion of access outlined above includes the resources that one can expect to find in classrooms, how students receive STEM education, students' access to STEM educational opportunities, and the perceived relevance and potential for the social impact of STEM education in students' lives. A focus on access alone, however, is insufficient. For example, providing all students with access to the same generic "opportunity to learn" does not achieve equity because students are not all the same; they are not located in the same position (Nasir, 2016, p. 11). Therefore, we must consider access in addition to the other pillars of equity.

3.4.2. Achievement

Achievement is the next pillar of equity, as described by Gutiérrez (2007). Achievement is concerned with student outcomes and tangible results (Gutiérrez, 2009). Achievement can be measured through student participation in class, attaining and

maintaining grades that meet or exceed the regional standardised levels and pursuing further education and careers in a particular field (Gutiérrez, 2009). Achievement is a significant consideration, in addition to access, because there are many profound implications correlated with acquiring high grades in STEM (Gutiérrez, 2009). However, there are many factors that determine students' likelihood of high academic STEM achievement, including but not limited to, (a) caregivers' impacts, (b) students' socioeconomic status, and (c) teachers as gatekeepers. The many considerations of student STEM academic achievement are easily forgotten when equity is not centred in the STEM classroom (Gutiérrez, 2009). As such, I discuss these factors below.

Research has shown a connection between caregivers' impacts on students' academic achievement in STEM and in other subject areas. For example, the work of Ogbu (2003) and Walberg (1984) both find that a student's home environment can influence their learning outcomes. Pinder (2007) found that students' science achievement improves when parents assist their children with their homework assignments. As such, Pinder (2007) strongly argues that schools should be encouraging more of this parental support, given that the improvement noted is significant. The research of Codjoe (2007), Jeynes (2003), Lee and Bowen (2006), Ogbu (2003), Ogbu and Simons (1998), Paik (2004), Walberg (1984), and Wang (2004) aligns with this finding, and also stresses the importance of home and family involvement in the learning process of the child. This is in part due to the role that families play in counteracting the "hidden curriculum" (see Jackson (1968)) taught in schools. In the context of STEM, the hidden curriculum regarding the identity of a scientist is particularly insidious as the current culture of STEM is dominated by white men, perpetuating the image of what it means to be a

scientist (i.e., a white male) (Wong, 2015) (see [Chapter 3.4.2 Achievement](#)). This is particularly important when considering that teachers are not always equipped to offer BIPOC students a model that counteracts the narrative provided by STEM's hidden curriculum (e.g., white teachers cannot embody racially relevant examples of Black scientists to Black students) (DuBow et al., 2016; Wong, 2015). When caretakers and school personnel are unable to provide students with the necessary guidance needed to make educational decisions, students are more likely to accumulate disadvantages that lead to large inequities in access later on in life, whether in labour market opportunities or post-secondary educational institutions (Admuti-Trache & Andres, 2008). Thus, families' and caregivers' interest and involvement in STEM activities can provide protection against the many factors contributing to the exclusion of students from STEM (Codjoe, 2007; Pinder, 2012).

What about the students whose caregivers are not as involved in their learning? A caregiver's lack of interest does not necessarily mean that they are not "good" caregivers or that caregivers are not invested in their students' educational outcomes. Assumptions such as these are not sensitive to the many reasons why caregivers may not support their students compared to other caregivers (i.e., they are deficit-based ways of thinking) (Patton Davis & Museus, 2019). One reason that some students receive more academic STEM support compared to their peers is socioeconomic status (SES). There are many barriers to education that are attributable to low SES. For example, low academic achievement is associated with food insecurity (Faight et al., 2017), high dropout rates (National Center for Education Statistics, 2008), poor psychological health (American Academy of Pediatrics, 2012; McLaughlin & Sheridan, 2016; Mistry et al., 2009; Morgan

et al., 2009) and underdeveloped career aspirations (Ali et al., 2005; Blustein, 2013; Diemer & Ali, 2009; Diemer & Blustein, 2007), all of which are inextricably linked with low SES (American Psychological Association (APA), 2017). Furthermore, caregivers with a low SES typically tend to work multiple jobs and jobs that extend beyond the typical 9-to-5 schedule, thus are not necessarily physically present to help students (e.g., homework) the way caregivers with high SES can (assuming there exist family members with the knowledge base to be able to assist with students' work) (Ellwood-Lowe et al., 2020). Additionally, families with higher SES may also be able to afford services such as tutoring, one-on-one coaching, and supplemental learning such as immersive STEM camps and experiences that have been shown to positively impact STEM academic achievement and identity development among students (Aschbacher et al., 2010). These additional and expensive resources put the receiving students at an academic advantage over students whose families cannot afford those things (Archer et al., 2014).

Reflecting on the literature explaining how structural oppressions disproportionately impact BIPOC families is important when considering the impact of SES on STEM achievement of BIPOC students (Pinder, 2012; Williams et al., 2016). BIPOC families not having the financial ability to ascertain the STEM resources as families from higher socioeconomic brackets (Pinder, 2012) is a barrier that contributes to the tendency for BIPOC students to have lower levels of academic achievement in STEM. Since it has been observed that low SES is more prevalent among racialized communities, all these factors are important considerations regarding the lower levels of STEM academic achievement among these communities (Doerschuk et al., 2016).

In addition to SES, some teachers may also act as a barrier to BIPOC students' STEM academic achievement through their conscious and unconscious biases manifesting as STEM gatekeeping (Gasiewski et al., 2012). Gasiewski et al. (2012) describe gatekeeping in the context of "gatekeeping courses" as introductory post-secondary STEM courses that "explicitly or implicitly function to eliminate all but the 'top tier' students" (p. 229). The high levels of attrition of these courses relate heavily to their instructional design (see [Chapter 3.4.1. Access](#)). These gatekeeper courses, sometimes referred to as "weed out courses" (Robinson et al., 2019, p. 3) tend to "encourage one-way, passive, superficial learning... promote memorization over conceptual understanding... focus too much on the acquisition of content knowledge through memorization and too little on the development of meta-cognitive skills related to critical thinking and scientific literacy" (Gasiewski et al., 2012, p. 230). The reason why gatekeeper courses are so commonplace in STEM is due to STEM's underlying belief that "scientists are born, not made" (Tobias, 1990, p. 11). This belief is problematic because it ignores the many real influences that determine one's ability to participate in and be successful in STEM, while promoting a "too narrow a vision of what kinds of attributes, behaviors and lifestyles the 'true' scientist displays" (Tobias, 1990, p. 11).

This is particularly true among BIPOC students, for whom, identification with STEM is an added barrier (see [Chapter 3.4.3. Identity](#)). In essence, when students achieve less, it reinforces certain stereotypes about them, causing teachers to expect less of them (Kaplan & Owings, 2013). Lower expectations result in less effort from students, which causes low achievement, thus perpetuating a feedback loop that works to the student's disadvantage (Kaplan & Owings, 2013). While "motivation is an internally ingrained

element, parents and teachers can help to cultivate it. If parents help to keep their children motivated, but teachers fail to do so, then this may create a breakdown in the child's learning process” (Pinder, 2012, p. 735). As such, Tobias (1990) argues that if STEM is concerned with “the recruitment and integration of women and minorities into science, then much more than school reform and talent-searching... will have to take place” (p. 11). She continues with “the science community is going to have to rework the ‘fit’ between science and any new class of recruits - in both directions” (p. 11). Identity, as it relates to achievement, will be discussed more in [Chapter 3.4.3. Identity](#).

While achievement is an important factor to consider in achieving STEM equity, it should not be considered alone. Tai et al. (2006) found that students’ early science aspirations are a better predictor of future science education than are their early science achievement levels; in other words, grades are not everything. Tai et al.’s (2006) findings show that students’ interest in science is also an important contributor to students’ pursuit of science education later in life. However, this is not necessarily the case for all ethnic groups (Elias et al., 2006). As we know from [Chapter 3.4.1. Access](#), there are many things that impact the accessibility of STEM education for BIPOC students, such as students’ abilities to see themselves as people who “do science” (i.e., students’ STEM identity). Thus, the role of identity must be considered alongside the pillars of access and achievement to better understand equity in the context of STEM education.

3.4.3. Identity

Identity, the third pillar identified by Gutiérrez (2007), enhances the pillars of access and achievement. Beginning in the 1950s, Erik Erikson popularised a definition of identity that is foundational to developmental psychologists (Cieciuch & Topolewska,

2016). Erikson defined identity as “a fundamental organizing principal which develops constantly throughout the lifespan,” (Ragelienė, 2016, p. 98). Erikson (1968) continues to describe identity as an “awareness of the fact that there is self-sameness and continuity to the ego’s synthesizing methods, the style of one’s individuality, and that this style coincides with the sameness and continuity of one’s meaning for significant others in the immediate community” (p. 50). In other words, identity allows us to 1) understand who we are and how we relate to others (i.e., self-sameness); 2) differentiate from others (i.e., uniqueness); and 3) function autonomously from others (Ragelienė, 2016). Erikson argued that identity development begins at birth and continues throughout one’s life (Cieciuch & Topolewska, 2016). However, Erikson argued that adolescence is a time of particularly intense identity development (Cieciuch & Topolewska, 2016) that has the potential to define the rest of one’s life (Erikson, 1968).

One of the most influential models of identity development that formed from Erikson’s theory is James Marcia’s (1966) identity status model (Mancini et al., 2015). Marcia defined identity as a “self-structure – an internal, self-constructed, dynamic organization of drives, abilities, beliefs, and individual history” (Cieciuch & Topolewska, 2016, p. 39). Marcia (1966) expanded on Erikson’s theory of identity development to consider behavioural indicators of individuals as they navigate areas of their identity: *exploration* and *commitment*. Mancini et al., (2015) describe *exploration* regarding identity development as “the active questioning and weighing of various identity alternatives before making decisions about the values, beliefs, and goals that one will pursue,” (p. 141). *Commitment* is defined as, “making a relatively firm choice in an identity domain considered important and engaging in significant activities oriented

toward the implementation of that choice,” (Mancini et al., 2015, p. 141). Marcia argued that these two dimensions of identity development can overlap in four different ways, creating four *identity statuses*: low exploration and low commitment (*diffusion*), low exploration and high commitment (*foreclosure*), high exploration and low commitment (*moratorium*), and high exploration and high commitment (*achievement*) (Marcia, 2010). Similar to Erikson (1968), Marcia (2010) argues that the stages are necessary for adolescents to endure in the process of developing a coherent understanding of their individual identity. However, Marcia (2010) acknowledges that the process of *identity achievement* is long and arduous, not necessarily achievable by the end of adolescence.

Erikson and Marcia both speak about identity development generally (Mancini et al., 2015) compared to the many contemporary branches of identity development that exist today (i.e., vocational identity, consumer and brand identity, STEM identity, racial identity, cultural identity, ethnic identity, gender identity, etcetera). Recently, researchers have worked to integrate various concepts of identity development from the Erikson–Marcia tradition in an effort to resolve some of the noted problems inherent in these foundational theories (see Ciecuch & Topolewska (2016)). Regardless, the Erikson–Marcia tradition of identity development served as a basis upon which many kinds of identity development research were built. In this study, there are a few identities that are of particular interest: STEM identity and racial/ethnic/cultural identity.

Identity, whether referring to gender or race, is a social construction that is fluid and ever-changing. Gutiérrez’s (2012) window-mirror metaphor is useful in explaining how identity plays a role in equity. In it, she explains that students need to have opportunities to see themselves in STEM curricula – the mirror – and a broader view of

the world – the window (Gutiérrez, 2012). As with the pillars of equity, both the mirror and the window in Gutiérrez’s metaphor are essential parts of identity development. Ceglie (2020) explains that a student’s ability to build an identity as someone who can *do science* is a major factor in long-term persistence in STEM fields. Building a sustainable science identity – an identity as someone who “does science” – requires self-recognition and others’ recognition, such as teachers and peers, as scientifically proficient, according to Carlone and Johnson (2007). This is supported by the work of Calabrese Barton et al. (2013), which explores the complexity of STEM identity development. They discuss the many factors that impact this, including the opportunities students have to author their identity through various science contexts and experiences. Carlone et al. (2013) also discuss the impact of specific science experiences on other areas of students’ lives, such as the carry-over from science classrooms into extracurricular science clubs and vice versa. This carry-over or transferability only strengthens the durability of students’ “identity trajectories” (Calabrese Barton et al., 2013, p. 72) and may influence students’ science career aspirations.

However, creating an identity as someone who *does science* can be challenging considering that modern science is a subculture of Western culture, born out of white male privilege and is currently dominated by white male privilege (Wong, 2015). In their study, Wong (2015) finds that scientists suffer from an image problem. Children’s perceptions of scientists continue to be heavily gendered (i.e., cisgender men) and racialized (i.e., white). This normalization of the expected embodiment of what a scientist looks like acts as a powerful ideological tool (Wong, 2015) in that it causes many girls and minority ethnic students to struggle to identify with STEM education and careers.

Structural, dominant gender and racial/ethnic identities (i.e., the construction of the white male scientist) interfere with recognizing minority students in STEM, thus complicating the development of science identity among those same students (Carlone & Johnson, 2007). Since careers in science are not commonly associated with identities outside of this eurocentric norm, then students without those embodied characteristics may struggle to identify themselves as participants in STEM education and careers (Brickhouse & Potter, 2001; Carlone, 2004; Johnson et al., 2011; Marlone & Barabino, 2009; Parsons, 1997).

In their work, Carlone et al. (2011) argue that how individuals can construct or author their identity within particular space and time are bounded by 1) specific power relations (i.e., teachers); and 2) norms and culture of practices (i.e., traditional classroom practices, curriculum, lack of diversity among staff). As we know from [Chapter 3.4.1. Access](#), specific identities are more likely to have the access and privilege of being afforded the science experiences that help develop a stronger sense of STEM identity. The power relations between students and their teachers, which we will discuss more in [Chapter 3.4.4. Power](#), also influence a students' ability to develop a STEM identity.

Within the identity pillar of equity, we must also consider the roles of social acceptance and belonging as a function of identification within a certain group. While the two terms may seem interchangeable, they are not. Social acceptance “means that other people signal that they wish to include you in their groups and relationships... Social acceptance occurs on a continuum that ranges from merely tolerating another person’s presence to actively pursuing someone as a relationship partner” (DeWall & Bushman, 2011, p. 256). Acceptance is a component of belonging, which refers to the “feeling of

security and support when there is a sense of acceptance, inclusion, and identity for a member of a certain group” (Cornell University Diversity and Inclusion (CUDI), n.d.). Catts (2019) explains that acceptance is reliant on others, “pursued through the act of ‘fitting in’ – choosing to act the way others would expect, want, or even need you to act” (para. 8). On the other hand, belonging “is when an individual can bring their authentic self” to a certain group, without having to hide or omit aspects of their identity to do so (CUDI, n.d., para. 1). As CUDI (n.d.) writes, “when employees feel like they don’t belong at work, their performance and their personal lives suffer”; the same can be said for students in STEM (para. 1).

A sense of acceptance and belonging in STEM is important for the development of STEM identity among students, particularly students who are traditionally marginalized in STEM (Caxaj et al., 2018). A sense of STEM identity, acceptance and belonging are also vital to the academic success and retention of students in STEM, again, particularly among marginalized students (Johnson & Elliott, 2020; Lane, 2016; Lewis et al., 2016). Research consistently finds that even the students who persist in STEM higher education face challenges regarding their STEM identities, despite having overcome many systemic barriers to get to where they are (Carlone & Johnson, 2007). For example, WOC in STEM education and professions often feel alienated by the culture of science in higher education (Atwater & Simpson, 1984; Carlone & Johnson, 2007). WOC report having to work twice as hard as their white colleagues because not only must they achieve and succeed at the same rates, but they are also fighting to fit in (i.e., they are fighting for acceptance) the culture of STEM (Atwater & Simpson, 1984; Carlone & Johnson, 2007). The sense of authenticity and belonging afforded to white

students based solely on their race is something Black students report feeling they must earn through assimilation to the dominant culture of those spaces (Carlone & Johnson, 2007). Additionally, Black students must navigate other aspects of their identities, such as how they dress, speak, and behave in ways that white students and professionals in STEM need not worry about (Ong, 2005). The process of assimilation (i.e., fitting in) into STEM spaces is, by definition, the opposite of a sense of belonging, which is cultivated by creating inviting environments (DuBow et al., 2016; Esquinca et al., 2021; Rodriguez, 2020) and counterspaces (Leggett-Robinson, 2020) through the faculty and institutional interventions (Ceglie, 2020; Johnson et al., 2017; Perna et al., 2009; Robnett et al., 2020). In contrast, white people in STEM, generally, already fit the standard of “what it means to be a scientist” by virtue of being white and aligning with whiteness, therefore, are less likely to be made to question their sense of belonging in STEM (Wiggan, 2008), putting them at an advantage in terms of their STEM academic success and persistence (Johnson & Elliott, 2020; Lane, 2016; Lewis et al., 2016). Another finding from Carlone and Johnson’s (2007) work is that Black women feel that they and their STEM identities are not taken seriously as contributors to their respective fields by their science departments. Instead, Black women are seen as representatives of entire racial groups and are forced to act as such (Archer et al., 2015; Carlone & Johnson, 2007; McGee, 2016). Black women tragically “perceived that their behaviors, or even just their appearance, triggered racial, ethnic or gender recognitions that overwhelmed their chances of being recognized as good science students” which negatively impacted their STEM identity development (Carlone & Johnson, 2007, p. 1202).

In summary, identity is an important pillar of equity to consider in the context of STEM education. Fostering a STEM identity among WOC allows them to understand STEM as relevant and meaningful to their lives (Carlone & Johnson 2007; Rodriguez et al., 2017). Additionally, when WOC in STEM can see themselves as scientists, they are more likely to achieve academic success and persist in their STEM education and careers. Fostering feelings of social acceptance and belonging is important, too, as it also contributes to STEM identity development and the associated benefits. As such, it is important to identify strategies that can be implemented to counteract the many gender-based and race-based barriers to STEM identity development facing WOC in the field (Fink et al., 2020; Johnson & Elliott, 2020). One such strategy includes providing students with opportunities to draw upon their cultural, ethnic, racial, and linguistic resources (Gutiérrez, 2007) to enrich their STEM content knowledge and inform their STEM practice (Yosso, 2005). This will be discussed in more detail in the next section which discusses Gutiérrez's (2007) last pillar of equity: power.

3.4.4. Power

Power is the last pillar of equity described by Gutiérrez (2007). Power is concerned with the potential for social transformation at many levels that can occur via STEM fields. The impact that STEM has on society is not debatable; STEM fields have positively influenced many aspects of human life, such as agriculture, transportation, health, nutrition, medicine, law, communication, entertainment, building and construction, to name a few (Ogunkola, 2012). Consequently, the United Nations Human Rights Charter includes STEM as an essential component of basic education, thus deemed a human right deserved by all (Ogunkola, 2012).

STEM education can enable people to provide the essential requirements that make life comfortable and worth living by keeping society healthy, productive, and progressive (Ogunkola, 2012). However, Archer et al. (2015) posit that to do “good” for more than just mainstream society, a “social justice case [must] be made for the value and need for all citizens to be able to participate in STEM, to be literate, and shape STEM developments in society” (p. 200). A wealth of research has outlined the various ways that marginalized groups are subjugated in certain STEM disciplines, which prevents them from participating in and contributing to STEM developments in society; power begets power and vice versa. The unique position of science in society and the role science plays in determining power relations must be acknowledged, particularly regarding how science has traditionally marginalized certain groups of people (Maulucci, 2013). Furthermore, a pluralistic view of science is necessary to represent the breadth of “cultures, ways of knowing, and stakeholders – people, animals, plants, and Earth’s natural environments – that have an interest in a sustainable, nurturing, and just society and world” (Mueller & Bentley, 2007, as cited in Maulucci, 2013, p. 454).

In his seminal work, Bourdieu (1986) discusses four types of capital: economic, social, cultural, and symbolic. As with Gutiérrez’s pillars of equity, Bourdieu’s four forms of capital do not operate in isolation. Instead, they interact together to determine a person’s position within any given field. Bourdieu posits that an individual’s interactions with their habitus, their own internalized matrix of dispositions and subsequent behaviour, within areas or social contexts, produces relations of either privilege or subordination within society (Archer et al., 2015). In other words, capital in all its forms interacts with habitus in relation to the field one is in; capital determines one’s position in

their field, while habitus determines one's disposition towards said field (Turnbull et al., 2019). Bourdieu's (1986) work has been extended to STEM (e.g., science capital) and can be related to Gutiérrez's (2007) pillar of power.

Simply, individuals who begin their life with more capital, or more power, will be more able to gain personal and social advantages (Turnbull et al., 2019). For example, students whose parents are formally educated are more likely to receive direct help, adequate knowledge, and positive dispositions towards their school activities, stimulating their interests in current and future schooling experiences (Adamuti-Trache & Andres, 2008). Similarly, "a student who grows up in a family that places [a] high value on science may share the same disposition" (Turnbull et al., 2019, p. 6). As explained by Adamuti-Trache and Andres (2008), "educated parents [are] instrumental in supporting school environments that 'push' students toward high achievement, in that such environments reflected their own backgrounds and the high post-secondary aspirations and expectations they held for their children" (p. 1561). As such, parents can transmit power in the form of dispositions, habits, and attitudes to their children, resulting in the reproduction of dominant culture, even if that dominant culture works to also reproduce inequalities in academic attainment and social status (Adamuti-Trache & Andres, 2008). Thus, based on the capital that students receive, combined with the internal matrix of dispositions – both of which can and are influenced by their access, achievement, and identity regarding STEM education – an individual's interest in STEM can be created. The positive feedback loop begins when this science capital generates heightened value for individuals to support and further enhance their achievement, access, identity, and

power in society – social capital – which breeds additional science capital (Archer et al., 2014).

However, the opposite is also true: a lack of science capital presents a challenge for students in STEM because it can breed further dissonance and the reproduction of inequities over time (Turnbull et al., 2019). For example, some families might not have the awareness that additional services are an asset to students’ STEM learning and STEM capital in addition to in-class STEM learning (Wong, 2015) (see [Chapter 3.4.4. Power](#)). This, combined with STEM’s “hidden curriculum” (Jackson, 1968, p. 33) that implicitly teaches students who can or cannot be a scientist, results in a lack of the visibility BIPOC students need in order to see themselves as part of STEM, classrooms and society (DuBow et al., 2016). Denying these students access to scientific literacy in the formative years of their education ultimately renders them unprepared for future secondary education training in STEM (King Miller, 2015).

A critique of Bourdieu’s (1986) work is that it is a deficit-based conceptualization of capital because the focus is being placed on those with cultural dominance, perpetuating the narrative that “groups who lack the characteristics of the group in power are assumed to be ‘less than’ [those in power]” or lacking something (Samuelson & Litzler, 2016, p. 94). Samuelson and Litzler (2016) write “deficit-based approaches tend to overlook institutional barriers, such as uneven educational funding, lack of faculty representation, and discrimination in college environments... Instead of recognizing institutional barriers, they localize the problems and solutions within individuals or their communities” (p. 94). Thus, they continue, “remedies informed by deficit-based approaches often fail to meaningfully address educational issues faced by certain groups

of students” (Samuelson & Litzler, 2016, p. 94). As such, frameworks such as Yosso’s (2005) community cultural wealth (CCW) have been developed to challenge the traditional interpretation of what is considered cultural capital and broaden the “perspective on how different cultural attributes can serve as resources for students of colour as they navigate educational institutions” (Samuelson & Litzler, 2016, p. 95).

Yosso (2005) developed CCW by building on Solorzano and Villalpando’s (1998) critical race theory framework, and their later conceptualizations of cultural wealth. Together, critical race theory and cultural wealth encompassed the idea that marginalized students had a unique cultural capital “as well as other accumulated resources, that they employed to complete high school and aspire to a college degree, including navigational, social, economic, experiential, educational, and aspirational capital” (Samuelson & Litzler, 2016, p. 96). Yosso (2005) believed this should be recognized as community cultural wealth for its ability for these different types of capital to be “developed in and nurtured by families and communities” (Samuelson & Litzler, 2016, p. 95). Yosso’s (2005) conceptualization of CCW includes six types of capital: aspirational, navigational, social, linguistic, familial, and resistant capital. Similar to the pillars of equity (i.e., access, achievement, identity, and power), the types of capital in CCW “are not mutually exclusive or static, but instead operate as dynamic processes that build on one another” (Samuelson & Litzler, 2016, p. 96). Together, the six types of capital comprising CCW are conceptually grouped to better understand strategies to use in supporting and empowering marginalized students’ pursuit of and success in post-secondary academic spaces (Samuelson & Litzler, 2016).

Empowerment is an important aspect of power, particularly as it pertains to WOC in STEM (Leggett-Robinson, 2020). Psychological empowerment is a dynamic process that is critical to humans' well-being (Travis, 2013). Empowerment “integrates components of experience such as control, competency, and self-efficacy ... it can be enhanced or diminished through internal and external factors such as age, social supports, or life events ... without it, one can develop helplessness, hopelessness and social disconnect” (Laffier et al., 2021, p. 96). Through models like Yosso's (2005), students can find empowerment within the aspects of themselves, their families, and their communities that are traditionally labelled as deficits (Samuelson & Litzler, 2016). Asset-based models for analysis are empowering for marginalized students in STEM because they result in the interruption of the incorrect presumption that marginalized students are lacking what they need to succeed in STEM education and careers (Samuelson & Litzler, 2016). As such, researchers must move away from deficit-based analysis frameworks to asset-based ones, especially when it comes to research regarding WOC in STEM, as a means to empower this demographic's STEM identity development, thus academic STEM success and persistence (Leggett-Robinson, 2020; Lewis et al., 2016; Samuelson & Litzler, 2016).

An aspect of empowerment that is of particular importance to this thesis is mentorship. Garmire (2021) defines mentorship as “a relationship between two people where the individual with more experience or knowledge is committed to pass along what they have learned to a more junior individual” (p. 1); the more senior individual being the mentor, and the more junior individual being the mentee. Garmire (2021) continues to explain that “in academia, mentor and mentee together are engaged in many activities,

such as helping the mentees to advance in their academic programs, imparting intellectual knowledge, giving advices on career navigation, and assisting the mentees through difficulties in their academic pursuit” (p. 1). Despite mentorship being common in STEM education and professions, it is an aspect that is often left out of conversations of STEM capital (Ceglie, 2020). Ceglie (2020) speaks to the power of personal contact and mentoring by faculty members as key to future science success. That said, students who do not necessarily have science capital provided to them by their families can still find positive, welcoming relationships with and by faculty members who go out of their way to engage their students (Ceglie, 2020). STEM faculty and advisors engaging in mentorship with STEM students can leverage their positions of power to push against traditionally oppressive academic structures that work against students marginalized in the STEM field, over time, positively contributing to students’ persistence in STEM (Ceglie, 2020). Ceglie’s (2020) findings corroborate Archer et al.’s (2015) findings that science capital can help support students’ attainment and participation in science. Thus, STEM mentorship acts as a protective factor against the historically hostile, unfriendly, and unwelcome culture of science (Carlone & Johnson, 2007; Malcolm & Feder, 2016).

In summary, power is an important consideration for equitable STEM education. In all of its forms (i.e., economic, cultural, symbolic, social, aspirational, navigational, linguistic, familial, and resistant capital), capital provides many benefits for those who possess it (Bourdieu, 1986; Yosso, 2005). The opposite is also true; those who lack capital face difficulty that others with capital do not (Turnbull et al., 2019). Therefore, increasing opportunities for capital development is important in addressing inequities in STEM. However, this goes beyond deficit-narratives that center marginalized students as

the problem (i.e., it is the fault of the student that they lack STEM capital) (Samuelson & Litzler, 2016; Yosso, 2005). Students' access to STEM capital is dependent on a variety of factors which are largely out of their control (see [Chapter 3.4.1. Access](#), [Chapter 3.4.2. Achievement](#), and [Chapter 3.4.3. Identity](#)). Thus, STEM capital must be reframed using assets-based models such as Yosso's (2005) model of CCW, in order to challenge traditional conceptions of capital by identifying and supporting the many ways racialized students access capital outside of traditional models (i.e., capital that is developed in and nurtured by community) (Samuelson & Litzler, 2016; Yosso, 2005). An understanding of power is needed in conjunction with Gutiérrez's (2007) other three pillars of equity – access, achievement, and identity – to understand the multifaceted ways that inequities are present in STEM.

In this chapter, I discussed the theoretical framework used to conduct this research study. The research in this thesis was situated within Crenshaw's (1989) framework of intersectionality and Gutiérrez's (2007) four pillars of equity (i.e., access, achievement, identity, and power), which were applied with an anti-deficit approach (Cresswell-Yeager & Whitaker, 2020; Harper, 2010; Mejia et al., 2018; Patton Davis & Museus, 2019; Williams, 2019). The combination of these three perspectives provided the foundation for which this study was developed and conducted. In the next chapter, I discuss the overarching methodological approaches and methods used to conduct this research study. I describe this study's research design, participants, context, data collection tools, procedure, data analysis, and ethical considerations.

Chapter 4.0. Methods

In this chapter, I discuss the overarching methodological approaches and methods used to conduct this research study. I describe this study's research design (i.e., phenomenology, narrative, and participatory research), participants, context, data collection tools (i.e., semi-structured interviewing, audio and video recording, and researcher notes), procedure, and data analysis (i.e., thematic content analysis). Ethical considerations are also discussed throughout.

4.1. Research Design

Deficit thinking is an uncritical and oppressive concept. As such, I exercised an anti-deficit lens to counter the overwhelmingly large body of deficit-based research that exists, particularly regarding minoritized people in STEM education (Adiredja, 2019; Martin, 2009; Nasir & Shah, 2011; Oppland-Cordell, 2014). I draw from the methods of phenomenological (Farrell, 2020), narrative (Fraenkel et al., 2012), and participatory (Chappell, 2000) research. Drawing from these methods allowed me to develop a deeper understanding of how online communities support the identity development of Indo-Caribbean women in STEM.

4.1.1. *Phenomenological Research*

Farrell (2020) describes phenomenology as “understanding the lived experiences of others. It is at once a philosophy, a perspective, and an approach to research,” (p. 1). Polkinghorne (1983) makes an important distinction between understanding (with a lowercase “u”) and Understanding (with an uppercase “U”) (Farrell, 2020). As described by Farrell (2020), understanding refers to any type of comprehension, such as mathematical understanding (i.e., two plus two equals four), or logic (e.g., if I touch a hot

stove with my hand, I will experience pain). This is not the type of understanding that phenomenology is concerned with. Rather, phenomenology is about Understanding, which is a specific type of understanding; “the understanding of meaning” (Farrell, 2020, p. 6). As such, phenomenology is concerned with Understanding the lived experience of others. The objective of gaining this level of Understanding through phenomenological research in education is to enable us to “respond, as educators, as humans, with insight and compassion in developing policy, instigating change and in engaging in our role as educators and as humans,” (p. 6).

Farrell (2020) provides an overview of the philosophical underpinnings of phenomenology that have been translated into the methodologies often seen being applied in education research. Rather than outlining a specific phenomenological procedure, Farrell (2020) describes six principles outlined by van Manen (1990) that researchers can use to ground themselves in phenomenological philosophy. The six principles are: 1) choose a phenomenon that interests us and commits us to the world; 2) investigate experiences as we live them, rather than as we conceptualize them; 3) reflect on the themes that characterize the phenomenon; 4) describe the phenomenon through writing and rewriting; 5) maintain a strong and oriented pedagogical relation to the phenomenon; and 6) balance the research context by considering both parts and whole (Farrell, 2020, p. 5; van Manen, 1990). These principles allow for a variety of phenomenological methods, all of which reflect the many paths of phenomenological researchers (Farrell, 2020).

4.1.2. Narrative Research

According to Fraenkel et al. (2012), narrative research studies an individual’s life

experiences as told by the individual to the researcher. In some narrative research, the participant recalls a special event, an “epiphany”, in their life, and the researcher’s job is to describe the setting or context in which the epiphany occurred (Fraenkel et al., 2012). In narrative research, the researcher is actively present and openly acknowledges that their report of findings is an interpretation of the participant’s experiences (Fraenkel et al., 2012) while recognizing that the intended interpretations may not be shared by all its consumers (Franzosi, 1998). The objective of using a narrative research methodology is not singular (e.g., to reach an agreement) and will depend on the aim or purpose of the research being conducted. But at its core, narrative research “aims to explore and conceptualize human experience as it is represented in textual form,” (Salkind, 2010, p. 869).

Narrative is important in phenomenological studies as the researcher uses narrative to describe the experiences outlined by the participants (Fraenkel et al., 2012, p. 433). The main models of narrative analysis are thematic analysis (i.e., what is said), structural analysis (i.e., how stories are told), and interactional analysis (i.e., the dialogue between the teller and listener) (Fraser & Jarldorn, 2016). For this study, I chose to use thematic analysis as the method of data analysis. Specifically, I apply a latent level, inductive and deductive approach to thematic analysis, guided by Braun and Clarke (2006); this will be discussed in greater detail in [Chapter 4.6.4. Thematic Content Analysis](#).

4.1.3. Participatory Research

In this section, I discuss the origin and relevance of participatory research to this study. According to Chappell (2000), participatory research refers to research in which

participants are actively involved. The participatory research approach used in this study was developed in the 1990s in connection with the U.K.'s disability rights movement (Brown & Strega, 2015; Lane, 2014). Participatory research rejects the traditional roles of *the researcher* versus *the researched*, pushing beyond the traditional conceptualization of them as “the expert” and “the object(s) of investigation,” respectively (Stalker, 1998, p. 6). Additionally, participatory research advocates that “people have the right to be consulted about and involved in research that affects their lives” (Stalker, 1998, p. 6).

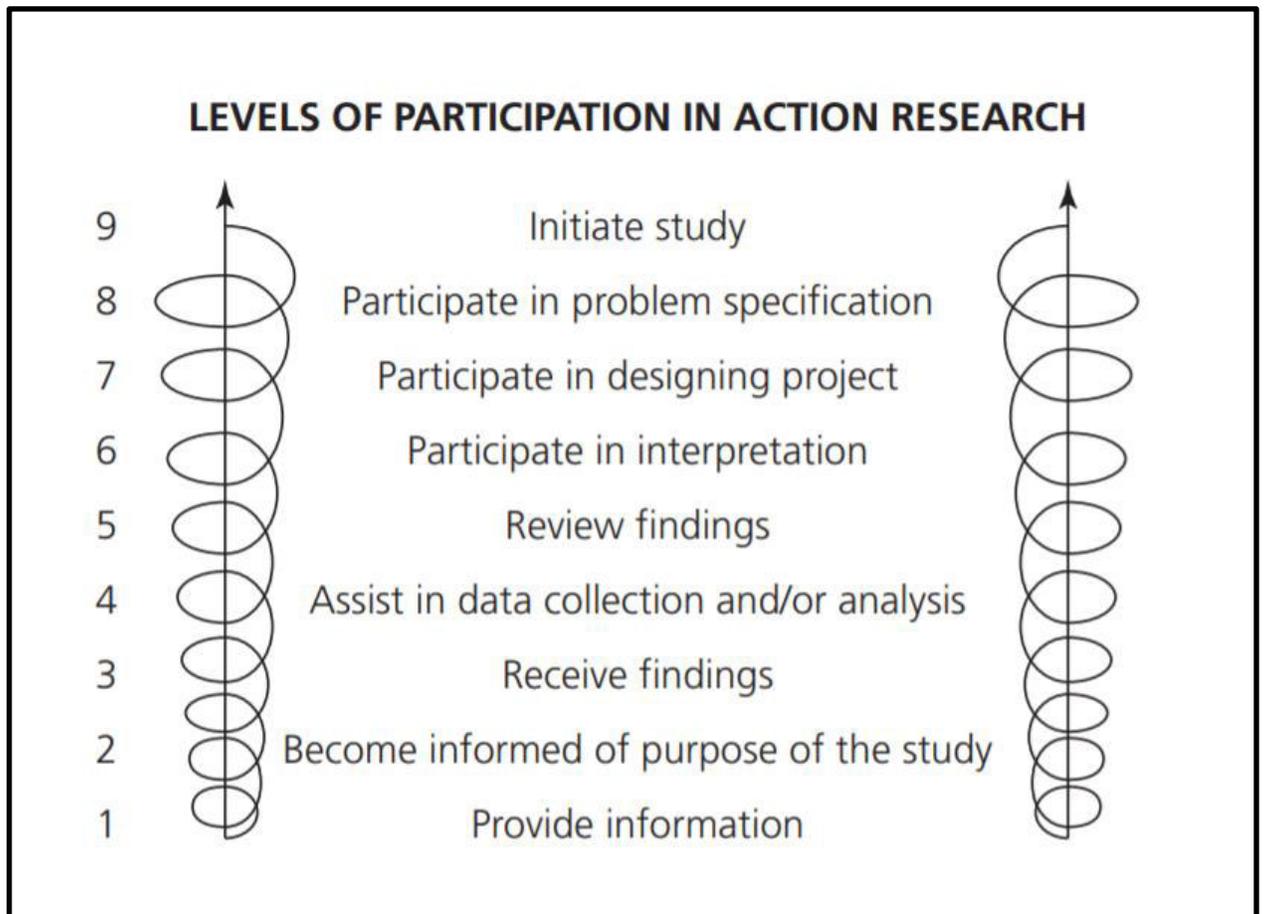
While the intention of this research approach is to level power imbalances between researchers and participants (Cooke & Kothari, 2001), a primary critique of participatory research is that the power imbalance is inevitable; impossible to avoid (Lane, 2014). Cooke and Kothari (2001) explain the way people usually become involved in participatory research projects (e.g., whose participation and, therefore, voice, is privileged in participatory research? Who are the stakeholders in the research versus who is funding the research? How much are participants empowered, versus what are they empowered for?) will always be a part of a complex web of power relations. Furthermore, despite the “listening” that is required of researchers in participatory research, there can be ambiguity around the reporting of “the listening” that occurred, especially if researchers do not clearly state their positionality and methods from the outset of the participatory study (Lane, 2014, p. 6). This is why some critics of participatory research argue that there is absolutely no reason to speak for others (e.g., Hinterberger (2007); Maclure (2009); Mazzei (2007)).

Lane draws on Alcoff's (1991) work arguing “in support of speaking for others, but in a way that requires careful attention, and demands from the ‘discursively

privileged' researcher, accountability, and responsibility for what is said, how it is said, and for which audience" (Lane, 2014, p. 6). Participants of this study were involved on Level Two and Level Four of the "Levels of Participation in Action Research" continuum as defined by Fraenkel et al. (2012, p. 592) (see [Figure 4.1. Levels of Participation in Action Research](#) below). Level Two, "Become informed of the purpose of the study," occurred in the initial meeting with participants to review the consent form (see [Chapter 4.5.1. Initial Meeting with Participants](#)). Level Four, "Assist in data collection and/or analysis," occurred via the participant validation of the transcripts before I started the processes of qualitative coding (see [Chapter 4.6.3. Qualitative Coding](#)) and thematic content analysis (see [Chapter 4.6.4. Thematic Content Analysis](#)).

Figure 4.1.

Levels of Participation in Action Research



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4.2. Participants

Broadly, this study focuses on Indo-Caribbean women. I established several criteria to narrow down a specific group of Indo-Caribbean women to which the research

questions of this study are more likely to apply. There were five requirements used to identify potential participants in this study. The criteria are as follows:

- 1) Participants must be 18 years or older to participate in this study.
- 2) Participants must belong to the racial and ethnic identity of “Indo-Caribbean” or the “Indo-Caribbean diaspora”.
- 3) Participants must self-identify as a woman.
- 4) Participants must have had some schooling experience in Canada. However, participants do not have to be Canadian citizens or Permanent Residents in Canada.
- 5) Participants must be pursuing a science, technology, engineering, or mathematics (STEM) education or career.

Eight Indo-Caribbean women reached out to express interest in taking part in the study. Since this study utilized qualitative research methodologies, smaller sample sizes are required to allow for deep and rich analyses to be conducted (Braun & Clarke, 2006; Creswell, 2003; Fraenkel et al., 2012). Interested participants were selected first-come, first-served. Ultimately, six Indo-Caribbean women, between the ages of 20 and 30 years, agreed to participate in the study. Participants’ names were changed to protect their identities. For the purposes of this study, I refer to the participants as Anjali, Premika, Nandani, Shanita, Sati, and Ayesha.

An ethical issue that I had to consider was regarding the collection and sharing of the participants’ demographic information. In this study, some of the participants’ demographic details are necessarily known because the criteria for participation were

specific (i.e., Indo-Caribbean heritage, identity as a woman, and some Canadian schooling). Throughout the course of the interview, more information was learned about the participants that, in other circumstances, would likely not compromise their privacy. However, the number of Indo-Caribbean women in STEM is small and I feared that revealing additional details about the participants could compromise their privacy and safety. Consequently, I felt it imperative to omit all unnecessary identifiable information, including, but not limited to, the participants' hometowns, schools, specific fields and levels of study, workplaces, places of residence, and their families' geographical, cultural, or ethnic backgrounds, wherever necessary.

4.3. Context

I used social media to recruit participants for this study. I reached out to the moderators of various social media groups that tailor their content to the experience of Indo-Caribbean women ([Appendix A – Social Media Groups](#)). These social media groups are grassroots individuals or groups of individuals that have set up forums via social media for discussions specific to the Indo-Caribbean women's experience. I asked the moderators of these groups ([Appendix B – Letter to Social Media Groups](#)) to post an REB-approved advertisement of the study on their social media accounts to aid in the recruitment of participants for this study ([Appendix C – Participant Recruitment Images](#)). The advertisement consisted of five images that contained a brief explanation of the study, the participant criteria, my university-associated email address, and instructions to contact me directly for more information about the study. The advertisements' images make it clear my affiliation with both Ontario Tech University as a Masters student, as well as my membership in that online community space (i.e., my identity as an Indo-

Caribbean woman) ([Appendix C – Participant Recruitment Images](#)). Participants who were interested in contributing to this study contacted me directly to arrange a time for an initial meeting. The goal of the initial meeting will be discussed in [Chapter 4.5.1. Initial Meeting with Participants](#).

An ethical consideration during the recruitment of participants was the question of already-existing relationships between me (the researcher) and potential participants that may possibly contribute to feelings of obligation or undue influence to take part in the study (e.g., instructor-student, service provider-client, manager-employee). This ethical issue was a possibility because I am a member of the population from which I was seeking participants (i.e., Indo-Caribbean women in STEM). My relation to the social media groups I reached out to was as a follower/subscriber; I am not (and was not) an organizer, leader, decision-maker for any of the social media groups that advertised the study. Since I had (and have) no power in these groups, no feelings of obligation or undue influence could have resulted during the recruitment process. Additionally, reimbursement and incentives were not offered to the participants of this study.

Another ethical issue to consider was regarding requesting permission to recruit participants for the study. I wanted to request permission and assistance from the organizers of the social media groups to recruit participants. The reason I chose to have the social media group moderators share the recruitment images from their account directly is to further prevent any feelings of obligation or undue influence within the participant pool (i.e., the previously ethical issue discussed) by removing the link between the research study and my personal social media accounts. Furthermore, I requested that the recruitment images not be linked to any of my personal social media

accounts on any of the social media platforms by way of tagging (e.g., tagging in captions, photos, Tweets, alt-text, etcetera), once the study advertisement was posted. All recruitment-related documents can be found in [Appendix A – Social Media Groups](#), [Appendix B – Letter to Social Media Groups](#), and [Appendix C – Participant Recruitment Images](#).

4.4. Data Collection Tools

In this section, I discuss the tools used to collect data for this study. They include semi-structured interviews, audio and video recordings, and researcher notes.

4.4.1. Semi-Structured Interviews

The instrument used for information elicitation in this study is a semi-structured interview. The semi-structured interview consists of a series of pre-planned questions designed to elicit specific information from the participants (Fraenkel et al., 2012). However, semi-structured interviews allow for freedom to stray from the pre-planned interview questions (Basit, 2010; Fraenkel et al., 2012). This allows the researcher to make in-the-moment decisions about participant responses that more rigid types of interviews (i.e., structured interviews) do not allow (Fraenkel et al., 2012). This allows the researcher to bring about a deeper understanding of participant information and encourage further development of relevant participant ideas, all while still allowing the researcher to center their research question(s) (Basit, 2010; Fraenkel et al., 2012). For the researcher, this may look like asking probing questions that surfaced naturally during the interview and were not pre-planned (Basit, 2010). This may also look like skipping some of the pre-planned questions entirely (Basit, 2010).

Moreover, because this is participatory research (Chappell, 2000) conducted

through a lens of equity (Gutiérrez, 2007), I wanted to give participants the power to lead the interview with their interests as they related to the study topic. Therefore, I implemented an element of unstructured interviewing in the semi-structured interview to achieve this. According to (Fraenkel et al., 2012), unstructured interviews are much less formal than semi-structured and structured interviews. They resemble casual conversations, and they pursue the interests of both the researcher and the participants. Unstructured interviews do not involve any specific type or sequence of questions, nor do they require any particular form of qualitative questioning (e.g., exploratory, predictive, interpretive questions) (Fraenkel et al., 2012). Though the interviews I conducted are more traditionally semi-structured (e.g., involving a pre-planned set of questions), implementing the casual tone and increased flexibility regarding the sequences of questions being asked did allow for some exchange of power between me and the participants during the interview. Also, I did not consider the specific type of questions being asked in the planning of the study. However, they were vaguely categorized during the data analysis phase. Lastly, the sequence of the pre-planned interview questions did bear some significance in the data collection. The three sets of questions asked were required to be asked in the order they were organized. However, within each set of questions, the order of the questions was less important. The organization of the sets of questions I created will be discussed more in [Chapter 4.5.2. Second Meeting with Participants](#).

Due to the nature of the interview design, I anticipated that the questions and subsequent conversations with the participants would stray from the pre-planned line of questioning; this was an accurate prediction. I decided to share the pre-planned questions

with all participants before the semi-structured interview to allow participants time to reflect meaningfully on the questions. I hoped that providing participants with this time to reflect on the questions, combined with the informal semi-structured nature of the interview, would result in deep, rich answers and consequently discussions, from and with the participants. In this study, the semi-structured interview questions were shaped to obtain information specific to the scope of my research (i.e., online identity development of Indo-Caribbean women in STEM). The pre-planned interview questions can be found in [Appendix D – Pre-Planned Semi-Structured Interview Questions](#) and will be discussed in more detail in [Chapter 4.5.2. Second Meeting with Participants](#). The semi-structured interviews took place through the video conferencing platform Google Meet, using my institution-affiliated account to ensure a secure connection with the participants.

4.4.2. Audio and Video Recording

Audio and video recording of the semi-structured interviews was the method of data collection for this study. Recording the semi-structured interviews was an indispensable part of this study because it allowed me to capture the participant information as accurately as possible. This is because, unlike humans, audio and video recording does not change what has been said because of conscious or unconscious interpretation, or accidentally tuning out conversations when deep in note taking (Patton, 2002). Also, audio and video recording do not record slower than how they are spoken (Patton, 2002). As such, audio and video recording allowed me to (a) more naturally engage in discussion with the participants; (b) take notes without worrying about tuning out (or losing) participant information; and (c) revisit the conversation for iterative, thus

deeper, analyses. Audio and video recording were also important for the method of data analysis I chose for this study, which required direct quotes from the audio and video data to support the results of the investigation. Audio and video recording in this study was easy to do as it is a function that is integrated into the video conferencing platform I used during the semi-structured interviews (i.e., Google Meet). Storage was also easy, as the audio and video recordings were automatically and securely saved to the cloud-based storage system (i.e., Google Drive) associated with the institution-affiliated and password-protected account used.

There are ethical considerations specific to the method of audio and video recording. First, there is a tendency for researchers to regard video and audio recordings as complete (Bottorff, 1994), objective and theory-neutral data (Hall, 2000). Of course, this is not true because each researcher analyses through their own unique theoretical perspective which will inevitably shape the data record (Powell, 2003). Additionally, as Bottorff (1994) explains, video data are incomplete because: 1) like human observations, they are also capable of selectivity due to mechanical limitations; 2) they are incapable of discerning the contexts of recording content (e.g., recorded behaviours); and 3) they are usually unable to convey historical context that may be important to the study (e.g., the historical context of the behaviour being captured). These concerns are part of the reason why I supplemented the method of audio and video recording with methods based on participatory research. Ideally, having participants verify the interview transcripts before data analysis served to limit the interference of my conscious or unconscious biases, and any preconceived (predicted) results of the study. Additionally, involving participants in the transcript verification allowed for a more complete and accurate data collection

because the changes provided context to the certain details of the data I missed or provided corrections to the data that were recorded or transcribed incorrectly.

Additionally, Roschelle (2000) speaks of the importance of obtaining progressive levels of informed consent regarding audio and video recording. This includes providing formal and written information about who will have access to, and the potential uses of the data, to all participants involved in the study. These considerations were incorporated in the Informed Consent Form ([Appendix E – Informed Consent Form](#)).

4.4.3. Researcher Notes

In addition to using direct quotes to support the results of this study, I used researcher notes to aid my interpretations of these data. Patton (2002) explains that using audio and video recording does not eliminate the need for taking notes during data collection. Patton (2002) states that notes can serve at least two important purposes. First, taking notes during a semi-structured interview allows the researcher to formulate and record new questions, even as the interview progresses (Patton, 2002). This is helpful if the researcher wants to follow up on something that is said but cannot do so right at the moment (Patton, 2002). Secondly, taking notes about what participants are saying will facilitate data analysis (Patton, 2002). For example, taking note of an important quotation will help the researcher locate it in the transcript later on (Patton, 2002). In the case of this study, I found taking notes during the semi-structured interviews helpful because of the aforementioned benefits. Additionally, it was helpful to review my notes during the data analysis process to revisit the comments I made during the interview process. In my notes, I recorded the things that were of particular importance and interest to me and my theoretical framing. Reviewing these notes became important in the inductive, latent

thematic content analysis I conducted on the data. This will be discussed more in [Chapter 4.6.4. Thematic Content Analysis](#).

4.5. Procedure

In this section, I explain the procedures followed in this study to 1) collect ongoing, informed consent from the participants; 2) collect data from the participants; and 3) secure storage of the collected data. [Table 4.1. Timeline of Study Procedures](#) provides a timeline of events related to the completion of this thesis.

Table 4.1.

Timeline of Study Procedures

Timing	Procedure
May 2020	Submitted initial research proposal to supervisors.
September 2020	Ethics approval of “Online Identity Development of Coolie Womxn in STEM” by Ontario Tech University Research Ethics Board; REB #15981.
October 2020	Began study recruitment through digital advertisement (see Chapter 4.3. Context).
October - November 2020	Met with individuals interested in the study and collected consent from those interested in participating in the research study; conducted semi-structured interviews with the participants.
November 2020 - January 2021	Transcription of participant interviews.
January - February 2021	Follow-up meetings with participants to verify transcripts (see Chapter 4.6.2. Participant Verification of Transcripts and Follow-Up Interview).
August 2021	REB file renewed/extended to allow for the completion of this thesis.

4.5.1. Initial Meeting with Participants

There were two meetings required from the participants of this study. The goal of

the first meeting was to review the consent form ([Appendix E – Informed Consent Form](#)) and give participants a chance to ask questions about their involvement in the study. During the initial meeting, participants were encouraged to take as much time as needed to make a decision regarding their participation. Participants were asked for their continued consent to contact them via email after the initial meeting. This was necessary to follow up with participants regarding a convenient date and time to conduct the semi-structured interview. The initial meetings took place through the video conferencing platform Google Meet, using my institution-affiliated account to ensure a secure connection with the participants.

An ethical issue I faced when designing this part of the study was concerning participants' consent and their right to withdraw from the study. Participants' consent was collected from all participants at various points throughout the research process, as required by the REB. Verbal consent to contact potential participants via email was collected at the end of the initial meeting. Participants' consent to participate in the semi-structured interview was collected by way of the REB-approved consent form ([Appendix E – Informed Consent Form](#)). Continued verbal consent regarding the individual participant's preferences regarding audio and video recording was also collected at the beginning of the semi-structured interview. At the end of the semi-structured interview, participants were also asked for their verbal consent for me to email them regarding scheduling the potential follow-up interview and verification of transcripts.

Also included in the consent form was information regarding the participants' right to withdraw from the study. The information included the steps to withdraw from the study and the deadline to withdraw from the study. The participants were informed

that (a) there would be no consequences of withdrawal from the study; and (b) the withdrawal deadline is up until the participants have approved the transcript, but before cross-analysis of all transcripts takes place. Participants were also informed that upon withdrawal, all collected data would be removed from all places where it is stored (see [Appendix E – Informed Consent Form](#)). Participants were encouraged to keep the consent form and refer to the information inside at any point throughout the duration of the study. No participants withdrew from the study.

4.5.2. Second Meeting with Participants

The second meeting that took place was the one-on-one, semi-structured interview with each participant. The semi-structured interview questions consisted of three sets of questions, each containing some of the six basic types of interview questions described by Patton (2002). I felt it was an important first step in the interview process to establish an appropriate rapport with the participants. Thus, I designed the first set of questions accordingly (see [Appendix D – Pre-Planned Semi-Structured Interview Questions](#)). The first set of questions were background (i.e., demographic) questions that I asked to get to know each of the participants beyond their demographic data related to the study's participation criteria. This first set of questions also provided the opportunity for the participants and me to get comfortable, which helped build an atmosphere of mutual trust, cooperation and respect among myself and the participants, allowing for the collection of the most natural and authentic information possible (Fraenkel et al., 2012).

The second set of questions was regarding participants' overall social media usage. In this set of questions, I asked a combination of experience (i.e., behaviour) questions and opinion (i.e., values) questions (Patton, 2002). First and foremost, I asked

the experience and opinion questions to verify that the participants in fact use social media and consider themselves consistent users of social media. Verifying this was vital to the study since I am interested in the way that online social media communities support the STEM identity development of Indo-Caribbean women. Collecting information from participants who do not use online social media platforms would be harmful to this study and be bad method practice. Secondly, the experience and opinion questions added context to the information that the participants were providing. For example, the experience questions helped elicit participants' descriptions of their social media usage, which is something that I was not able to observe or quantify for this study. Additionally, the opinion questions provided me with insight into the participants' perceptions of their personal social media usage, and their general overall attitudes towards the use of social media.

The final set of questions I asked participants was related to the role social media played in supporting the participants in STEM. This set consisted of the widest variety of questions: knowledge, experience, opinion, and feelings questions. For example, I asked what the participants' institutional STEM experiences were like: did they enjoy their STEM education; why or why not? How did their institutions make them feel supported throughout their STEM education? If nothing was done, I asked how they thought their institutions could have improved. Also, I asked questions to determine participants' feelings towards their online communities; (i.e., How did they feel about the representation as Indo-Caribbeans in their online communities? Indo-Caribbean women? Indo-Caribbean women in STEM?) At the end of the interview, I asked the final debriefing question and moved on to explain the next steps of the study. A full list of the

semi-structured interview questions can be found in [Appendix D – Pre-Planned Semi-Structured Interview Questions](#).

There were some risks inherent in this research that needed consideration before the start of this project. Given the nature and topic of the study, there was a possibility of psychological risk for the participants (e.g., feeling demeaned, embarrassed, worried, or upset). It was anticipated that participants could become emotional when (a) reflecting on the ways in which online communities have supported them; and (b) in possibly sharing negative or positive experiences of participating in STEM education. However, the potential discomfort experienced as a result of the interview was not expected to be any more than what the participants would experience in sharing through online social media communities. Participants were made aware of the possibility of the harm they could encounter by participating in the study. Participants were also made aware that because this research is based on an anti-deficit narrative approach (Adiredja, 2019), and participatory research (Chappell, 2000), they would be given the final say over the transcripts (i.e., what, and how they want to share). Participants were encouraged to consider all the provided information regarding the inherent risks of this study and encouraged to make a decision regarding participation that was best for them.

Plans were made to prepare for the possibility that participants did experience negative emotional responses throughout any part of the study. For example, prior to the start of the study, I compiled a list of community counselling and support service resources ([Appendix F – List of Community Supports and Services](#)). This list was provided to the participants at the initial meeting and again at the time of the semi-structured interview, via the video-conferencing platform’s “Chat” feature. I encouraged

the participants to access the resources at any point of their involvement in the study, as needed. During the semi-structured interview, there were a number of actions I planned on taking if the participants began expressing distress. The first action was to remind participants that they have the right to "pass" any questions that they are uncomfortable answering. The second action involved reminding the participants that they will have the opportunity to review the interview transcripts before data analysis and were in control of what and how the information would be shared. Thirdly, I reminded participants of the community counselling and support service resources that I shared in the chat at the start of the interview. Lastly, I planned on asking participants about their willingness to continue with the interview. If they were unwilling to proceed with the interview at that moment, the participant would have been allowed to leave the interview, and we would continue at a later date and time. If the participant was no longer interested in participating in the study, the necessary steps would have taken place (see [Chapter 4.5.1. Initial Meeting with Participants](#) and [Appendix E – Informed Consent Form](#)).

Opposite to the inherent risks of the study, there were no direct benefits to the participants for participating in this research. However, it was made known to participants that knowledge and information generated from this study have the potential to help other researchers understand the role that online communities play in supporting Indo-Caribbean women's pursuits of STEM education, careers, and excellence in their personal and professional lives. The Indo-Caribbean community in Ontario and Canada continues to grow, however, their contributions and struggles are rarely recognized as compared to other racialized communities. As such, it was also explained to the

participants that this research has the potential to begin to validate the lives and experiences of Indo-Caribbean peoples in Canada.

Lastly, because this is participatory research (Chappell, 2000), I proposed an optional third meeting to all participants. The purpose of this meeting is discussed further in [Chapter 4.6.2. Participant Verification of Transcripts and Follow-Up Interview](#).

4.6. Data Analysis

Qualitative data analysis is an iterative process in which information is retrieved, reduced, and continuously compared (Fraenkel et al., 2012). The data analysis in this project consisted of three steps: 1) transcribing; 2) participant verification of interview transcripts; 3) qualitative coding; and 4) thematic content analysis.

4.6.1. Transcribing

After collecting the data, I transcribed the data by hand. When completed, I checked my manual transcription for accuracy using ATLAS.ti. ATLAS.ti is a Computer-Aided Qualitative Data Analysis Software (CAQDAS) that offers features, such as transcribing and coding tools, that are helpful in analyzing qualitative data from a variety of theoretical approaches (Friese et al., 2018).

4.6.2. Participant Verification of Transcripts and Follow-Up Interview

Due to the participatory nature (Chappell, 2000) of this project, participant verification of the transcribed interviews was an essential part of the data analysis process. As discussed in [Chapter 4.1.3. Participatory Research](#), the objective of involving participants in the research process is to balance the innate imbalance of power that exists between “the researcher” and “the researcher” by giving voice to the participants. I

involved participants in Level Four (i.e., assist in data collection and/or analysis) seen in [Figure 4.1. Levels of Participation in Action Research.](#)

At the end of the semi-structured interview (i.e., the second meeting with participants), participants were asked for their verbal consent for me to email them regarding scheduling the potential follow-up interview and verification of transcripts. Participants who gave their informed consent were contacted via email regarding the verification of their interview transcript. Participants were emailed a password-protected document containing their interview transcript. Participants received a unique password at the time of the interview that was required to access the document. Participants were asked to review the transcript and make notes of any changes (e.g., edits, omissions, clarifications). Participants were also provided with time slots to choose from if they were interested in completing a follow-up interview with me to discuss any questions, comments or concerns about their interview transcript or the study, in general.

After the participants and I met (i.e., the third meeting with participants) to review the changes made to their transcripts, they were debriefed again. This debrief included informing the participants of my next steps (e.g., beginning the process of coding and thematic analysis). Participants, again, were asked for their consent in allowing me to communicate with them further in the event that I needed further clarification or assistance with my interpretation of their interview transcripts. This same process had the potential to occur multiple times in the project between data analysis and the dissemination of results because of the iterative, participatory nature of the study. That said, I was prepared to repeat the same process of conducting a follow-up interview, debriefing the next steps in data analysis, and collecting continued consent, as needed.

Ultimately, only one round of follow-up interviews and transcript verification was completed for this study (i.e., no fourth meeting with participants was necessary).

4.6.3. Qualitative Coding

Coding in qualitative studies is the analytic process that involves the fracturing, conceptualization, and integration of data to form theory (Strauss & Corbin, 1998). Generally, codes are applied to data as a means to tag or label specific segments of the data as meaningful (Strauss & Corbin, 1998). The meaning that the chunks of codes hold depends on the aim of the analysis (Friese et al., 2018). When coding, the objective is to capture the major idea brought about by the segment being coded (e.g., a sentence or paragraph) (Strauss & Corbin, 1998). In addition to codes, subcodes can also be created during the data analysis process (Fraenkel et al., 2012). Codes and subcodes are often iteratively refined to help qualitative researchers make sense of their data (Fraenkel et al., 2012). Sense-making can be done through categorization, thematic content analysis, which is used in this study, or advanced theory building (Fraenkel et al., 2012).

Analysis can be completed in two ways: deductively (selective coding, theory-based, top-down) or inductively (open coding). Deductive analysis involves the use of a coding frame which is developed at the beginning of data analysis based on the researcher's theoretical or analytical interests (Friese et al., 2018). Deductive analysis is based on the specific research interest of the researcher, meaning they may not code the entirety of the data set (Friese et al., 2018). On the other hand, inductive analysis is driven by the data collected, meaning the researcher is not trying to fit the data into a pre-existing code frame (Friese et al., 2018). Instead, the codes are developed by and reflect the collected data (i.e., the participants' responses), and inform the themes derived from

the data (Friese et al., 2018). I used both deductive (selective coding) and inductive analytical (open coding) approaches in this study.

My initial approach was deductive; I read through the interview transcripts applying codes relating to the theoretical framework guiding this study. First, I coded for each of the individual pillars of equity according to Gutiérrez (2007): access, achievement, identity, and power. During this time, I also considered the context of the study (i.e., social media) and applied codes to identify the instances where social media was discussed. In the subsequent iteration of reading and coding transcripts, my process became more inductive. I applied codes more freely, based both on my interests and the patterns I was seeing in the transcript data. I was most interested in the equity pillars of identity and power as they related to social media. I also saw many connections between those sets of codes. Therefore, subcodes relating to power, identity and social media were developed. A summary of my coding process can be seen in [Figure 4.2. Codes Developed During the Deductive and Inductive Qualitative Coding Process](#), and a list of the codes and associated definitions relevant to this study can be found in [Table 4.2. Relevant Codes and Code Definitions](#) below.

Figure 4.2.

Codes Developed During the Deductive and Inductive Qualitative Coding Process

CODING			
1st Iteration	2nd Iteration	3rd Iteration	
POWER (community)	power - empowerment	-	
	power - generational strength	-	
	power - mentorship	-	
IDENTITY	identity - STEM	-	
	identity - Canadian	-	
	identity - first-gen. students	-	
	identity - issues	-	
	identity - questioning	-	
	identity - Coolie	identity - Coolie - deficit/stereotypes	
		identity - Coolie women - deficit/stereotypes	
identity - Coolie - lack of representation			
SOCIAL MEDIA	social media - representation	-	
	social media - usage	social media - usage - connection	
		social media - usage - entrepreneurship	
		social media - usage - mental health	
-	COMMUNITY/CONNECTION	community & connection - desires	
		community & connection - lacking	
		community & connection - social media	

Note. This figure is a screenshot of the codes created throughout the deductive and inductive qualitative coding process used in this study.

Table 4.2.

Relevant Codes and Code Definitions

Code	Definition
Power	A symbolic and relational concept; based on the ways capital (i.e., economic, cultural, or social capital) is cultivated within societal structures to create dominance in society; the interplay between multiple factors in a specific context (Bourdieu, 1986; Siisiäinen, 2008).
Empowerment	Psychological empowerment (PE) is “a process that integrates components of experience such as control, competency, and self-efficacy... PE is dynamic; it can be enhanced or diminished through internal and external factors such as age, social supports, or life events. Empowerment is critical

	to well-being; without it, one can develop helplessness, hopelessness and social disconnect” (Laffier et al., 2021, p. 96).
Mentorship	“A mentorship is a relationship between two people where the individual with more experience or knowledge is committed to pass along what they have learned to a more junior individual. The more senior individual acts as the mentor, and the more junior individual is the mentee. In academia, mentor and mentee together are engaged in many activities, such as helping the mentees to advance in their academic programs, imparting intellectual knowledge, giving advices on career navigation, and assisting the mentees through difficulties in their academic pursuit” (Garmire, 2021, p. 1).
Identity	Erikson defined identity as “a fundamental organizing principal which develops constantly throughout the lifespan” (Ragelienė, 2016, p. 98). Erikson (1968) continues to describe identity as an “awareness of the fact that there is self-sameness and continuity to the ego’s synthesizing methods, the style of one’s individuality, and that this style coincides with the sameness and continuity of one’s meaning for significant others in the immediate community,” (p. 50). Identity allows us to 1) understand who we are and how we relate to others (i.e., “self-sameness”), 2) differentiate from others (“uniqueness”), and 3) function autonomously from others (Ragelienė, 2016).
STEM Identity	STEM identity is defined as a reflection of how an individual understands, identifies with, and makes meaning of the STEM community and culture (Carlone & Johnson 2007; Hughes & Hurtado, 2013; Rodriguez et al., 2017). The development of STEM identity can be thought of as a developmental process of “coming to be” in STEM, which enhances the way an individual identifies with and participates in STEM (Lave, 1992, p. 2; Lave, 1998).
Stereotypes	“In social psychology, a stereotype is a fixed, over generalized belief about a particular group or class of people. By stereotyping we infer that a person has a whole range of characteristics and abilities that we assume all members of that group have... The use of stereotypes is a major way in which we simplify our social world; since they reduce the amount of processing (i.e. thinking) we have to do when we meet a new person. Stereotypes lead to social categorization, which is one of the reasons for prejudiced attitudes (i.e. “them” and “us” mentality) which leads to in-groups and out-groups” (McLeod, 2015).
Representation	“The way that someone or something is shown or described... a sign, picture, model, etc. of something... the fact of including different types of people, for example in films, politics, or sport, so that all different groups are represented” (Cambridge Dictionary, 2022, paras. 1-3).

Social Media	Internet-enabled information and communication technologies (ICTs) include all online technologies and platforms (i.e., Internet, social media, smartphones and tablets) that allow for the exchange of information and media (McInroy & Craig, 2020); “At its most basic level it is simply a collection of websites and applications designed to build and enhance online communities for networking and sharing information. It really is no different from hanging around the water cooler exchanging the latest news, sharing a pint after work talking about ‘the game,’ or having friends over to just hang out and ‘talk shop.’ The only difference in social media is that these interactions occur online” (Osborne-Gowey, 2014, p. 55).
Community	“First and foremost, community is not a place, a building, or an organization; nor is it an exchange of information over the Internet. Community is both a feeling and a set of relationships among people. People form and maintain communities to meet common needs. Members of a community have a sense of trust, belonging, safety, and caring for each other. They have an individual and collective sense that they can, as part of that community, influence their environments and each other. That treasured feeling of community comes from shared experiences and a sense of—not necessarily the actual experience of—shared history. As a result, people know who is and isn’t part of their community. This feeling is fundamental to human existence” (Chavis & Lee, 2015, paras. 4-6).
Acceptance	The opposite of belonging (Brown, 2010); “pursued through the act of ‘fitting in’ – choosing to act the way others would expect, want, or even need you to act” (Catts, 2019, para. 8); “Social acceptance means that other people signal that they wish to include you in their groups and relationships. Social acceptance occurs on a continuum that ranges from merely tolerating another person’s presence to actively pursuing someone as a relationship partner. Social rejection means that others have little desire to include you in their groups and relationships. Social rejection also is a complex construct, consisting of behaviors that can range from ignoring another person’s presence to actively expelling him or her from a group or existing relationship. People can experience acceptance and rejection chronically or acutely” (DeWall & Bushman, 2011, p. 256).
Belonging	To be a part of something larger than oneself (Brown, 2010, p. 40); an innate and fundamental human need (Fink et al., 2020; Lane, 2016; Leggett-Robinson, 2020); the psychological feeling of “connectedness to a social, spatial, cultural, professional, or other type of group or a community” (Raman, 2014); “Belonging is the feeling of security and support when there is a sense of acceptance, inclusion, and identity for a member of a certain group. It is when an individual can bring their authentic self to work. When employees feel like they don’t belong at work, their performance and their personal lives suffer” (CUDI, n.d.).

4.6.4. Thematic Content Analysis

While coding is important, it is only one part of the data analysis process. Braun and Clarke (2006) state that coding is helpful in organizing, structuring, and retrieving data, which supports the identification of themes. However, single codes rarely represent entire themes (Friese et al., 2018). Instead, themes are constructed as an outcome of coding (Friese et al., 2018), by linking related codes through a process called thematic content analysis. Specifically, Braun and Clarke (2006) describe thematic content analysis as a method for “identifying, analyzing, and reporting patterns (themes) within data. It minimally organizes and describes your data set in (rich) detail. However, frequently it goes further than this and interprets various aspects of the research topic” (p. 79). Importance is not necessarily measured by prevalence. In other words, the frequency of occurrence within or across a dataset is not necessarily a criterion for developing a theme (Friese et al., 2018, p. 8). Braun and Clarke (2006) describe a theme as capturing something important about the data as it relates to the research question(s), which represents some level of patterned response or meaning within the data set. Thus, “essential is the researcher’s assessment of whether or not the theme captures something important in relation to the overall research question” (Friese et al., 2018, p. 8). The meaning developed from datasets will depend on the aim of the analysis, which in turn, impacts the level(s) at which themes are identified (Friese et al., 2018). In this study, I conducted a thematic content analysis to determine the results that will be shared in the next chapter.

Thematic analysis can be conducted at two levels: semantic level analysis or latent level analysis (Friese et al., 2018). Semantic analysis involves coding data at face

value because the researcher is not looking for meaning beyond what is said or written is not (Braun & Clarke, 2006; Friese et al., 2018). Latent analysis is the opposite of semantic analysis in that the researcher is interested in examining the meanings, assumptions, and conceptualizations underlying the semantic content of the data (Friese et al., 2018). The development of themes in latent analysis requires interpretive work from the researcher, meaning the subsequent results are already theorized (Friese et al., 2018). As such, latent analysis works well in studies that are highly theoretically grounded within a specific theoretical framework (Denzin & Lincoln, 1994; Friese et al., 2018). Also, a latent analysis will always be an inductive analysis (i.e., will use inductive coding) in some capacity (Friese et al., 2018). In this study, I used a latent level of analysis to conduct a thematic analysis.

The approach to data analysis I took in this study was an inductive and deductive, latent thematic analysis. I did not have a prepared code frame at the start of my analysis. Instead, I initially coded the interview transcripts looking for instances in which connections were being made with my theoretical framework (i.e., I was looking for reflections of Gutiérrez's (2007) pillars of equity (i.e., achievement, access, identity, and power) in the participants' responses). Once the initial coding process was complete, I reviewed the initial codes and started to identify patterns among them (e.g., certain pairs of codes were being applied together much more than other pairs of codes; certain code pairings I found more interesting than others). From the patterns I observed, I began identifying potential themes to explore. These themes were further defined by revisiting the researcher notes I recorded during data collection (i.e., during the semi-structured interviews). The identified themes were reviewed by another round of coding, in which I

began to refine existing codes and create new codes that better reflected my interest in the themes I initially identified. The multiple layers of coding that I conducted were possible because I followed the six-step approach to thematic content analysis by Braun and Clarke (2006). I chose this approach because, according to Friese et al. (2018), Braun and Clarke's (2006) approach to thematic content analysis fits well with inductive (i.e., latent) thematic content analysis. Braun and Clarke's (2006) steps are: 1) become familiar with the data; 2) generate initial codes; 3) search for themes; 4) review themes; 5) define themes; and 6) report writing (Braun & Clarke, 2006). Lastly, once I felt comfortable with the themes that I identified, I selected direct quotes from the interview data to begin the report of results. [Figure 4.3. Themes Identified During the Process of Thematic Content Analysis](#) below contains images of my thematic analysis process.

Figure 4.3.

Themes Identified During the Process of Thematic Content Analysis

COMBINATIONS OF CODES		DEVELOPED THEMES
identity - STEM	identity - Coolie	Identity Crisis: STEM Identity (Versus? And?) the Coolie Identity
identity - issues	identity - Coolie - lack of representation	Poor institutional Representation of Coolie Women in STEM
Identity - lack of representation	Social Media - Representation	A Lack of Online Representation for Indo-Caribbean Women in STEM
identity - issues	identity - Coolie - deficit/stereotypes	Stereotypes and Microaggressions Directed Towards Coolie Women in STEM
	identity - Coolie women - deficit/stereotypes	
power - empowerment	identity - Coolie	Cultural Identity as a Protective Factor for Coolie Women in STEM
power - empowerment	power - generational strength	Reflections on the Past for the Benefit of the Future
community/connection - lacking	Acceptance	Lack of Community (Acceptance/Belonging/Mentorship) for Coolie Women in STEM
	Belonging	
	Power - Mentorship	
community/connection - desires	Acceptance	A Desire for More Community (Acceptance, Belonging and Mentorship) for Coolie Women in STEM
	Belonging	
	Power - Mentorship	
Power - Empowerment	Social Media - Representation	Development/Reinforcement of STEM Identity
Power - Empowerment	Social Media - Connection	STEM Persistence
Power - Mentorship	Social Media - Rep. + Conn.	Mentorship & Networking

Note. This figure is a screenshot of the themes created throughout the thematic analysis process used in this study.

In this chapter, I discussed the overarching methodological approaches and methods used to conduct this research study. I described this study’s research design (i.e., phenomenology, narrative, and participatory research), participants, context, data collection tools (i.e., semi-structured interviewing, audio and video recording, and researcher notes), procedure, and data analysis (i.e., thematic content analysis). Ethical considerations were also discussed throughout. In the next chapter, I present the results of my study. I discuss the themes that emerged while following the methods discussed in this chapter, and the codes that led to the identification of these themes.

Chapter 5.0. Results

This chapter presents the results identified from the participants' semi-structured interview data. This study was designed to explore the online identity development of Indo-Caribbean women in STEM. The participant data provide insight into the STEM identity development of the participants through their interactions with online Indo-Caribbean communities. The data results are organized below according to the coding frame that initially guided the data analysis process: identity, community (power), and social media. Sub-codes were created in each subsequent iteration of the coding process, which allowed for identifying and developing themes and sub-themes. The identified themes and sub-themes are covered in the following sections.

Each section begins with an overview of the codes used to determine the themes and sub-themes, and the number of co-occurrences between the codes. This is followed by the supporting participant data (i.e., direct quotes). I intentionally use direct quotes from interviews exactly as they were transcribed to honour the participants' voices, presenting them as authentically as possible (Gilgun, 2005; Lather, 1986; Lincoln et al., 2011). As such, I have bolded keywords within the data to guide readers' attention to the main idea of the direct quote. [Table 5.1. Summary of Codes and Subcodes, Co-occurrences, and Themes and Subthemes](#) contains a summary of the codes and subcodes that were combined to create the themes and sub-themes that follow, as well as the number of co-occurrences of each. [Table 4.2. Relevant Codes and Code Definitions](#) in [Chapter 4.0. Methods](#) contains a summary of all relevant codes and their definitions.

Table 5.1.

Summary of Codes and Subcodes, Co-occurrences, and Themes and Subthemes

	CODE COMBINATIONS		CODE CO-OCCURRENCES & DISTRIBUTION	SUBTHEMES
I D E N T I T Y	Identity - STEM	Identity - Coolie	12 times; all participants	Identity Crisis: STEM Identity And/Or Coolie Identity
	Identity - Issues	Identity - Coolie - Lack of Representation	19 times; all participants	Poor Institutional Representation of Coolie Women in STEM
	Social Media - Representation	Identity - Coolie - Lack of Representation	23 times; all participants	A Lack of Online Representation for Indo-Caribbean Women in STEM
	Identity - Issues	Identity - Coolie - Deficits & Stereotypes	13 times; five participants	Stereotypes and Microaggressions Directed Towards Coolie Women in STEM
	Power - Empowerment	Identity - Coolie	38 times; all participants	Cultural Identity as a Protective Factor for Coolie Women in STEM
C O M M U N I T Y	Community & Connection - Lacking	Acceptance	14 times; five participants	A Lack of Acceptance for Indo-Caribbean Women in STEM
	Community & Connection - Lacking	Belonging	14 times; five participants	A Lack of Belonging for Indo-Caribbean Women in STEM
	Community & Connection - Lacking	Power - Mentorship	seven times; all participants	A Lack of Mentorship for Indo-Caribbean Women in STEM
	Community & Connection - Desires	Acceptance	19 times; all participants	The Impact of Representation on Participants' Acceptance in STEM
	Community & Connection - Desires	Belonging	26 times; all participants	The Impact of Belonging on Participants' STEM Identity
	Community & Connection - Desires	Power - Mentorship	24 times; all participants	The Impact of STEM Mentorship on Participants' STEM Identity
S O	Power - Empowerment	Social Media - Representation	23 times; all participants	Fostering STEM Identity Development Through Online

C I A L M E D I A				Social Media Groups
	Power - Empowerment	Social Media - Connection	15 times; all participants	Increased Acceptance & Belonging in STEM Through Online Connection & Representation
	Power - Empowerment	Power - Mentorship	21 times; all participants	Social Media Groups As A Means For STEM Mentorship & Persistence

This research is anti-deficit in nature, meaning it focused on the participants' strengths, positives, and successes in their STEM education and careers (Cresswell-Yeager & Whitaker, 2020; Harper, 2010; Mejia et al., 2018; Patton Davis & Museus, 2019; Williams, 2019). Unsurprisingly, though, the participants also faced negative experiences throughout their education, resulting from the racism and sexism embedded into the structure of the STEM fields. To highlight the importance of the results found in this study, I include some of the participants' negative experiences (i.e., racial and gender exclusion and discrimination) in the chapter. Doing so may seem to contradict the anti-deficit approach that I applied to this project. However, my intention in mentioning these negative experiences is to do just that: mention them. I will not focus on the participants' barriers in the following stories. Instead, I intend to use the instances of discrimination that the participants face to (a) provide context to their experiences (i.e., as Indo-Caribbean women in STEM); (b) acknowledge and showcase the reality of the oppressive systems and structures that actively work against Indo-Caribbean and other racialized women within the STEM fields; and ultimately (c) highlight the qualities within these women that led them to succeed despite the barriers they faced.

5.1. Identity

The code “Identity” was used to highlight instances where participants reflected on their identities, generally, but sub-levels of codes related to identity were needed to further distinguish the participants’ nuanced perceptions of their identities. Sub-codes (i.e., Identity - STEM, Identity - Coolie; Identity - Issues; etcetera) were applied in iterative levels of coding. I analyzed the co-occurrences of codes and identified the following notable findings: 1) the apparent conflict between participants’ “Indo-Caribbean” and “STEM” identities; 2) the poor representation of Indo-Caribbeans in STEM; 3) the stereotypes and microaggressions directed towards Indo-Caribbean women in STEM; and 4) the participants’ perceptions of cultural identity aiding in their perseverance in STEM.

5.1.1. Identity Crisis: STEM Identity And/Or Coolie Identity

The codes “Identity - Coolie” and “Identity - STEM” were created to reflect the distinctions made by participants’ reflections of their Indo-Caribbean identity and their STEM identity, respectively. This distinction was necessary because all the participants reported that they saw the two identities (i.e., Indo-Caribbean women and women in STEM) as separate; they did not feel that the identities supported one another. The link between the codes “Identity - STEM” and “Identity - Coolie” was presented 12 times across all six participants. [Table 5.2. Participant Perspectives Regarding their Indo-Caribbean and STEM Identities](#) contains excerpts from the semi-structured interviews that showcase participants’ perspectives regarding their Indo-Caribbean and STEM identities.

Table 5.2.

Participant Perspectives Regarding their Indo-Caribbean and STEM Identities

Participant	Description
Anjali	Anjali shared that she would “like to [see the two identities] supporting each other,” she acknowledged that there had not been many opportunities to bring her cultural background into her STEM education.
Premika	Premika considered her Indo-Caribbean identity separate from her STEM identity, crediting the “othering” she experienced growing up in a community with “not a lot of mixture.” She explains: Yes, I actually do see [them] as separate entities . And the reason why is, and I don't know, maybe it's just my mother speaking in my head or my father speaking in my head, but I feel like it has a lot to do with our race. You know, my last name, for instance.
Nandani	Nandani expressed her explicit intention to keep her Indo-Caribbean identity separate from her STEM identity. She explained: Well, I see them as separate identities ... as a woman in STEM, first of all, that is a challenge in and of itself, right?... There are a lot of obstacles in the way, right? And also, as an Indo-Caribbean woman in STEM, I find that there are additional [obstacles]... I kind of have to separate them because it's too much [of a] hassle , right? It would be too much [of a hassle] to put them together .
Ayesha	Ayesha explains why she never considered her Indo-Caribbean identity in a STEM context: I feel like I never really considered my identity as an Indo-Caribbean woman to be part of how I navigate the STEM community , especially online. Because within my university setting, there's a bunch of different clubs... I really connect with a bunch of different STEM people through the clubs, but I never really took my Indo-Caribbean identity as part of that , if that makes sense?
Sati	When asked how she perceives her STEM identity and Indo-Caribbean identity, Sati answers: My first initial thought is that they're distinct . Because I don't necessarily, or haven't, I guess over the last four years for my undergrad, incorporated my culture into schooling ... I don't think anyone in my undergrad ever, in any of my classes has asked me what I identify as. No one in my master's program has either. I don't think anyone knows what my background is unless I present it without being asked.
Shanita	When asked how she navigated her STEM education as a person with multiple

	<p>intersecting identities, Shanita explained: I feel like I'm somewhere in between. Like, they weren't this perfect symbiosis... they were just two parts of me that I don't ever [think] interacted. I didn't see the intersectionality in it until I got older... So now I'm seeing it as kind of intertwined. But when I was younger, they were two aspects of me that didn't really meet but they didn't clash either.</p>
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In summary, the participants reported feeling their identities as “Indo-Caribbean Women” and “Women in STEM” were distinct and not mutually supportive.

5.1.2. Poor Representation of Coolie Women in STEM

After the first iteration of coding, it was apparent that the participants felt they faced many issues related to identity. The code “Identity – Issues” was created to pinpoint the participants’ identity issues within STEM. One of the particularly constant issues among the participants was a lack of representation of Indo-Caribbean women within STEM institutions, which was identified using the code “Identity – Coolie – Lack of Representation.” Participants’ reflections of their online social media communities also indicated a lack of representation. As such, both contexts are discussed below.

5.1.2.1. Poor Institutional Representation of Coolie Women in STEM.

The codes “Identity - Issues” and “Identity - Coolie - Lack of Representation” were examined to identify the instances where participants reflected on the institutional representation of Indo-Caribbean women in STEM. The co-occurrence of these two codes appeared 19 times throughout five of the six total participant interviews. The general consensus among participants was that they felt underrepresented in their STEM institutions. [Table 5.3. Participant Perspectives of Indo-Caribbean Women’s Representation in STEM](#) contains

excerpts of participants’ reflections regarding the underrepresentation of Indo-Caribbean women in STEM institutions.

Table 5.3.

Participant Perspectives of Indo-Caribbean Women’s Representation in STEM

Institutions

Participant	Description
Anjali	<p>Anjali reflects that she did not see a lot of women in STEM throughout her education. The women that she did see in STEM, however, were not Indo-Caribbean. She recalled the following:</p> <p>Honestly, I don’t see a lot of women in STEM period. But the ones that I do are not necessarily Indo-Caribbean. Like going through [university], the entire math program, I’ve only met like two other West Indians that were Jamaican men. And they were only taking that one course, for example, for their program, not necessarily in a [STEM] program... I can’t say I found a lot of West Indians in my program, let alone [West-Indian] women.</p>
Nandani	<p>Nandani mentioned that being one of very few girls in her physics and chemistry classes made it an uncomfortable space to be in. She explained, “I’d like to see this change... sometimes it’s not as inclusive. You don’t feel comfortable, right? Like, who can I ask for help?”</p>
Ayesha	<p>Ayesha reflects on her time in STEM education as something that did not involve her ethnic identity. She explained:</p> <p>I feel like it’s just me as a student, like, it doesn’t really involve my Caribbean identity and how I connect with other people online that are in STEM programs... I haven’t really come across many Indo-Caribbeans in STEM... I feel like there’s not really much of a representation there.</p>
Sati	<p>Sati explains the exhaustion of having to constantly explain “who she was” to her STEM peers:</p> <p>But a lot of people didn’t know what Guyana was when I would tell them what am I. The first question I usually get is “Ghana?” as a reaction, and I have to then teach people about the geography of the world [laughs]... [It’s] like a half identity crisis where people don’t understand that I can have ancestors of Indian descent who are in the Caribbean, being Indo-Caribbean.</p>
Shanita	<p>Shanita shared the immediate observation she made once she started her post-secondary STEM education:</p>

	<p>And then it's like, [look around] right? They all go. Are we not also -? “Like where are the Guyanese girls at?” Like, I would say this all the time. I'd be like, “are Guyanese people just not ambitious?” because I'm seeing all them Trinis here. Where's the Guyanese girls? Where's the Guyanese guys, even? You know? That was something I would ask myself all the time; “where they at?”</p> <p>Shanita continued, explaining her shock at the lack of Indo-Caribbean representation in STEM, by saying, “Indo-Caribbean women are such a big population in [my city], right? And then I'm the only one – and specifically Guyanese – I'm the only one seeing myself here, you know, let alone Trinidadian or any other Indo-Caribbean group, you know?”</p>
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In summary, participants reported feeling a lack of representation of Indo-Caribbean women in STEM in STEM institutions.

5.1.2.2. A Lack of Online Representation for Indo-Caribbean Women in STEM.

The codes “Social Media - Representation” and “Identity - Coolie - Lack of Representation” were used to identify the instances where participants discuss their experiences of poor representation of Indo-Caribbean women in online social media groups. These codes co-occurred a total of 23 times across all six participants. The participants reported that the representation of Indo-Caribbean women in STEM in online social media communities mirrors the representation experienced institutionally. In other words, participants felt that Indo-Caribbean women in STEM are underrepresented in online social media groups. [Table 5.4. Participant Perspectives of Indo-Caribbean Women’s Representation in STEM in Online Social Media Groups](#) contains excerpts of participants’ reflections regarding the underrepresentation of Indo-Caribbean women in online social media groups they have experienced.

Table 5.4.

Participant Perspectives of Indo-Caribbean Women’s Representation in STEM in Online

Social Media Groups

Participant	Description
Anjali	Anjali states that her perception of the online representation of Indo-Caribbean women in STEM is “none”. She continues, “it’s hard to come across the female representation in STEM , let alone a cultured section of [STEM] ... I know one other West Indian woman that’s an engineer. I don’t know anybody else, male or female, that’s gone into [my field].”
Premika	Premika shares that she has had no exposure to Indo-Caribbean women in STEM in online spaces: When I think about STEM, and my platforms, you’re absolutely correct in the sense that there is a lot of women that are in STEM that are Caucasian and they don’t really have that experience of what it is like to be an Indo-Caribbean or even - I don’t like saying that we’re a marginalized community, but I feel like that’s how the government perceives us. And it’s really weird for me to say that ‘cuz I never thought of [us] as a marginalized community... but I just find it really weird that there isn’t a lot of [Indo-Caribbean] people that are in STEM that post about their career [subject]... there’s no platform that says “Indo-Caribbean women in STEM” ... there isn’t really a voice for it, I feel.
Nandani	Nandani reflects on one Indo-Caribbean scientist in particular: “She is amazing! I follow her very closely... But she is the only one that I know of, right? Girls in STEM, we need that... but, for Indo-Caribbeans, I feel like there needs to be more. ” She adds: I plan to actually do [this] one day, you know? There needs to be more, "I know it. I've done this kind of studying before. I'll show you how you can go about this, and why you should do this; why you should pursue these things, [and] give more resources to how you can do this," you know?... Those [resources] are important and I feel like there's not a lot of those [resources]. Like I said, I only know one of them, and it's great that there is one, but [Indo-Caribbean women in STEM] need more than one.
Ayesha	“ I don't really feel like there is much representation [of] my [Indo-Caribbean] identity in these online communities, with STEM. I think it's just mostly because there is that lack of representation already. It doesn't really create room for more representation.”
Sati	Sati explains that when she spent a semester abroad, she tried her best to find

	<p>other Caribbean folks in STEM:</p> <p>I made it a point to educate everyone on the location of Guyana, and the history and the culture. So using social media, I was able to find the Caribbean Students Association there. Fun fact, there were no Indo-Caribbean people on that association. And the two individuals who I met outside of that didn't want to join. So I was like, "okay, whatever." So I was able to use social media to find the groups that I at least resonated with but [the group] still didn't help me with developing my [STEM] identity.</p>
Shanita	<p>Shanita expresses her gratitude for the online communities that cater to women in STEM, generally. She says:</p> <p>As a woman in STEM, I feel like the online community has been really helpful because that's just a broader catchment area... it's a bigger population of just women... [so] learning more about STEM and strong women in STEM, that was really easy. However, when it comes to Indo-Caribbean women in STEM, that has been the hard part for me. I've found a few."</p>

In summary, participants reported feeling a lack of representation of Indo-Caribbean women in STEM in online social media groups.

5.1.3. Stereotypes and Microaggressions Directed Towards Coolie Women in STEM

Two code combinations were initially used to disseminate the participants' perceptions of the climate of STEM towards Indo-Caribbean women: 1) "Identity - Issues" and "Identity - Coolie - Deficit/Stereotypes"; and 2) "Identity - Issues" and "Identity - Coolie Women - Deficit/Stereotypes." The codes "Identity - Coolie - Deficit/Stereotypes" and "Identity - Coolie Women - Deficit/Stereotypes" were collapsed, resulting in the co-occurrence of "Identity - Issues" and "Identity - Coolie - Deficit/Stereotypes" 13 times among five of the six total participants. The representation of Indo-Caribbean women that the participants felt *did* exist in STEM spaces was largely negative. The five participants speak extensively about the experiences with microaggressions and stereotyping they faced in their STEM education. [Table 5.5.](#)

[Participant Experiences of Racial and Gender Microaggressions and Stereotypes in STEM](#) contains excerpts of the participants reflecting on these experiences.

Table 5.5.

Participant Experiences of Racial and Gender Microaggressions and Stereotypes in STEM

Participant	Description
<p>Anjali</p>	<p>Anjali expressed her frustration with having to work harder than others to prove her STEM talent:</p> <p style="padding-left: 40px;">At work, I just don't give 100% anymore. Not because I can't but because I won't. Why should I when nobody else will, right? Why should I, you know, bang out five projects in a week when [another] person who could have done the same thing is only [giving] half the turnover from [one project]? I feel like we're expected to do a lot more.</p>
<p>Premika</p>	<p>Premika shares the role that family had on her confidence in STEM:</p> <p style="padding-left: 40px;">As much as you know your parents are pushing you to do good and to keep getting those degrees and stuff like that, I feel like sometimes it can still be a double-standard... They say that you can do everything, and you're going to be this person, and I feel like sometimes it's kind of like, "can women really do it?" [They want] their kids to do the best, all of their kids... But I know that there are families in the Indo-Caribbean culture that have this double-standard and say things like, "you know, maybe you're not smart enough. You're not as smart as your brother," or "you're not as smart as a man to be able to be in STEM," you know?</p>
<p>Nandani</p>	<p>Nandani shares that experienced numerous microaggressions regarding her Indo-Caribbean identity while pursuing her STEM education. She gives examples:</p> <p style="padding-left: 40px;">Some of them were the famous, "we didn't know that your type of Indian people would go to school and do science subjects in school." They thought that we didn't go to university... I've gotten a lot of these negative comments on it. There are lots of "they don't go to university, they don't take further studies, lots of alcohol abuse, and like dancing," very negative, "party animal," kinds of things, right?... And it's quite shocking to me because I come from a family with very educated individuals. So it's very shocking that people would say something like that, but it's happened to me many times... It's quite</p>

	<p>upsetting, actually. Quite upsetting that people [would] do that, you know what I mean?</p> <p>Nandani is often asked why she did not get married early, as is a common stereotyped expectation for women in South Asian communities. She explains, “[they act like] we don’t have a proper say in these kinds of things... like we can’t make a name for ourselves... like we can’t achieve greatness... or become leaders in our fields... I’ve heard this a lot.”</p>
<p>Sati</p>	<p>Sati shares numerous experiences of racial judgement from peers in STEM: For some reason, growing up, I feel like being Guyanese, sometimes I was embarrassed to say that I was because of the stereotypes that were presented. And this is from high school, middle school all the way up until undergrad... People don't even identify us as Caribbean because we are in South America. That's a whole other issue. Like I've had to Google why Guyana is Caribbean to show people proof that it's not just geographical, it is also cultural. And it's honestly sometimes easier to just not explain... because if you are that arrogant to assume things about me and not want to learn, I'm not going to talk to you and waste my breath about it either. So that's something I've struggled with my entire life... Oh, the way [Guyanese] talk. Firstly, how in comparison to a Trinidadian accent, it does not sound as nice quote-unquote, nice... so it was always, that was always like [the] superior comparison. Just being loud, loud music, being vulgar. Like dancing in mas costumes, like that was [and is] shunned. Like when I participated in a [carnival], a lot of people were like, "your dad let you wear that?" And I'm like, "this is part of my culture. I've been going to [carnivals] since I was like six years old. This is all I know. This is comfortable for us. This is ingrained in my culture." So there's no reason as to why that should be judged.</p>
<p>Shanita</p>	<p>Shanita expressed her frustration with people in her STEM courses assuming her identity is the same as every other Brown girl’s identity. She says, “when you walk into a room, the automatic assumption is based on the colour of your skin, you know? Like, ‘I'm just a Brown girl.’” She continues:</p> <p>I’m not! I’m someone who has a completely different experience than a South Asian woman, right? The way I was raised is totally different. I don’t have another language, you know? The food I eat is different. The way I was raised was completely different, you know? I mean, I've heard things like, and I'm probably - you've certainly heard them, too. Like, you know, "you speak English so well!" Well, yeah, I should. It's my only language! You know, like, my parents only speak English, too! [laughs] And I mean, like, sounding white on the phone, right? [laughs] Like, I don't, you know, not sounding like, because I have no accent. I was born and raised here. I don't have any other languages. So like, you know, you get those experiences... The number of times people have spoken Tamil to me is like [laughs]... I</p>

	worked at a community center [in my city] with a lot of Tamil people and they would just come up to me and speak Tamil to the point where one time someone spoke Tamil to me, and I said, "I don't speak Tamil," in Tamil. They were like, "okay, but how did you know I was asking you if you spoke Tamil?" [laughs] and I was like, "because I've been asked it so many times!"
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In summary, participants reported facing negative experiences and microaggressions in STEM that were based on their Indo-Caribbean identities.

5.1.4. Cultural Identity as a Protective Factor for Coolie Women in STEM

The codes “Power - Empowerment” and “Identity - Coolie” were examined to locate instances where participants talk about the positive impact of their Indo-Caribbean identity on their STEM identity. The codes appeared 38 times across all six participant interviews, the highest code co-occurrence under the overarching theme of “identity”. As reported so far, there are many barriers the participants feel they face because of the Indo-Caribbean identity. However, the participants report these barriers are ones placed on them by others and do not reflect their personal beliefs about themselves. The participants report being very proud of their cultural and ethnic background. They report finding resiliency and persistence from their identities and from stories of their families and ancestors. [Table 5.6. Participant Reflections on their Indo-Caribbean Identities as Strength in STEM](#) contains participants’ thoughts on how their cultural identity has positively impacted their STEM identity.

Table 5.6.

Participant Reflections on their Indo-Caribbean Identities as Strength in STEM

Participant	Description
Anjali	When asked how her identity as an Indo-Caribbean woman impacted her role as

	<p>a woman in STEM, Anjali made the following remarks:</p> <p>“I feel like West Indians and women, like [West Indian] women, specifically, have always had to kind of fight for what they want... [they] have kind of always had to make themselves more assertive than others, just throughout life in general, just to get the bare minimum. So I think that kind of attitude and that kind of mentality definitely helped me in my career... being able to express the things that I want or the things that I expect from a company or my boss... whether or not it's heard, at least I have the backbone to kind of say it... Even when I was going to school, I had no idea what I was going to study, and I was terrified. And I remember one night I went to my parents, I was like, "I really don't know what I want to do. But can I just do math? This is something that I like, this is something that is interesting to me, I don't want to waste my time, and I don't want to do something I don't like." That kind of attitude, now that I think about it, came from my mom, came from my grandma [laughs], and I think that's how being an Indo-Caribbean woman kind of stemmed my life in terms of, you know, turning to STEM and falling into STEM. It just helped me be more assertive and more willing to advocate for what I want.</p>
<p>Premika</p>	<p>Premika shares that the historical lack of access to education for women in her culture was a big motivation to her STEM education:</p> <p>Overall with our background, I think education is such a big deal. And obviously, you know, our parents always say, "no one can take away your education"... I find that gender has a big deal to do with how far we'll go or how our parents receive it... My dad is very much that type of person to like, you know, call [me] to help him [change a light bulb and move heavy things]. He knows [my] effort and he knows that [Indo-Caribbean women] are strong women, and we can do anything a man can do. And [I think that] is a big deal in being in STEM and just being Indo-Caribbean... I feel like in our community, women kind of play that motherly role. The Molly Maids, [chuckle] you know? They have that personality because that's what our lineage was about, you know? Like the mother, or the females always stayed home. Even my mom talks about that... My mom said, "You know, I didn't get to go to school. I finished high school [eventually], but I had to wait. I would have to take care of my siblings." And she said, "it would have been so nice to be prepared when I came here to actually have the opportunity to go to university or go to college. When I came to Canada... it would have been really nice if I had had that opportunity to really go further in education." So yeah, overall, I think, I think that being an Indo-Caribbean woman in STEM, and getting this far, means a lot for my gender. It means a lot for being Indo-Caribbean.</p>

<p>Nandani</p>	<p>Nandani shares her insights about where her resilience as an Indo-Caribbean woman in STEM comes from:</p> <p>It comes from the stories of my family. They sacrificed so much. Our families - all our families sacrificed so much to come to Canada, and [the] resilience comes from, like, if I want to make a difference, I have to push through and do it, right? And then hopefully I'll be able to be a positive influence on a younger Guyanese or West Indian female in STEM. If I can't have that, I can do that in the future, you know what I mean? I should push forward and do it... It is quite important to also acknowledge the strength that we have because [being Indo-Caribbean] isn't easy. And it is fair to say that we have so much trauma from indentureship, to our parents, to ourselves, to adjusting, to them adjusting; there is so much trauma. But it is also from that trauma, a strength, right? There isn't an old road paved for us, we have to pave it ourselves, but we're gonna do it well. So that's for our future generations, this is so important, it's so important. And that you just can't sit back and do nothing. You have to have conversations like these, (they) are very important. I find this (is) so important. Because if we don't connect (to) people with similar kinds of interests as us, and so forth, then (ask), "how is the room to improve?" How is there room to say, "you know what? There are more role models of females in STEM of Indo-Caribbean or Indo-Guyanese or West Indian descent, right? There has to be more of that, right? And we have to do it, right?</p>
<p>Ayesha</p>	<p>Ayesha explains that learning about her Indo-Caribbean identity has made her realize the importance of integrating her culture into all areas of her life:</p> <p>I feel like in the beginning I never really understood much about my identity because the community wasn't there. Now, I'm understanding more about the history and the culture and stuff like that, and I realize how important it is to know my identity and bring that into different aspects of my life because there is that lack of representation.</p>
<p>Sati</p>	<p>Sati gives an example of how getting to know her Indo-Caribbean identity has empowered her to be proud of her identity:</p> <p>One particular application of that was, the current lab that I'm working in, they asked us to do a little synopsis of ourselves for our like biographies. And the first thing I started was, "my name is [Sati] and I am a woman of colour. I am Indo-Guyanese." Like, I included as much information about my demographics as possible... I need people to understand that I'm a person of colour. I'm a minority in this program, in this school, in society, and I got this far. Just to kind of gain that extra level of respect to have to identify my culture... That was definitely one thing that now I'm seeing the value of. And also just want to put myself out there, and identify who I am, wholly as a person, as to why and how I am; who I am and how this has got me to the</p>

	place that I am in my career.
Shanita	<p>Shanita shares why she is so open about her identity:</p> <p>I'm very loud and proud about my background... it's not that I make a point for it to come up in conversation, but it will come up in conversation if you're talking to me. Because, I mean, when I think about, like - I'm proud of who I am, I'm proud of all that I've accomplished. And I'm also proud of the culture I was raised in. Of course, it's not perfect, and there's a lot of things that could be fixed. And as an adult, I actively rally against some of the more problematic aspects of our culture. But for the most part, it was a sanctuary for me. And I really was involved in the diaspora because growing up, I was bullied a lot. And I didn't mingle with other kids. I didn't get that regular Canadian experience which my [younger sibling] did, you know? So like, [they were] out playing ball hockey in the street, you know? [They] know how to ski. [They] hung out with a ton of like, multiple, like, seventh-generation Canadian white kids, you know? Like I didn't even go to a birthday party growing up, you know? I never went to sleep over unless it was my family. So I was very much in my own bubble. And that was so important for a kid who was bullied on an almost daily basis for years, to be able to go home and be among my own people. They were the ones who protected me and kept me sane... I was saved from [bullying] because of my family, embracing me and lifting me up the way they did, right? So, yeah, that's like - so I'm proud of both parts of my identity and I see that being really important to share.</p> <p>When asked where she thinks her pride in her identity came from, Shanita answers:</p> <p>For being a woman in STEM, it's definitely all my accomplishments. And the things I've been able to accomplish with my own hands. And for my pride in my identity: the uniqueness of it, and the openness of it... mostly the uniqueness of it. Because as I've gone up in the ranks, you know, there's been fewer people who even know much about the culture. And I can so proudly talk about it with people and tell them all that's good about it. Why, you know, it's different from everything else. So, yeah, I think pride in the uniqueness of it is part of it.</p>

In summary, participants reported their Indo-Caribbean identities as sources of strength and resilience for them in the pursuit of their STEM education.

5.2. Community

The code “Community & Connection” was used to highlight instances where participants: 1) reflected on the perceptions of the community(ies) they experienced throughout their STEM education; and 2) how these communities made them feel regarding their connection to STEM (i.e., STEM fields, their personal STEM identities, etcetera). Sub-levels of codes related to community and connection were also used to distinguish the participants’ nuanced experiences (i.e., “Community & Connection - Lacking”; “Community & Connection - Desires”). Below, we will explore two notable findings: 1) the participants’ perceived lack of community (i.e., acceptance, belonging, mentorship) for Indo-Caribbean women in STEM; and 2) the participants’ perceptions of how the lack of community for Indo-Caribbean women in STEM influenced their STEM identity development.

5.2.1. A Perceived Lack of Community for Coolie Women in STEM

The code “Community & Connection - Lacking” was created to identify the instances where the participants felt they lacked a sense of community in STEM. All six participants reported feeling like an outsider throughout their STEM education a total of 28 times, which manifested in three ways. First, the participants felt a lack of acceptance in STEM. Second, they felt as if they did not belong in STEM. Lastly, participants feel they experienced a lack of STEM mentorship as compared to their peers.

5.2.1.1. A Lack of Acceptance for Indo-Caribbean Women in STEM.

The code “Community & Connection - Lacking” was examined alongside the code “Acceptance” to identify instances where the participants felt a lack of acceptance in STEM. The two codes co-occurred 14 times across five of the six

total participants. Overall, the five participants reported feeling unaccepted in STEM. [Table 5.7. Participant Experiences of Exclusion in STEM](#) provides excerpts of the participants' commentary regarding their feelings of a lack of acceptance in STEM.

Table 5.7.

Participant Experiences of Exclusion in STEM

Participant	Description
Anjali	<p>Anjali shares what it was like being the only Indo-Caribbean student among her STEM peers:</p> <p>It was a completely different experience... We did grow up with a lot of cultures, with a lot of Indian (East Indian) influence there. But I mean, to find our own identity - at the time, I didn't think of it, but now that I think back on it - it kind of made me self-conscious of who I was back then because I couldn't really relate to any Brown person or West Indian that I knew.</p>
Premika	<p>Premika shared that she thinks, "it'd be really interesting to see, like, the types of careers and opportunities there are to connect with people [in STEM]. She always found herself feeling on the exterior of these opportunities because "there's not really like, for me, at least living in [my city], there's not really a lot of Indo-Caribbean people."</p>
Nandani	<p>Nandani reflects that throughout her education, she rarely felt accepted by her peers. An example she shares is:</p> <p>Also acceptance in certain groups. Like, for instance, you have to get a lab group in your class. A lot of students have a very negative connotation of... Indo-Caribbean [women]... Like they have kind of a negative, like, "Oh, you don't really want her to be in our group. She's not the same kind of Indian as us," you know what I mean? And like, I've had issues getting group members. I've had people speak their different language[s] in their group... and I don't know what they're saying. And I'm like, "this is a group project, we need to get it done." And it's very frustrating. Like I told them... I have to be included in this, you know what I mean? It's a group project. So I find that's a big issue. That's something that happened to me quite a bit... I would feel ignored, [and that maybe] I would be better off doing something else.</p>

<p>Sati</p>	<p>Sati found difficulty in finding a community of peers in STEM. When asked what it was like being an Indo-Caribbean woman in STEM, Sati responded: The first word that came to mind is "isolating" because just even appearing in a classroom full of 40 people and being the only person of colour, that's like, it's very intimidating. And the other thing though, like, opportunistic, for sure. Because my mom always taught me, "use that to your advantage. Play the diversity card. If you want to be the diversity hire, go for it. Like, if you want to hire me, just because I'm Brown? I know I'm qualified!" You know what I mean? Stuff like that. But I definitely felt like I had something to prove. Because a lot of people looked at me as if I was different. So in undergrad when I entered, and I realized [which] other people were smarter than me, or the same level [as me], I felt like I needed to stand out just that little bit extra.</p>
<p>Shanita</p>	<p>Shanita adds the pressure she felt to represent the whole Indo-Caribbean population in order to be accepted into the STEM community: You know, and then also, like I said, feeling like I have to be this representative of my culture because everyone around... they all had their own communities and I didn't fit in with either community, you know? Like, I just didn't fit in. I didn't get the experiences that they had at home, for example. I didn't get to speak more than one language. I didn't get the food they ate. Things like that, you know?... You just want to fit in and you see everyone else cliquing up based on their background, and you don't have anyone to clique up with, you know? It's a little sad... But if I had it, you know, I would have cherished it, I'm sure... I was feeling a bit like an outsider among my peers. I definitely felt like that.</p>

In summary, participants reported feeling a lack of acceptance towards Indo-Caribbean women in STEM.

5.2.1.2. A Lack of Belonging for Indo-Caribbean Women in STEM.

The code “Community & Connection - Lacking” was examined alongside the code “Belonging” to identify instances where the participants felt a lack of belonging in STEM. The two codes co-occurred 14 times across five of the six total participants. The five participants reported feeling like they did not belong in STEM. [Table 5.8. Participant Experiences of Alienation in STEM](#) provides

excerpts of the participants' commentary regarding their feelings of a lack of belonging in STEM.

Table 5.8.

Participant Experiences of Alienation in STEM

Participant	Description
<p>Anjali</p>	<p>Although she was not the only Indo-Caribbean student at her school, Anjali still struggled with feeling like she belonged within her own culture because the culture is largely misunderstood and underrepresented, particularly in STEM. She explains:</p> <p style="padding-left: 40px;">We had our Caribbean, you know, your Indo-Caribbean people there. And we all found each other literally on the first day... But I feel like other groups or other cultures had their sense of like, their identity. Like, that was kind of grounded (in them), where we were kind of just like, “yeah, we know where we're from [and] the things we have in common.” But it wasn't a sense of like, true community in that setting, compared to how I've seen other people interact with people of their own culture.</p>
<p>Nandani</p>	<p>Nandani shares that even though she was present in STEM courses, she was still made to feel as if she did not belong. She describes:</p> <p style="padding-left: 40px;">Connecting in the field, just feeling welcomed. Feeling that I have a mentor that looks like, not looks like me, but like, is similar to me, like in terms of the culture, you know what I mean? What else is there? There's [pause] (a lack of) accessibility in general in these subjects, you know what I mean?... I'll give a specific example. When you're doing math, the TAs and stuff wouldn't take time with me per se, but they're like answering someone else's questions... I don't feel welcome by them in the environment. There's not many people that are from a similar place like me, right?</p>
<p>Ayesha</p>	<p>Ayesha explains that even though clubs catering to students in STEM existed, she always hesitated to join them because they did little to make her feel like she belonged. She says:</p> <p style="padding-left: 40px;">I feel like, especially with university students, when people join clubs it's like, mostly like, they join with their friends, right? So I feel like that also decreases the appeal of joining any other clubs because just like someone else is coming from the outside to a bunch of friends. Does that make sense? Like, you have to find your way within the club of people that already know each other. I feel like that happens with some clubs.</p>

<p>Sati</p>	<p>While Sati tried very hard to learn about and participate in her peers' culture, Sati's peers never made an effort to get to know hers. She explains:</p> <p>I felt that going to university, I totally separated my culture from education, because I didn't see it [as] relevant. And like I mentioned, no one asked me ever, like, I cannot think back to a situation where anyone ever asked me, so it was easier for me to not talk about it, so I could avoid wasting time to explain to someone the whole story. [That] particularly sucked in social situations out outside of school, though, where they would be like parties and stuff. And I just never enjoyed my time ever. And I think that was one of the aspects of me conforming to whiteness and trying to make friends with people. Like simple things like a party, or just hanging out with friends, like the music they would play, not the same music I would listen to. But I would put up with it, because I knew that if I was hanging out with these people who I was also working on a group project with, they needed to see me as likable. And yeah, mostly that. I used to come home often on the weekends, and I would go to parties or events and stuff. And I would post stuff on my stories on Instagram, or social media, like Snapchat and stuff like that. Never once did anyone ever ask me like, "Oh, what is this? This looks cool. What event are you at?" And it's funny, I'm looking at a photo of my family, and right now, at this event that we were at, it's on my kitchen table. And yeah, I would post a lot of stuff and people would be like, never once did I have anyone ask me like, "oh, what was that thing you were doing? Because it looked different. Or it looked interesting." Like, never.</p>
<p>Shanita</p>	<p>Despite eventually achieving a sense of acceptance in STEM, she still struggled to feel like she belonged in STEM. She explains why she thinks that is:</p> <p>I think it's most likely because I didn't see anybody like me. I was so different. And I mean, growing up, the last thing you ever want to be is different, right? You know, you want to blend in. So it was just easier to fall back on my STEM identity - woman in STEM - and being this girl who's going into sciences, than worry at all about being Indo-Caribbean because there was no one else around me. So like, I felt very different from the rest when it came to that kind of background. So why did it matter, you know? Why play that up at all?</p>

In summary, participants reported feeling a lack of belonging as Indo-Caribbean women in STEM.

5.2.1.3. A Lack of Mentorship for Indo-Caribbean Women in STEM.

The code “Community & Connection - Lacking” was examined alongside the code “Power - Mentorship” to identify participants’ perceptions of the amount of STEM mentorship that was available to them throughout their STEM education and careers. The two codes co-occurred seven times across all six participants. Participants reported that they felt they received a lack of STEM mentorship compared to their peers. [Table 5.9. Participant Reflections on Limited STEM Mentorship](#) contains participants’ commentary on the lack of STEM mentorship they received.

Table 5.9.

Participant Reflections on Limited STEM Mentorship

Participant	Description
<p>Anjali</p>	<p>Anjali shares that as an Indo-Caribbean student, she was never encouraged to pursue STEM:</p> <p style="padding-left: 40px;">Our generation, when we were taught math, literally everyone was scared of it, everyone. AP classes nobody wanted to take because they're the nerdy classes, first of all, but also, what are we going to learn there?... And it really wasn't pushed either. Our AP courses in math, at my high school, you kind of just fell into. It wasn't a program that was promoted... even math competitions, like that stuff, wasn't promoted at all... So I mean, I guess if you have nothing to sort of work towards, you don't see a benefit in it, right? And you're just taught to be scared of it for most of your life.</p> <p>Somehow, she says that she was still able to, “create that mindset of, ‘I can do this, and I'm not going to be scared of it.’ That's, I think, what people could benefit from, or what people could take from [STEM mentorship] from a young age.”</p>
<p>Premika</p>	<p>Premika reflects on the lack of mentorship she experienced in STEM compared to her peers and her siblings that pursued other disciplines:</p> <p style="padding-left: 40px;">My [sibling], [they] did [their] teaching degree at [university], and did [their] teachable in Indigenous Studies. And I remember [they were] talking about how [they have] to go to Teachers College and stuff. But I</p>

	<p>was like, "okay, what does that mean for me? I want to go into sciences"... My oldest [sibling] ended up going to a private college for massage therapy. So, I didn't really have that influence of like, knowing what it means [to go into STEM].</p>
Nandani	<p>Nandani shares that as an Indo-Caribbean woman in STEM, she did not expect much guidance in her STEM education. She believe this is because: Nothing is handed out on a silver spoon [for us]. Especially in the terms of [mentors]. There aren't any kind of mentors. There isn't anyone to say, "I'll help you with this," or look up to a specific person, right? To say "oh, you did it like this so I will do similarly." And because I don't necessarily have that, I find that I have to - I really want this, like I really want this school. I really want to achieve my goals, so I have to do whatever it takes to get there.</p>
Ayesha	<p>Ayesha shares that she had no one to turn to for guidance in her STEM education. She said, "Rather than having people to look up to, to make me feel included, it was just like more of myself, within the community, just trying - the STEM community - just trying to find my place."</p>
Sati	<p>Sati considers herself lucky to have had mentorship from her family members throughout her post-secondary STEM education because she did not receive any institutional STEM mentorship. When asked if her family's mentorship was beneficial to her, she responded: 100 percent. All of my cousins and second cousins, who are all Indo-Caribbean, went to university. They were the ones who encouraged me to go to a university where I can live on campus. Because, "you need to experience that. You need to get out of your house and figure out who you are as a person." And it was also inspiring, because I knew they could do it, so I could do it, too. My [sibling] has been a role model to me over the course of my life. So the fact that I knew [they] did [an] undergraduate bachelor's degree, I knew that it was possible for me to get one, as well.</p>
Shanita	<p>Shanita shares that she experienced no mentorship in STEM, which she likens to jumping hurdles: It's like "How many? How many hurdles do you want to jump?"... Even from a young age, like, helping with homework. Like once you hit high school, were [my parents] even able to do that? So for so long, they have been the supporters and the providers; the logistical parts of your education. I, myself, like you, was going through a Master's myself. No one else in my family was doing it. I had no one to turn to, so, you figure it out on your own.</p>

In summary, participants reported feeling a lack of mentorship for them as Indo-Caribbean women in STEM.

5.2.2. Participant Reflections of Community on STEM Identity Development

The code “Community & Connection - Desires” was created to identify the instances where the participants expressed a desire for a stronger sense of community and connection to STEM. The code was applied 40 times across all six interview participants. In these instances, participants often also considered what their experiences would have been like if they had a stronger connection and community to STEM in their past. A pattern emerged from the participants’ responses: all participants strongly believed that improved acceptance, belonging, and mentorship throughout their STEM education would have better supported their STEM identity development and STEM persistence.

5.2.2.1. The Impact of Representation on Participants’ Acceptance in STEM.

The code “Acceptance” was used alongside “Community & Connection - Desires” to identify the instances where participants spoke about their desire for a greater feeling of acceptance in STEM. The co-occurrence of these codes appeared 19 times across all six participants. All participants reported feeling that increased representation of Indo-Caribbean women in STEM would have increased their sense of acceptance in the STEM community. [Table 5.10. Participants’ Desires for Increased Representation and Acceptance in STEM](#) outlines what the participants said about their feelings of representation and acceptance in STEM communities.

Table 5.10.

Participants' Desires for Increased Representation and Acceptance in STEM

Participant	Description
<p>Anjali</p>	<p>Anjali shares that she felt alienated as an Indo-Caribbean woman and wishes she had more representation of not just her culture in STEM, but other cultures, too:</p> <p>Yeah, I think it was harder for me to self-identify. It was harder for me to figure out what it meant, what me as a Guyanese person meant... You're kind of just trying to relate to the people around you. You're trying to relate to your friends and things like that. So I kind of led towards, you know, relating to Indian people or Sri Lankan people and not really saying, "Okay, well, I'm also Guyanese."... I would have never talked about that stuff... It never occurred to me until university and much later on in life where I was like "Why? Like why? Why was it like that?" ... we could have had such a better childhood, I think, if we were all just exposed equally to each other's cultures.</p>
<p>Premika</p>	<p>While Premika reflects that "it'd be really interesting to see the types of careers and opportunities there are to connect with people", when she was going through her STEM education. However, she reflects that it would have been hard to find those connections during her STEM education. She says, "I don't know how I would do that, but it would be so interesting to see people, like people of the same [culture], for instance, us?... I think it's really hard to say."</p>
<p>Nandani</p>	<p>Nandani reiterates a number of times, "we need to see more representation of West Indians, especially females. We need to see more representation of [us]." She advocates for a representation of both "the good" and "the bad" parts of being Indo-Caribbean:</p> <p>Yes, there are traumas, but there also is a resilience. There is a strength, right? And these are things that we can use to make it better [for Indo-Caribbean women in STEM] because there's no point in going back in the past.</p>
<p>Ayesha</p>	<p>When asked what the community could have provided that would have aided in her STEM identity development, she expressed that, "if there was more Indo-Caribbean representation, it might be more appealing to join [STEM clubs and extracurriculars], just because there is that common ground amongst all of us, that we share the same identity."</p>
<p>Sati</p>	<p>When asked what an increase in the representation of Indo-Caribbean women in STEM would mean for Sati, she responded, "[I] definitely think that would have helped with my relations with my peers and with my professors."</p>
<p>Shanita</p>	<p>Shanita reflects that she had "never thought about that before" when asked what</p>

	<p>an increase in representation of Indo-Caribbean women in STEM would mean to her. After some reflection, she shares the following:</p> <p>[It would mean] being able to work in groups with people who are like me, you know? Being able to talk about my experiences... I would love to be able to talk about that... Being able to have these conversations with people and feel like, you know, I didn't have to be anyone other than myself. I was so comfortable being surrounded by Guyanese people, being surrounded by people just like me. So losing that, and then you know, getting older and no one else has the time anymore, right? At least being around people who have that experiences, because my family doesn't even have the same experiences as me anymore, right? There's no one else even in the educational field that I chose... So yeah, I missed that. I craved that. I spent so much of my life, like more than half my life in that kind of environment. And now, I'm trying to - I've lost part of that. I can't communicate with my family the way I used to. And like I said, it's such a big part of my identity. I would have really liked to continue to reaffirm my identity with those people and not feel like the odd one out, you know?</p>
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In summary, participants believed that increased representation of Indo-Caribbean women in STEM would increase their feelings of acceptance in STEM.

5.2.2.2. The Impact of Belonging on Participants' STEM Identity.

The code “Belonging” was used alongside “Community & Connection - Desires” to identify the instances where participants spoke about their desire for a greater feeling of belonging in STEM. The co-occurrence of these codes appeared 26 times across all six participants. All participants reported feeling that an increased sense of belonging in STEM would have increased their sense of STEM identity.

[Table 5.11. Participants' Desires for Increased Belonging and STEM Identity](#)

outlines what the participants said about their feelings of belonging and STEM identity.

Table 5.11.

Participants' Desires for Increased Belonging and STEM Identity

Participant	Description
<p>Anjali</p>	<p>Continuing what she shared in Table 5.7. Participant Experiences of Exclusion in STEM, Anjali shares why she believes learning more and educating others about her Indo-Caribbean identity would increase her sense of belonging in STEM:</p> <p>I definitely wish we had [identity] resources because I have to tell you, I had a hard time with some people in high school... [they would say] things like, "you're Coolie this, Coolie that." And it's like, "Do you even know what that word means?"... And I couldn't even be like, "here's a post, go read it."... I wish we had those [resources] back then to educate people because I feel like they don't know any better either. Especially at that age, like you're very impressionable. You're basically regurgitating a lot of the things you've grown up with... even now, I find myself learning a lot about our culture and about what things mean, and where they come from. And I find that a lot of people on my social media are willing to learn about those things, if I repost them, or if I post them, or if I make mention of them, which shows me... who I would be comfortable having a conversation with about these things.</p>
<p>Premika</p>	<p>Premika reflects on how she wished it was easier to identify her fellow Indo-Caribbean women in STEM because it would help her own STEM identity development. She says:</p> <p>I always wondered if other women who are in STEM, including yourself, or like the "Brown Girl Diaries", "Cutlass Podcast", or "Lotus Toronto", any of those other women... I wonder if [they] really identify themselves as [women in] STEM. I would say that it's hard to really know the women that are in STEM, in the online community, at least, unless you really like [talk] about it. And those specific pages that I follow, they're more on the history of Indo-Caribbean women than it is on [women] that are in STEM. Maybe I just need to find those pages, and if you know of them, please let me know, but it would be [interesting] to see what are the challenges that Indo-Caribbean women in STEM face?</p>
<p>Nandani</p>	<p>Nandani shares how feeling like she was a part of the STEM community would have helped her curb the frustration and doubt she sometimes felt regarding her STEM identity:</p> <p>Sometimes when you're frustrated, yes, I would feel ignored, [and that maybe] I will be better off doing something else... Definitely, those things have crossed my mind. However, [the feeling] doesn't necessarily</p>

	<p>stay there because I really enjoy [STEM], right? And I have come to find ways that - even if I don't have the resources, I will try to reach out and make it. An "if I can't get it, I have to do it myself," kind of thing. But the [STEM] community didn't really play a role in that.</p>
<p>Ayesha</p>	<p>When asked if having other Indo-Caribbean STEM students in a club would help her to feel more like she belonged in STEM, she said: I feel like that would affect my interest in the club... I feel like it would be easier because when you're trying to find your place within a group, you try to find common things amongst yourselves, right? So I feel like, especially, sharing that identity, we would be sharing common experiences that we experience day-to-day, with our family and culture and stuff like that. We will share a lot of stuff, so I guess that would be easier to make friends with, and be a part of the club with them.</p>
<p>Sati</p>	<p>Sati reflects on the differences between her identity development inside and outside of STEM contexts. She explains, "in high school, there [were] a lot of Indo-Guyanese [and] Indo-Trini people in my school... and it was always a supportive environment... a nice community." However, she explains that in "going to university, [she] totally separated [her] culture from education, because [she] didn't see it [as] relevant... I definitely dissociated my culture from being a student." When asked what her STEM education would have been like if she had more opportunities to incorporate her culture, she responded: 100 percent, I would have been all for that. I think people would gain a different level of respect for me if they knew a little bit more about me and my culture and where I come from, and like this certain oppressions that Indo-Guyanese, Indo-Caribbean people, people of colour face, even if it was just like a five-minute brief talk about me saying like, "this is who I am as a person," for them to see me on more of like a personable level.</p>
<p>Shanita</p>	<p>Shanita reflected on what her STEM education would have been like if she felt more belonging in STEM: I think I'd probably have more friends, honestly. [My institution] has its own special brand of isolation, in which you feel like you're in constant competition with the people around you... So feeling like you even had that one common relationship with people just by looking at their last name. You're like, "hold on, hold on. I think I know where you're from." Right? And having those people around you just like to understand where you're coming from, like that can be helpful. And I don't think a lot of people can get that, especially when I went from a community where I had a lot of that, right? I knew what it was like. Maybe if I didn't know what it was like my whole life, I probably wouldn't have been something I craved as much, you know?</p>

In summary, participants believed that increased feelings of belonging in STEM would increase their sense of STEM identity.

5.2.2.3. The Impact of STEM Mentorship on Participants’ STEM Identity.

The code “Community & Connection – Desires” was used alongside “Power – Mentorship” to identify the instances where participants spoke about their desire for a greater mentorship in STEM. The co-occurrence of these codes appeared 24 times across all six participants. All participants reported feeling that increased opportunities for STEM mentorship would have increased their sense of STEM identity. [Table 5.12. Participants’ Desires for Increased STEM Mentorship and STEM Identity](#) outlines what the participants said about their feelings of STEM mentorship and STEM identity.

Table 5.12.

Participants’ Desires for Increased STEM Mentorship and STEM Identity

Participant	Description
Anjali	<p>Anjali expressed a desire for mentorship for Indo-Caribbean women in STEM that went beyond showcasing women in “great glamorous” STEM careers; mentorship that “truly focused on promoting [Indo-Caribbean] women in STEM.” She explains:</p> <p style="padding-left: 40px;">Women are so far and few in this field of study, and even in the workforce. So, I mean, if there was [mentorship] that even was, you know, geared towards mentoring women coming into STEM, mentoring women, or talking to women that are considering an education in the field or career in the field, that kind of thing. It’s great to kind of post a picture of someone who’s an engineer, but let’s talk about what they went through to become that engineer, what challenges they faced, and how they can help others to maybe bypass that hard part of it... it’s nice to acknowledge people, but at the same time, women that go through STEM programs – which are very male-dominated programs – for four years of your life, five years</p>

	<p>of your life; this can be very daunting... it can be very intimidating... the women that are already doing this know that they want—to do it, they're already sure of themselves. So I think the journey there is a little more important, like what you had to (do) to get there? Or what you had to bypass? Or how you grew as you got to that point? I think that, to me, is more important [regarding mentorship].</p>
<p>Premika</p>	<p>Premika considers what more mentorship would have meant for her as an Indo-Caribbean woman in STEM, but also for the young Indo-Caribbean women who are about to embark on their own STEM journey. She reflects on resources that could have helped her, applying them to current-day students:</p> <p>Maybe if these platforms have like a video interviewing an “average Joe” person, not necessarily myself [laughs], but I’m saying like anyone that could talk about their career... their journey. [Can] we help educate and teach these young individuals that are Indo-Caribbean and women, and they see themselves in these sort of careers, but how do they get there? Even my [relative], she wants to become a doctor. When she talks about becoming a doctor, I tell her all the time, “[Relative], we really have to think about, you know, how do you get there? How to get there, and what are your options?” And she always asks my [partner], “What do I do? What are the things I need to prepare for?” And she’s now going into her third year of university. So, I think if there was some sort of that support, you know, having informational interviews or having videos that talk about it... what if there’s like workshops?... Just someone to reach [out to] that kind of has like an idea of how it works, that would be so great! Because then all these young individuals that are Indo-Caribbean, they have some sort of basis and not being afraid to just talk about anything, you know?</p>
<p>Nandani</p>	<p>Despite being dedicated to achieving her goals, Nandani reflects on the many times she wished she had a mentor for guidance. She explains:</p> <p>Because [STEM is] definitely not, it’s not an easy thing, right? The subjects alone require a lot of work, as you know. Lots of studying, lots of practice. Also, in terms of opportunities, right? It’s one thing to study your subjects in school [and] one thing in the working world. How are you going to get experience, right? And I find that it isn’t easy to network as someone who doesn’t know anyone in the field, right? Like, it is difficult. Who can I go to? I have friends who know somebody that helps them get a position somewhere. I don’t know anybody who’s willing to [help me], you know? And not that I should be complaining, but it’s sometimes nice to have mentorship, you know?... [someone to] understand where you’re coming from. So it definitely (feel that) it is an important thing and (I think) [we] should have that.</p>
<p>Ayesha</p>	<p>When asked what more STEM mentorship would mean for her as an Indo-</p>

	<p>Caribbean woman currently pursuing a STEM education, she replied simply: “I feel like definitely now, it would help me feel more supported... I feel like that will help build more community and representation, especially. It helps with networking, as well.</p>
Sati	<p>Though she was fortunate to have older cousins as mentors to guide her through the start of her post-secondary education, Sati reflected on the “extra little bit of push” it took to be recognized by her professors as a serious student: Quickly, I realized, I’m not here to make friends. I’m here to get an education and better myself as an individual. That was a quick turnaround, for sure. Because I realized, it’s going to be a lot of effort for me to pretend to be like these people.</p> <p>Sati compares this to her experiences in high school, acknowledging that it was never this hard before: In high school, there were a lot of Indo-Guyanese [and] Indo-Trini people in my school specifically, who I was all like friends with, and it was always a supportive environment. We all always hung out at the same parties and like always, like, just, it was a nice community.</p>
Shanita	<p>Shanita speaks fondly of the idea of having a mentor, “another girl”, to help her navigate the world of post-secondary STEM education: If I had another girl who was going through what I was going through, trying to apply for undergrad and masters bursaries, all that stuff, right? Because my family wasn’t rich, you know? I had to go through a lot of student loans. Imagine having another girl who was going through that, and could help explain it to me... Like, how powerful would that be? Right? Because we’re in our 20s now. We don’t have these discussions, and we’re having issues, and we have to go through it by ourselves.</p>

In summary, participants believed that increased STEM mentorship for Indo-Caribbean women in STEM would increase their sense of STEM identity.

5.3. Social Media

The code “Social Media” was used to highlight instances where participants reflected on their online social media usage, both generally and as it relates to their STEM identity, education, and careers. The code appeared 30 times across all six participants. Sub-levels of codes related to social media were also used to distinguish the participants’ nuanced experiences within their online social communities (i.e., “Social

Media - Representation”, “Social Media - Usage”, etcetera.) Below, I explore three notable findings: 1) online social media representation of Indo-Caribbean, generally, fosters participants’ STEM identity development; 2) online social media groups for Indo-Caribbean women provided participants with a sense of acceptance and belonging in STEM that they lacked elsewhere; 3) online social media groups for Indo-Caribbean women provide participants with opportunities for mentorship and networking that they do not usually have access to. Lastly, I present participants’ reflections on strategies they believe online social media groups can implement to support the STEM identity development of Indo-Caribbean women.

5.3.1. Fostering STEM Identity Development Through Online Social Media Groups

The code “Social Media - Representation” was used to identify instances where participants reflected on their perceptions of the representation of Indo-Caribbean women in online social media communities. It was used alongside the code “Power - Empowerment” to identify the instances where participants discuss how representation of their Indo-Caribbean identities in online social media communities encouraged and/or reinforced their identity development as Indo-Caribbean women in STEM. The two codes appeared together 23 times across all six participants. What participants reported was that despite the representation of Indo-Caribbean women in STEM being virtually non-existent in their experiences, the participants largely agreed that the online social media representation of Indo-Caribbean women in all fields was helpful for them to self-identify in their respective fields. [Table 5.13. Participants’ Reflections of STEM Identity Development via Online Social Media Groups](#) contains what the participants said about

their feelings of STEM identity development in relation to their experiences with social media groups.

Table 5.13.

Participants' Reflections of STEM Identity Development via Online Social Media Groups

Participant	Description
Anjali	<p>Anjali agrees that Indo-Caribbean representation on social media, STEM or non-STEM, has helped her battle cultural expectations and helped her develop her STEM identity. She explains:</p> <p style="padding-left: 40px;">I find a lot of the pages I follow on Instagram or Facebook, they promote women who are very successful, whether that be in STEM or not. And they're kind of celebrated... they're kind of promoted as the norm for West Indian women now. Like strong, educated, you know, forceful people. And they don't even need to be educated; [just] people that are making a difference in the community, right? Things like that are really promoted. And I appreciate that, because, again, we never heard about that... It makes it the norm to be like a working woman who's not necessarily married right now. You know? I'm focusing on my career. It doesn't make it such a taboo... I think it's helped [ease the taboo], in addition to helping me with my [STEM] identity and things like that.</p>
Premika	<p>Premika thinks that the online social media groups geared towards Indo-Caribbean women have been “a really great way to encourage yourself to continue to do STEM.” Premika began to share that “it's kind of difficult to find [online social media Indo-Caribbean representation in STEM],” when she interrupts herself with a realization: “when I think about it now, maybe I really should say that I am an Indo-Caribbean woman in STEM and that I'm here to support other [Indo-Caribbean] women that are in these types of careers, too.”</p>
Nandani	<p>Nandani shares how Indo-Caribbean representation outside of STEM has encouraged her to identify more with her STEM studies. She explains that she follows an Indo-Caribbean content creator studying social work on social media. Despite not being in the same field, Nandani found the content creator’s account valuable. Nandani states the importance of “seeing [the content creator’s] educational journey” for seeking inspiration in her own studies. She explains:</p> <p style="padding-left: 40px;">It's a good stepping stone to inspire you to like, "okay, I saw her educational journey." She kind of shared like, okay, well, like, and how was it stressful applying for grad school, that kind of thing. And those are things that I feel like, those are important for us to see, too, as</p>

	<p>women in STEM... or even different career paths! Sometimes it's frustrating because you study all this (but) you don't know what you want to do. But seeing somebody that's passionate about their field and explaining it, helps to kind of explain, "oh, maybe like, you might enjoy something like that," or "maybe I will not enjoy something like that." So, I find that it does help. And it would be great if there was more, so that (it) can help more people in more diverse fields of STEM, right? So I think that's important.</p>
Ayesha	<p>Ayesha shares, "I feel like my dance community really plays a big role in connecting me to other Indo-Caribbean women." However, she admits that her social media has yet to impact her STEM identity development. She explains, "I feel like the only overlap to Indo-Caribbean women in STEM was finding this research project. Yeah, that's really the only overlap I found on social media, really."</p>

In summary, participants reported that online social media representation of Indo-Caribbean women in all fields was helpful for them to self-identify in their respective STEM fields.

5.3.2. Increased Acceptance and Belonging in STEM Through Online Connection and Representation

The code "Social Media - Connection" was used to identify the instances where participants discuss the ways online social media groups influenced the participants' feelings of connection to, belonging in, a community within STEM. It was used alongside the code "Power - Empowerment" to identify the instances where participants discuss how the connections formed in online social media communities increased their sense of acceptance and belonging in STEM. The two codes appeared together 15 times across all six participants. The participants spoke a great deal about how their connection to various online social media groups has been helpful in feeling acceptance and belonging in STEM, even if the communities themselves are not STEM-specific. [Table 5.14.](#)

[Participants' Reflections of STEM Acceptance & Belonging via Online Social Media](#)

[Groups](#) contains more participant responses that highlight this finding.

Table 5.14.

Participants' Reflections of STEM Acceptance & Belonging via Online Social Media

Groups

Participant	Description
<p>Anjali</p>	<p>Anjali reflects on the benefit her social media groups provided her in feeling a sense of belonging in STEM. She begins: It's sad to say... [STEM] a very predominantly Caucasian-driven industry... and very male-driven... You find women that work hard and you like to see that they're given credit where they're due... But from what I've experienced, I find women are not promoted enough. I personally feel like it is recognized when we do good work, but nothing comes of it. It's as if they are saying "thank you, now carry on," as if it is expected of us.</p> <p>She continues, comparing the connections she made in her online social media communities to her positive experiences of "being in high school again": But [in] encountering West Indian women, or Indo-Caribbean women, I feel like we just find each other and stick together. And not in a bad way, in a supportive way. We help each other, right? I feel like for the most part, we all just want to see each other make it in a man's world. A white man's world.</p>
<p>Premika</p>	<p>Premika shares how her online social media groups have positively impacted her STEM identity: It's interesting to see how connected everything is and just following a bunch of these pages and just getting connected with stories about our culture, overall, and, the studies that take place, and the different types of STEM women, and just women in particular that are out there, and that are working really hard. And it's just a really great way to encourage yourself to continue to do STEM and to continue to [create] your own community.</p>
<p>Nandani</p>	<p>When asked if she finds her online social media groups to be beneficial to her sense of belonging in STEM, she answers: Oh, 100%. Like, very helpful because they're not in my neighbourhood, they don't live on my street, they don't go to my school. So their social media and, generally, social media serves as a great connecting tool when used appropriately, right? So I feel that it has been instrumental... and I feel they are very important in fostering</p>

	<p>a sense of community. And it's easy to access because it's not something that will cost me so much, it's not something that will take up too much of my time. All I have to do is pick up my phone and go on the app and find what I'm looking for, right? It's accessible in that sense...</p> <p>She ends with, “we're definitely out here. We're just not geographically together. But [through] online communities, we can get a little bit closer.”</p>
<p>Shanita</p>	<p>Shanita shares the sentiment that seeing other Indo-Caribbean women’s successes, STEM or not, have been helpful in helping her feel like she belonged in STEM:</p> <p>I think it's always exciting to see a woman as a first author on a paper or doing a presentation or something in science. And for me, it's inspiring to see them doing presentations for little girls and stuff like that. And I think about some of my youngest female cousins, I'm really close to one of my younger cousins, and I want those examples for her, you know? I discovered them all much later in life, you know, in my 20s. So I mean, other than just the thrill of seeing, you know, "there's another woman in STEM," and reading about the experiences they face, [it's] knowing that I'm not alone.</p>

In summary, participants reported that their connection to various online social media groups was helpful in increasing their feelings of acceptance and belonging in STEM, even if the groups themselves are not STEM-specific.

5.3.3. Social Media Groups As A Means For STEM Mentorship and Persistence

The code “Power - Mentorship” was used to identify the instances where the participants reflected on STEM mentorship. It was used alongside the code “Power - Empowerment” to identify the instances where participants discuss how social media groups for Indo-Caribbean women provided them with STEM mentorship, consequently increasing their STEM persistence. The two codes appeared together 21 times across all six participants. Participants reported believing that there are many benefits of being involved in online social media groups for Indo-Caribbean women in STEM, even if the groups are not STEM-specific. Participants cite opportunities for mentorship and

networking with other Indo-Caribbean women via social media groups as important for their STEM identity and persistence in their STEM careers. [Table 5.15. Participants’](#)

[Descriptions of STEM Mentorship and Persistence via Online Social Media Groups](#)

outlines examples of the participant responses that exemplify this.

Table 5.15.

Participants’ Descriptions of STEM Mentorship and Persistence via Online Social Media Groups

Participant	Description
<p>Anjali</p>	<p>Anjali shares the following when reflecting on how her online social media groups have impacted her STEM education and career: My community right now that I follow on social media, they're very supportive. They're very, you know, we're pretty much cheerleaders of each other, right? And I appreciate that. And I know that if I was looking for, you know, someone within my industry as well, that I wanted to talk to, I could reach out to any of them and they would try to find someone, right? Or they would try to help in whatever way they could, in whatever I was looking for. Whether that be finding other women in STEM, whether that be finding, you know, a mentor in STEM, anything like that. I feel like we're very supportive of each other... for example, whenever I post a single dance post, everybody's reposting... and I appreciate that, right? You appreciate that sense of community, that sense of support. So I think like, if it came to career, or like STEM research or STEM - anything having to do with it, I feel like I would get the same support as well.</p>
<p>Nandani</p>	<p>Nandani reflects on how her online social media groups have not only provided her with STEM mentorship and support that she lacked elsewhere, but how they have also encouraged her to create a mentorship group of her own geared towards Indo-Caribbean women in STEM: We need to make new platforms on different social media to show [Indo-Caribbean women in STEM] that they're not alone. We are here, we are mentors for you, we went through this... and we're successful, [so] you can be, too. And we really love what we do. I encourage more (of) these conversations. So let's have our voices heard, you know? Let there be more, like - less building walls and more breaking down these things, right?</p>
<p>Ayesha</p>	<p>Ayesha shares, “I feel like social media has definitely helped with the</p>

	networking aspect of finding other STEM students.”
Sati	<p>Sati shares how online social media groups for Indo-Caribbean women have been vital to her persistence in STEM:</p> <p>I think it's honestly just seeing people doing stuff in their career that encourages me to continue to do stuff in my own career. Even if they aren't from a STEM background, someone who, like within academia, or like just doing something that they enjoy, like, that's enough. That's enough for me to just say, like, "here's a rope," like, you know what I mean? Like for me to just grab on to and, like, encourage me as an Indo-Caribbean woman, to continue with my career. And to hear people's success stories, because I know, a lot of us grew up with the same style of parenting, that may not have been the most, like supportive or facilitative to get to where we are. And definitely meeting an individual who is in STEM would be great, too. So I hope that happens!... We need those connections in order for all of us to be successful. Which I think is super important.</p>

In summary, participants reported that online social media groups for Indo-Caribbean women provided them with many opportunities for mentorship and networking that they did not otherwise receive, even when the groups are not STEM-specific.

5.3.4. Participants’ Recommendations for STEM Capital Development via Online

Social Media Groups

During the interview process, participants in this study shared a common belief that their online social media groups could provide support in developing STEM capital among Indo-Caribbean women in the field. Some participants revealed they have spent a lot of time considering what this support would look like, while others mentioned having thought about it briefly. Overall, participants shared a number of examples regarding the ways they believed online social media groups might support the STEM capital development of their Indo-Caribbean women members. [Table 5.16. Participants’ Recommendations for STEM Capital Development via Online Social Media Groups](#) outlines some of the recommendations made by the participants.

Table 5.16.

Participants' Recommendations for STEM Capital Development via Online Social Media

Groups

Participant	Suggestions
Anjali	<p>When asked what she believed would be beneficial to her, Anjali shared the following:</p> <p>For me, it would be more forum based. Forums where you could talk to each other. Postings are great. Postings, you know, can highlight people and highlight their skills, but you don't really benefit from it unless you kind of get involved in a discussion, right? You don't (change) the narrative of STEM and representation in STEM unless you change, or unless you start talking about it, right? So, I think a forum. Instagram is great; you can post, you can comment and things like that, but I find Facebook is probably a bit more conducive in that sense, where you could have people posting blogs, and people can respond on it. And it drives conversation more, I think. I feel like it just needs to be conversational based versus posting about women and posting about Indo-Caribbean women. It needs to be more, "let's have a discussion about this," you know?... I feel like that would be something we could benefit from because women have a lot to talk about when it comes to their experiences, especially in the workplace, especially in school. Like, those years are a good chunk of your life, so why not talk about it? The same way you give attention to childbirth and marriage and discussions around that, why not, you know, give way to discussions on your career? On your education and why you decided to choose this path?</p>
Premika	<p>Premika shares what she would like to see more of by sharing an example of conferences she has seen hosted for other demographics of students in STEM:</p> <p>Yesterday I was talking to my [friend] and [they are] also in the process of looking for a job... [They] said, "I'm on this conference, an open conference, and it's all about the Black community." And [they] said it's all up-and-coming graduates that are looking for a job... and that it was pretty interesting, because it was all these individuals of [African] descent that are coming together... [they] said, you know, "it was really great to just meet people." And even a lot of people were like, "Oh, you know, send me your resume, send me your LinkedIn. We should connect and we can talk about, you know, where you where you see yourself in the next few years," or whatever. I think maybe those informational interviews would be a great way for people to connect... I don't know if I've seen anything like that, as yet, for our community.</p>

	<p>Like it would be really interesting to hear about all women in the Indo-Caribbean culture, if there was like a STEM conference, specifically for Indo-Caribbean women, or like Indo-Caribbeans of any background or any, like, gender, you know? Like, it'd be really interesting to see, like, the types of careers and opportunities there are to connect with people... I don't really consider myself to have a lot of Indo-Caribbean friends that are in STEM, that live in my area or help me... navigate through these challenges... But I would love to see if there was a conference. That would be so awesome to, like, connect with people or women in general about STEM. Maybe doing informational interviews or setting up a connection through people who are actually following your page and connecting people [together]? I don't know how you would do that, but it would be so interesting to see people of the same [culture], people like, for instance, us!</p>
<p>Nandani</p>	<p>Nandani shares that she has spent a lot of time considering the ways that her online social media groups could support her. She shares the following:</p> <p>There needs to be more outreach. So, I feel that, if you think the instance, "I am going to create an account," right? I would try to post as much relatable things as possible. Don't post for the likes, that whatever you call it, popularity. So, we'll post relatable content. Things that girls in STEM can relate too, right? Maybe like different resources, how to study better, how to like access help in like mathematics or physics, these kinds of things. [We] need more live streams. Even if we can't actually meet up to have a convention per se, you can do it online. There can be online Zoom calls, conferences, like places that we haven't been represented in, we should be in! Like there should be like, good links! For example, in Public Health there are lots of conferences, like different global health conferences, all these things, right? There should be like links to all these things, showing that, "okay, you know what? We're all gonna go there, and go there as a group, a united front! And learn from these experiences. We'll become more in tune with our craft," kind of thing. There should be like, different outreaches on these apps, on different websites, that leads and helps students in a sense. Also, too, are networking events! It can be intimidating to do all this networking. There can be online facilities to help them. Maybe there will be LinkedIn groups, all these different things, associated with helping [students through] a person's Instagram account. You can make it become so much more bigger.</p> <p>Nandani emphasizes the point that "we need to see more. We need to see more representation of West Indians, especially [women]. We need to see more representation on this." She continues:</p> <p>And I like how you're asking about how would I kind of give a platform like, make it like more inclusive, and so forth, right? And there are the things we need to do. We need to make new platforms on different social medias to show them that [they're] not alone. We are here, we</p>

	<p>are mentors for you. And we went through this and then you can do it too, because we went through this and we're successful, you can do, too, right? We really love what we do. And I encourage more (of) these conversations. So, let's have our voices heard, you know? Let there be more like - less building walls, and more breaking down these things, right?</p>
<p>Ayesha</p>	<p>While she admits that she is “not sure about that” when initially asked what she believed her online social media groups could do to better support her, Ayesha does eventually share the following:</p> <p>I feel like workshops would be nice, just to like, get to network. And also, I feel like within Indo-Caribbean communities, I feel like they're really close knit. So, finding that community within STEM and then getting to know them better. Like, not even just a professional basis, even on like a personal basis would help.</p> <p>When asked if this looked like “going beyond your, you know, like suit and tie, meet at a networking event? But like, you know, have study groups, hang out on weekends?”, Ayesha agrees.</p>
<p>Sati</p>	<p>Sati explains what she would like to see more of in her online social media groups by sharing some positive experiences she has had so far:</p> <p>So, I'm just pulling up this group that I'm in right... it's kind of like a support group... [it] is something where like, if I was doing research on individuals of color, I could throw my application, or like the description of my research to recruit individuals, into that group. And that's just the research aspect of that, where I know I'd be able to gain the help of others from a group such as that, because it is super inclusive. It's a private, but semi-public group in the sense that everyone can post whatever they want. And everything has been so positive. No one has posted anything offensive. It's always informative, always, "hey, support my business!" or "support this person that I know" and stuff like that, which has been great. A lot of the Instagram accounts that I follow, like the Jahaji Sisters, Brown Girl Diary, all of them... that I discovered through Instagram or word of mouth or through Facebook – I was able to recognize that there was this community who now can support me in my career... one of the Brown Girl Diary events they had just like random guest speakers, and I talked to them saying like, "Can I talk about my research?" in one of those groups to, like, inspire individuals to see that there are women of color in, in academia, post-secondary, post-grad, undergraduate. Like, just literally to inspire little girls, little Guyanese girls to say like, "You can be here. It is possible." The stereotypes of our culture do not limit us. And social media has been great for that... And I think that because of COVID, it has allowed us to create these online platforms now, where we don't have to be in-person. Like we're talking to people are all over the States, different people in Canada, from different places around the</p>

	<p>world, in Guyana, even, who are going to be in [an upcoming] call to tell us about their experiences. And I think that's amazing... that's one of the things that the online community has allowed us to do through like platforms like Zoom, and Google, whatever you [used], Meets? Hangouts, whatever? So, I think that's been, I think I've experienced more positives through the use of social media.</p>
<p>Shanita</p>	<p>Shanita did not have many recommendations to make, but she did speak about the potential positive impact social media groups could make on Indo-Caribbean women in STEM, particularly regarding mentorship opportunities and how they help to increase representation. She shared her experiences with mentorship regarding another aspect of her identity – musician – to explain:</p> <p>As I grew older and [began] understanding intersectionality and seeing people who are proud of their cultural identity, as well as their educational identity, their professional identity; I [became] okay with “standing out” ... I have two strong backgrounds: so, there's my STEM, and then music background. I spent years doing music. I've been in a lot of ensembles, things like that, and I actually had the opportunity from two amazing mentors of mine, both white ladies, who saw the importance of bringing people of colour to the table and seeing talent in me. [They] brought me to all sorts of different like music education events... and then seeing myself as the one Brown girl in the room in a sea of white, you know? And realizing it is kind of a big deal that they brought me here, because how the hell else would I get to this table? How would anyone hear my voice? You know, and it's so funny to just see a sea of white people talk about diversity and inclusion and sit there and be like, "yeah, so how do you get more of me here?" [laughs] At first, I was like, "How am I just one? How is it just me out here? How did that happen?" And just leaning into an understanding that that's kind of how things are. So, you know, be proud of who you are, because there are other kids who need to see that, right?</p>

In summary, participants provided several examples regarding the ways they believed online social media groups might support the STEM capital development of their Indo-Caribbean women in the field.

5.4. Summary of Findings and Conclusions

Within this chapter, I have provided an overview of my results. The investigation into the participants’ online STEM identity development revealed several findings. They are summarized below.

5.4.1. Identity

1. Participants report feeling their identities as “Indo-Caribbean Women” and “Women in STEM” were distinct and not mutually supportive.
2. Participants report feeling a lack of representation of Indo-Caribbean women in STEM in STEM institutions.
3. Participants report feeling a lack of representation of Indo-Caribbean women in STEM in online social media groups.
4. Participants report facing negative experiences and microaggressions in STEM that were based on their Indo-Caribbean identities.
5. Participants report their Indo-Caribbean identities as sources of strength and resilience for them in the pursuit of their STEM education.

5.4.2. Community

1. Participants report feeling a lack of acceptance towards Indo-Caribbean women in STEM.
2. Participants report feeling a lack of belonging as Indo-Caribbean women in STEM.
3. Participants report feeling a lack of mentorship for them as Indo-Caribbean women in STEM.
4. Participants believe that increased representation of Indo-Caribbean women in STEM would increase their feelings of acceptance in STEM.
5. Participants believe that increased feelings of belonging in STEM would increase their sense of STEM identity.

6. Participants believe that increased STEM mentorship for Indo-Caribbean women in STEM would increase their sense of STEM identity.

5.4.3. Social Media

1. Participants report that online social media representation of Indo-Caribbean women in all fields was helpful for them to self-identify in their respective STEM fields.
2. Participants report that their connection to various online social media groups was helpful in increasing their feelings of acceptance and belonging in STEM, even if the groups themselves are not STEM-specific.
3. Participants reported that online social media groups for Indo-Caribbean women provided them with many opportunities for mentorship and networking that they did not otherwise receive, even when the groups are not STEM-specific.
4. Participants shared a number of examples of ways they believe online social media groups might support the STEM capital development of Indo-Caribbean women in the field.

In the subsequent chapter, I will discuss the findings of this chapter in the context of the project's research questions ([Chapter 2.4. Research Questions](#)) and the existing literature ([Chapter 2.0. Literature Review](#)). I will also discuss the educational implications of this study, the limitations of this study, and future research, theory, and practice.

Chapter 6.0. Discussion

In this chapter, I present my discussion of the results shared in [Chapter 5.0. Results](#). The purpose of this study is to explore the question: *How has online activity supported the identity development of Indo-Caribbean women in STEM fields of education in Canada?* The additional specific questions that guided this study are:

- 1) What support do the participants (i.e., six Indo-Caribbean women in STEM) receive from their post-secondary educational institutions?
- 2) How do online social media groups provide support for these Indo-Caribbean women in STEM in ways that their institutions do not?
- 3) How might incorporating racial, cultural, and ethnic identity into STEM education strengthen Indo-Caribbean women's STEM identity development?
- 4) What might online social media groups provide to Indo-Caribbean women in STEM that might increase their STEM capital?

The results address these specific research questions; therefore, the following discussion is organized accordingly. I begin each of the following sections by briefly summarizing the specific finding I am addressing. Second, I explain how that finding addresses the associated research question. Thirdly, I connect the finding to the existing literature (see [Chapter 2.0. Literature Review](#)) through the frameworks and perspectives discussed in [Chapter 3.0. Theoretical Framing](#). At the end of this chapter, I share the potential implications and limitations of this study, as well as suggestions for future research, theory, and practice.

6.1. A Lack of Institutional Support

The first research question asked: *what support do the six Indo-Caribbean women in STEM participants receive from their post-secondary educational institutions?* The study found that the participants experienced little to no institutional support regarding many aspects of their STEM education, particularly when it came to their Indo-Caribbean identities. Specifically, the participants reported feeling: 1) they were underrepresented in STEM; 2) they were denied a sense of community in STEM; and 3) they experienced numerous identity-based negative experiences and microaggressions.

The six Indo-Caribbean women participants in this study reported feeling underrepresented in STEM. One commonality between all participants' STEM experiences was that there was no space in STEM for their Indo-Caribbean identities. They had little to no opportunities to integrate their Indo-Caribbean identities with their STEM identities. In other words, they were made to feel they could identify as either Indo-Caribbean women *or* women in STEM, but not both. As such, they reported feeling that their overall identities were segmented. This finding echoes Carlone and Johnson's (2007) findings that WOC in STEM tend to develop disrupted identities because of their constant negotiation of their identities to fit into the hegemonic STEM culture (Ulriksen et al., 2010). Constantly having to choose sides (i.e., STEM identities versus Indo-Caribbean identities) within STEM spaces caused participants to feel unrepresented and as if the Indo-Caribbean identity did not belong in STEM. These feelings persisted, despite the participants being active participants in STEM in a number of capacities (e.g., students, mentors, educators, researchers, professionals). This mirrors Carlone and Johnson's (2007) findings that state WOC in STEM higher education tend to face

challenges regarding their STEM identities, despite having overcome many systemic barriers to persist.

Furthermore, all participants in this study reported feeling denied of a sense of STEM community within their post-secondary educational institutions, which they attributed to their Indo-Caribbean identities. Participants felt that the lack of positive representation of their Indo-Caribbean identities prevented them from being perceived as members of the STEM community by their peers, as well as established members of the STEM community (i.e., teaching assistants and faculty members). We know that recognition by meaningful others in the field (i.e., receiving acceptance from people whose opinions matter) is an important aspect of STEM identity development (Carlone & Johnson, 2007). Therefore, it is not surprising that the institutional lack of representation of the participants' Indo-Caribbean identities manifests in an insecure STEM identity development among the participants, leading them to feel that they do not belong in STEM. Not only did the participants fail to see their Indo-Caribbean identities represented in their institutional STEM communities, but they were also denied opportunities to increase the representation of their identities because the Indo-Caribbean aspects of their identities were denied entry into STEM spaces.

Participants also reported a lack of STEM mentorship as compared to what was observed among their peers, furthering their alienation from the STEM community. Participants did not see their Indo-Caribbean identities reflected in the members of the STEM community that they could turn to for acceptance, belonging or mentorship. Instead, the participants often experienced “othering” at the hands of members of the STEM community. Thus, the participants reported feelings of isolation within their

institutions and craved the same kind of support from the STEM community that they observed among their peers.

None of the aforementioned findings are surprising given what the existing literature shows about the representation, identity and belonging of BIWOC in STEM. While we cannot say with exact certainty the extent to which BIWOC are underrepresented in STEM in Canada due to the lack of intersectional analyses (Finnie & Mueller, 2008), this particular finding is corroborated by existing American literature that states that BIWOC are largely underrepresented in STEM (National Science Foundation (NSF), 2019; NSF, 2020). STEM identity, which is connected to STEM representation, is also severely lacking among BIWOC in STEM education and careers (Carlone & Johnson, 2007; Malcolm et al., 1976; Ong et al., 2011; Rodriguez et al., 2017). As we know from the research of Caxaj et al. (2018), a strong racial, ethnic, or cultural identity has been shown to act as a protective factor for racialized students' STEM identity development. When this is missing, it has been shown to have negative impacts on students' academic STEM success and persistence (Leggett-Robinson, 2020; Lewis et al., 2016; Samuelson & Litzler, 2016).

Furthering their alienation from the STEM community is the fact that the participants reported being discriminated against based on their perceived racial, ethnic, and cultural backgrounds, as well as their perceived gender identities (i.e., as Indo-Caribbean women). Participants attribute this discrimination to the unchallenged and inaccurate negative stereotypes that exist about Indo-Caribbean culture. In the face of these challenges, participants reported feeling pressure to be “good” representatives of the Indo-Caribbean identity and expressed frustration that others' perceptions of their

Indo-Caribbean identities did not align with their own. In other words, the participants did not see their Indo-Caribbean identities as hindrances to their STEM education. Rather, they saw their identities as sources of inspiration and empowerment. Again, this is not surprising, given the existing literature. When BIWOC enter STEM fields, they report feeling a responsibility to positively represent their entire racial, cultural, and ethnic demographic (McGee, 2016). They feel pressured to embody the qualities that oppose the pre-existing stereotypes associated with their specific identity; failing to do so would cause the perpetuation of those false beliefs (Archer et al., 2015; Carlone & Johnson, 2007; McGee, 2016). In the case of the BIWOC represented in the literature, as well as the Indo-Caribbean women in this present study, it is unreasonable to assume that one individual accurately represents an entire demographic, especially considering the complexity of human identity (Calabrese Barton et al., 2013). However, it is something that BIPOC almost exclusively experience because white people in STEM are rarely burdened with the pressures of representing their entire race (Marlone & Barabino, 2009); they are given the privilege of being an anomaly or different from their stereotypes (Wiggan, 2008). Even in the face of stereotypes, white people historically hold power and capital in academia and are, thus, not at real risk of facing the consequences of stereotype threat (Beasley & Fischer, 2012; McGee & Martin, 2011). As such, they are more likely to persist long-term in STEM as compared to BIWOC (Ceglie, 2020; Rodriguez, 2017) because they are afforded the opportunities for self-identification and peer recognition that contribute to the development of a sustainable STEM identity (Carlone & Johnson, 2007).

What these results add to the existing literature is that Indo-Caribbean women face barriers to their STEM identity development and require additional institutional support, as well. STEM culture is often incorrectly considered a “culture of no culture” (Traweek, 1988, as cited in Conefrey, 2001, p. 174): unbiased and objective. However, the notion that STEM is unbiased, objective, and free from culture is false; there is a culture (Carlone & Johnson, 2007; Malcolm & Feder, 2016). But because that culture is considered the *norm* or *the default setting* and is in alignment with those who hold the power in STEM, it is not seen; the invisibility of the culture is one of its successes. This white privilege exists via the white supremacist ideology upon which the structure of academia was built and continues to operate (Carlone & Johnson, 2007; Emdin et al., 2021; Taylor, 2009; Wong, 2015). As such, the Indo-Caribbean women in this study felt pressured to hide aspects of their intersectional identities (i.e., Indo-Caribbean women) so as not to conflict with the traditional image/identity of a person in STEM (i.e., white, male, straight, cisgender) (Carlone & Johnson, 2007; Ong, 2005). Additionally, the representation of women that *does* exist in STEM is also singular: predominantly white, straight, cisgender (Carlone & Johnson, 2007; Wong, 2015). As a result, even with a shared aspect of identity, the Indo-Caribbean participants of this study could not find solidarity with a majority of women they encountered in their institutional STEM spaces. I re-emphasize the importance of increasing the number of intersectional analyses of BIWOC in STEM in Canadian contexts to do the following: 1) begin to fill the current research gap that exists, 2) create a representation of the various groups that are lumped together in the categorization of *BIPOC*, and 3) understand how to support these populations of students in STEM.

Ideally, Indo-Caribbean identity and STEM identity should co-exist; they should be cohesive. Additionally, Indo-Caribbean women should be welcomed into, not barred from, institutional STEM communities, and provided opportunities to enrich their STEM identities with their cultural, ethnic, and racial identities. The participants reporting that they felt the need to conceal certain aspects (i.e., their Indo-Caribbean heritage) of their identities in order to gain entry to STEM communities in their post-secondary educational institutions is an indication that these institutions have much work to do in including, retaining and supporting Indo-Caribbean women in the field.

6.2. Finding Community and Power in Online Social Media Groups

The second research question asked: *How do online social media groups provide support for these Indo-Caribbean women in STEM in ways that their institutions do not?*

The study found that participants' online social media groups supported them in many ways their institutions could not. Participants' online social media groups supplemented participants' STEM education by filling certain gaps the participants felt they had regarding their institutional STEM education and experiences. Specifically, the participants reported that their online social media groups filled gaps in relation to the following: 1) Indo-Caribbean representation in STEM; 2) feeling a sense of community in STEM; and 3) identity-based empowerment in STEM.

The six participants of this study reported feeling that the lack of representation, community, and power they felt regarding their Indo-Caribbean identity in STEM spaces was remedied by their involvement in online social media groups for Indo-Caribbean women. Specifically, the representation of the Indo-Caribbean identity within these online social media groups led to the development of a sense of community for the

participants. This ultimately led to the participants feeling a sense of empowerment in their Indo-Caribbean identities. For example, the participants noted that the representation they lacked in their STEM courses made them feel very alone and as if they did not belong in the program. However, seeing themselves (e.g., their physical characteristics and shared cultures, histories, and experiences) represented in online spaces, participants reported feeling less alone; a sense of belongingness to a community began to form.

Interestingly, the Indo-Caribbean women's representation that participants experienced online was rarely STEM-specific. However, despite this, the participants still found the representation to be empowering. For the participants, seeing other Indo-Caribbean women pursuing their education and career goals seemed to bolster their sense of identity and belonging within their own educations and careers (i.e., as Indo-Caribbean women in STEM). Additionally, participants developed connections with other Indo-Caribbean women via various online social media groups, which they reported increased their sense of belonging in their respective fields. The participants report similar findings as above: the connections and communities they formed with other Indo-Caribbean women online were meaningful despite the connections not always being STEM-specific.

This makes sense given that research finds that BIWOC's STEM identity development is supported by positive representation of other BIWOC in the field (Ulriksen et al., 2010). Research shows that positive social interactions with and recognition of STEM identity from STEM peers are important for the STEM identity development and maintenance for WOC in STEM (Rodgers, 2016) given the negative academic climate of STEM (Settles et al., 2016). It seems as though the shared collective

identity of the group (i.e., Indo-Caribbean women) had a similar impact on the participants, despite their interactions not necessarily occurring with other Indo-Caribbean women in STEM (i.e., they were Indo-Caribbean women in all sorts of fields). Perhaps this is because, unlike in the world of STEM, these Indo-Caribbean women did not struggle to have their STEM identities validated in these online spaces as compared to STEM spaces (Malone & Barabino, 2009). Additionally, perhaps participants felt the connections contributed to their STEM identities because, in their online relationships with other Indo-Caribbean women in STEM, the participants were celebrated in their identification with the STEM profession, rather than made to work twice as hard to gain entry into STEM (Atwater & Simpson, 1984; Carlone & Johnson, 2007). Much research discusses the impact of specific science experiences on other areas of students' lives, such as the carry-over from science classrooms into extracurricular science clubs and vice versa, which strengthens the durability of students' identity trajectories and may positively influence students' science career aspirations (Calabrese Barton et al., 2013; Carlone et al., 2013). Research shows that when participants of online communities engage in the practice of solidarity and empowerment in their online communities, it carries through to their offline lives, as well (Cappellini & Yen, 2015). That said, perhaps the feelings of representation and community experienced by participants in their online social media groups carried through to their offline STEM lives, creating positive experiences that counteracted the many negative experiences associated with their post-secondary STEM institutions.

Furthermore, online social media groups provided support to the participants by way of mentorship (i.e., information about STEM opportunities and events), which the

participants reported not receiving in their STEM institutions. What this resulted in for the participants was a sense of empowerment – another experience the participants reported lacking in their STEM institutions. Alongside their reflections of how beneficial they found their online social media groups to be in terms of their personal STEM successes, the participants shared about the potential value they believed online social media groups will provide to future generations of Indo-Caribbean women in STEM. The participants spoke about the longing they felt towards community building and mentorship from other Indo-Caribbean women in STEM during their education and careers. The desire they had for such things was somewhat fulfilled by their membership in the groups they found online. Participants believed that online social media groups for Indo-Caribbean women should be created to connect and support future Indo-Caribbean women and girls pursuing STEM. Participants also spoke about the mentorship they would like to provide to future Indo-Caribbean women and girls in STEM, expressing that they want to be the mentors they wished they had throughout their STEM experiences.

The participants all expressed a deep responsibility to their communities. The responsibility participants feel is not surprising given what the literature says about representation, community, and power in relation to motivating influences for POC in academia. As discussed in [Chapter 2.2.1. How Racial, Ethnic, and Cultural Identity Impact STEM Identity Development](#), racialized students who strongly identified with their communities had a desire to pursue higher education as a means to contribute to the betterment of their communities (Codjoe, 2006; Gordon, 2012; Gosine, 2007; Hernandez-Ramdwar, 2009). This is seen in the participants' shared dedication to protecting and

improving the experiences of their descendants, especially Indo-Caribbean women and girls who wish to pursue STEM. Furthermore, racialized students are more likely to seek harmony between their education and their cultural identities (Ampaw & Jaeger, 2011), because their affinity or aversion towards a subject matter or career is analyzed through a lens of cultural identities (Haley et al., 2014). This is why strong identities and community-focused aspirations can act as protective and motivating factors for their academic persistence and success (Caxaj et al., 2018). This is why the Indo-Caribbean women in this study found such empowerment in their online social media groups. These groups provided them with opportunities to express their Indo-Caribbean identities without fear of the repercussions they faced for doing so in physical STEM institutions. We also know from [Chapter 2.2.1. How Racial, Ethnic, and Cultural Identity Impact STEM Identity Development](#) that racialized international students' ethnic community membership and positive cultural identity has significant positive impacts on their sense of self-worth and belonging in their academic spaces (i.e., on-campus environments) even when the larger community context continues to make them feel excluded (Sherry et al., 2010). In being able to find community through feelings of acceptance, belonging and mentorship in online social media groups, these Indo-Caribbean women finally received the validation of their identities for which they were longing in STEM spaces but were unlikely to receive due to having to constantly negotiate their identities to fit STEM's hegemonic culture which tends to privilege white and male identities (Carlone & Johnson, 2007; Malcolm & Feder, 2016; Ulriksen et al., 2010).

In summary, the Indo-Caribbean women in this study reported finding the representation, community, and power in online social media groups they were not

afforded in their post-secondary STEM educational institutions. Though these findings resulted in positive outcomes for the participants and adds evidence to existing literature regarding the many affordances of online communities, it also speaks volumes about the nature of post-secondary STEM educational institutions. These findings further indicate that much work must be done by these institutions to support the development and maintenance of STEM identity and community (i.e., through acceptance, belonging, and mentorship) for Indo-Caribbean women in STEM fields.

6.3. Ethnic, Racial, and Cultural Identity Strengthens STEM Identity

The third research question asked: *How might incorporating racial, cultural, and ethnic identity into STEM education strengthen Indo-Caribbean women's STEM identity development?* The study found that participants believed that incorporating their racial, cultural, and ethnic identity into STEM education would strengthen their STEM identity development. Participants expressed feeling deep connections to their Indo-Caribbean heritage, which they often turned to find strength and resiliency to endure in all aspects of their lives, including their STEM education. However, participants reported feeling frustrated that the things they viewed as assets in their lives (i.e., their racial, cultural, and ethnic identities) were not only considered irrelevant in STEM but considered hindrances to participants' STEM ability and, resultantly, STEM success.

A commonality among the participants was their shared sentiments about how their Indo-Caribbean heritage has encouraged their success in STEM. During their interviews, many participants allude to their Indo-Caribbean heritage (e.g., the collective history of Indo-Caribbeans, as well as their individual family histories) as sources of encouragement and strength needed to move through adversity facing them in their

education and careers. Many participants attributed their tenacity, courage, and perseverance in STEM to the legacies of their ancestors, which contributed to the deep responsibility they felt towards their communities (see [Chapter 6.2. Finding Community and Power in Online Social Media Groups](#)). As discussed in [Chapter 2.2.1. How Racial, Ethnic, and Cultural Identity Impact STEM Identity Development](#), incorporating racial and cultural identities into STEM identity formation benefits STEM identity development in a number of ways (Caxaj et al., 2018; Chavous & Drotar, 2016; Dweck, 1999; Wigfield & Wagner, 2005). For example, Chavous and Drotar (2016) found that when Black students saw a connection between their Black identities and their STEM identities, they felt more motivated and capable in their pursuit of STEM. Similarly, the participants of this study reflected on their Indo-Caribbean identities when in need of motivation to persist in STEM. The connections the participants created between their Indo-Caribbean heritage and the world of STEM relate well to Yosso's (2005) model of community cultural wealth (CCW). The participants turned to the cultural attributes associated with their Indo-Caribbean identities as a resource in surviving and navigating post-secondary STEM educational institutions (Samuelson & Litzler, 2016). By doing so, the participants challenged the traditional interpretation of what is considered cultural capital as it relates to STEM (Samuelson & Litzler, 2016; Yosso, 2005) – a transgressive act in the face of what one participant called a “white man’s world.”

Another commonality among participants was that the realization of their Indo-Caribbean heritage as a source of strength occurred later in life, once they had reached adulthood. This was due to the fact that participants were made to feel as if their Indo-Caribbean identities were irrelevant and/or hindrances to their STEM ability and,

resultantly, STEM success. Carlone and Johnson (2007) reported that a sense of authenticity and belonging in STEM is hard to come by for Black students because unlike their white peers, Black students feel they must earn their membership in STEM partly by assimilating to the dominant culture (i.e., white, heterosexual, cisgender, male culture) of STEM spaces. Additionally, Ong (2005) reports that Black students must navigate aspects of their identities, such as how they dress, speak, and behave, in ways that white students and professionals in STEM need not worry about because their STEM identity is less likely to be questioned or denied for transgressing against the dominant culture. Similarly, the participants of this study have been pressured to ignore aspects of their identities (i.e., their Indo-Caribbean identity) to gain entry, maintain membership, and achieve success in the STEM world. In doing so, the participants inadvertently reinforced the idea that only certain people can *do science* (i.e., only certain identities are well-suited for STEM) (Ceglie, 2020). In other words, in an attempt to fit into the narrow culture of STEM (Carlone & Johnson, 2007), participants may have developed negative associations with their Indo-Caribbean identities; deficit-based perspectives that influenced them to view their Indo-Caribbean identities as barriers to their STEM success (Samuelson & Litzler, 2016; Yosso, 2005). Additionally, the culture of STEM is particularly chilly towards BIWOC (Leggett-Robinson, 2020; Leggett-Robinson et al., 2018), and does not typically value non-traditional conceptualizations of capital that BIWOC bring to the world of STEM (Samuelson & Litzler, 2016; Yosso, 2005). In other words, post-secondary STEM educational institutions place more value on traditional, deficit-based conceptions of capital (Samuelson & Litzler, 2016; Yosso, 2005) among students, because the white supremacist foundation of educational institutions (Collins &

Bilge, 2016; Emdin et al., 2021; Ladson-Billings & Tate, 1995) fail to see the value of capital that is “developed in and nurtured by families and communities” (Samuelson & Litzler, 2016, p. 95). Thus, it makes sense that the participants’ realizations of their identities occurred later in life – they needed time to unlearn the powerful and pervasive imagery of the expected embodiment of a scientist that causes girls and minority ethnic students to struggle with STEM identity in their education and careers (Wong, 2015).

However, the participants reported that upon realizing the power their Indo-Caribbean identities afforded them, they became more empowered than ever before. The empowerment they experienced seemed to have been exacerbated by the positive experiences gained in their membership of online social media groups for Indo-Caribbean women. As we know from [Chapter 2.3. Online Communities](#), existing literature outlines the many affordances (i.e., social support) of online communities, particularly for members of marginalized communities (Andalibi, 2016; Burke et al., 2010; Hernandez et al., 2014). Online communities have been shown to be liberatory spaces for people to challenge their traditional forms of affiliation (i.e., age, gender, ethnicity, family, profession, neighbourhood) and allow for the creation of more fluid and less localized affiliations based on their interests, regardless of the geographical locations of members (Breitsohl et al., 2015; Cova & Cova, 2002; Croft, 2013; Maffessoli, 1996). Therefore, in finding online social media groups that celebrate the Indo-Caribbean identity, particularly Indo-Caribbean women’s identity, the participants found liberation from the traditional (i.e., white, heterosexual, cisgender male) embodiment of STEM they are so used to being exposed to (Ulriksen et al., 2010; Wong, 2015). Participants’ membership in online social media groups that centered Indo-Caribbean women’s experiences was a place

where they could easily identify with the dominant culture of the group (i.e., Indo-Caribbean women in a space created for Indo-Caribbean women). In other words, the participants felt an ease in their sense of acceptance, belonging and community within their online social media groups – one that is likely on par with the ease Wiggan (2008) writes white students experience by virtue of their racial identities aligning with the dominant culture of STEM. The ease in identification with their Indo-Caribbean identities experienced by participants in their online social media groups caused a sense of identity-based empowerment among them, which likely carried through to their offline STEM lives (Cappellini & Yen, 2015) (see [Chapter 6.2. Finding Community and Power in Online Social Media Groups](#)).

In summary, the Indo-Caribbean women in this study reported believing that the incorporation of their racial, cultural, and ethnic identity into their STEM education could strengthen their STEM identity development. Participants expressed feeling deep connections to their Indo-Caribbean heritage, which they often turned to find strength and resiliency to endure in all aspects of their lives, including their STEM education. As such, participants report that seeing their identities represented in ways that aligned with their own positive perceptions of their identities would be very meaningful and empowering regarding their STEM identity development. However, the participants also reported feeling frustrated that the things they viewed as assets in their lives (i.e., their racial, cultural, and ethnic identities) were not only considered irrelevant in STEM but considered hindrances to participants' STEM ability and, resultantly, STEM success. That said, more can and should be done to incorporate representations of racial, cultural, and ethnic identity into STEM education to (a) support Indo-Caribbean women in STEM,

and (b) challenge STEM's narrow perceptions of assets (i.e., capital and power) that non-traditional identities bring to the industry.

6.4. Using Online Social Media Groups as Tools for Building STEM Capital

The final research question asked: *What might online social media groups provide to Indo-Caribbean women in STEM that might increase their STEM capital?* As seen in [Chapter 5.3.4. Participants' Recommendations for STEM Capital Development via Online Social Media Groups](#), participants shared a number of examples regarding the ways they believed online social media groups might support the STEM capital development of their Indo-Caribbean women members. Generally, they include (a) increasing the representation of Indo-Caribbean women in STEM, (b) creating opportunities for networking and community building among Indo-Caribbean women in STEM, and (c) providing resources and mentorship for Indo-Caribbean women in STEM. In the following section, I discuss participants' responses regarding strategies they believe online social media groups can implement to help build capital among Indo-Caribbean women in STEM in relation to existing literature pertaining to STEM capital development.

The participants express a desire to see increased representation of Indo-Caribbean women in STEM in their online spaces. Despite their consensus that online spaces for Indo-Caribbean women in STEM are currently hard to find, there is no shortage of ideas around how to change this. Overall, participants discussed a number of ways to increase the online presence and visibility of Indo-Caribbean women in STEM. This includes discussion forums, Facebook groups, and Instagram accounts, all curating resources and content specific to Indo-Caribbean women in STEM. The participants'

suggestions mirror the research of DuBow et al. (2016), Esquinca et al. (2021), and Rodriguez (2020), who report that the creation of welcoming environments is an asset to STEM identity development, maintenance, and by extension, belonging (i.e., community). A sense of community in STEM is vital to students' success and well-being. Therefore, if online social media groups tailored to Indo-Caribbean women in STEM are able to create a welcoming space for Indo-Caribbean women in STEM, there is likely to be a positive impact on their STEM identity development, maintenance, and sense of belonging (i.e., community). The likelihood of these groups being able to achieve this high considering that part of creating a welcoming space to build the STEM identity of BIWOC in the field includes allowing students to relate to and see themselves in the community, by seeing people who resemble them in the community (DuBow et al., 2016). In other words, Indo-Caribbean women in STEM need to see other Indo-Caribbean women in STEM in order to feel a sense of community within STEM.

Also, through these online social media groups, the participants posit that they will be able to engage in their second recommendation: networking and community building opportunities among Indo-Caribbean women in STEM. The participants acknowledge that geographical distance may be a barrier in their ability to connect to other Indo-Caribbean women in STEM. As a result, the participants' ability to find solidarity and support specific to their experiences as Indo-Caribbean women in STEM is hindered; the Indo-Caribbean community is a minority in Canada, after all! Since the participants feel that, in their experiences, online social media groups have been a useful tool in bridging the geographical gaps between diasporic Indo-Caribbeans everywhere, they believe that the same impacts can be made on Indo-Caribbean women in STEM, no

matter where they are located. These recommendations also mirror the research of DuBow et al. (2016), Esquinca et al. (2021), and Rodriguez (2020), as well as Brahmia (2008), Leggett-Robinson (2020), and Lindemann et al., (2016). Not only is creating welcoming environments for BIWOC in STEM important to their well-being and success (DuBow et al., 2016; Esquinca et al., 2021; Rodriguez, 2020), but centering those spaces around racial and cultural identity is, too (Brahmia, 2008; Lindemann et al., 2016). Allowing Indo-Caribbean women in STEM to connect their racial and cultural identities to STEM through using real-world examples (i.e., discussing STEM topics that impact their communities; connecting them to other Indo-Caribbean women in STEM), allows them to “see the impact of their work and to make a difference in the world around them” (Lindemann et al., 2016, p. 234), all while developing their STEM identity (i.e., by seeing others who look like them) (DuBow et al., 2016) and STEM efficacy (i.e., STEM capital) (Brahmia, 2008). Being able to do so without the barrier of geographical distance, allows for an increased depth (i.e., an increase in representation) and breadth (i.e., an increase of diversity in representation) of students’ racial and cultural identities in STEM (Breitsohl et al., 2015; Cova & Cova, 2002; Maffessoli, 1996). In other words, connecting Indo-Caribbean women in STEM across disciplines and geographies may allow them to better see their potential impact on the world (Lindemann et al., 2016), thus increasing their sense of meaning, interest, responsibility, and consequently, identity and power (i.e., STEM capital) (Ampaw & Jaeger, 2011; Caxaj, et al., 2018; Chavous & Drotar, 2016; Dweck, 1999; Gosine, 2007; Rincón & Rodriguez, 2021).

Finally, the participants expressed a desire for online social media groups to provide resources and mentorship for Indo-Caribbean women in STEM. There is a wealth

of literature around the importance of mentorship, as discussed in [Chapter 3.4.4. Power](#). Given that the participants reported feeling they received a lack of STEM mentorship compared to their peers (see [Chapter 5.2.1.3. A Lack of Mentorship for Indo-Caribbean Women in STEM](#)) and that they expressed a strong desire for STEM mentorship (see [Chapter 5.2.2.3. The Impact of STEM Mentorship on Participants' STEM Identity](#)), it is unsurprising that their recommendations include increasing mentorship opportunities for Indo-Caribbean women in STEM. Mentorship has been shown to counteract the effects of stereotype threat on students (Beasley & Fischer, 2012), which may be especially important for Indo-Caribbean women in STEM who are constantly incorrectly associated with various racial and ethnic groups (Plaza, 2006). Given their many experiences with stereotyping and microaggressions ([Chapter 5.1.3. Stereotypes and Microaggressions Directed Towards Coolie Women in STEM](#)), it makes sense that the participants would want to engage in mentorship with other Indo-Caribbean women in STEM; doing so would allow for the creation of welcoming and safe counterspaces that we know are conducive to BIWOC success and well-being in STEM (DuBow et al., 2016; Esquinca et al., 2021; Leggett-Robinson, 2020). Interestingly, the participants speak about opportunities for mentorship for themselves as current STEM students or STEM professionals, as well as the importance of mentorship for up-and-coming Indo-Caribbean women and girls in STEM. Furthering their desire to see these opportunities presently and in the future, some participants express their goals to become mentors themselves, specifically geared towards Indo-Caribbean women and girls in the field. Congruent with the findings of [Chapter 6.3 Ethnic, Racial, and Cultural Identity Strengthens STEM Identity](#), the participants seem to have a deep connection and

responsibility towards contributing to the success of future generations of Indo-Caribbean women in STEM. This finding aligns well with research regarding racialized students' tendency towards alignment in their education and/or careers and their racial, ethnic, and cultural identities (Chavous & Drotar, 2016). Through the lens on Yosso's (2005) model of CCW, it also makes sense that the participants feel this responsibility towards the future of Indo-Caribbean women in STEM; the participants seem to recognize the privilege and power associated with STEM mentorship, thus, want to share, develop, and nurture opportunities for STEM mentorship within their communities (Samuelson & Litzler, 2016; Yosso, 2005). This allows for the development of STEM capital (i.e., power) within their communities that has the potential to address the academic and cultural STEM knowledge gaps the participants reported having as first-generation women students in STEM (Ceglie, 2020). Also congruent with the findings of [Chapter 6.3. Ethnic, Racial, and Cultural Identity Strengthens STEM Identity](#), is the role that online social media groups can play in facilitating mentorship among Indo-Caribbean women and girls in STEM, since online communities do not have fixed geographical locations and can, therefore, allow for fluid mentee-mentor relationships to develop help to bridge the geographical distance among (Breitsohl et al., 2015; Cova & Cova, 2002; Croft, 2013; Maffessoli, 1996).

In summary, the participants shared a number of examples regarding the ways they believed online social media groups might support the STEM capital development of their Indo-Caribbean women members. Participants' responses include strategies such as (a) increasing the representation of Indo-Caribbean women in STEM, (b) creating opportunities for networking and community building among Indo-Caribbean women in

STEM, and (c) providing resources and mentorship for Indo-Caribbean women in STEM. Given what literature tells us about the importance of representation, community, and mentoring for racialized students' success in STEM, the participants' recommendations are reasonable and likely to be effective. Additionally, literature regarding the affordances of online communities contributes to the likelihood and effectiveness of the participants' recommendations.

6.5. Implications and Recommendations

This study contributes the experiences of six Indo-Caribbean women in STEM to the existing body of literature regarding STEM identity development in racialized women. This study also presents a number of potential implications for STEM education research and practice. First, the findings of this study suggest that more institutional support services are needed to support Indo-Caribbean women's success and well-being in STEM. Current literature contains recommendations on how to achieve this. For example, Chang et al. (2014) recommend three strategies that institutions can implement to increase the likelihood of engaging in key academic experiences for underrepresented racial minorities (URM) in STEM. First, Chang et al. (2014) argue that institutions should provide more extracurricular "earn and learn" opportunities for URM to meaningfully engage in their major subject, while earning money to meet their financial needs (p. 571). These opportunities include, but are not limited to, "well-structured research programs or student organizations that enable students to be more engaged, including major-related extracurricular activities, work on a professor's research project, peer study groups, or other social networks that support access to information and strategies for navigating a STEM major" (Chang et al., 2014, p. 571). Second, they also

recommend faculty and departments to “closely monitor the success of those URM students who aspire to obtain a professional/clinical science-oriented graduate degree (M.D., D.O., D.D.S., or D.V.M)” to ensure that rates of STEM enrollment are comparable to rates of STEM degree completion among URM students (p. 571). Collecting this information is important because while STEM career aspirations are high among URM undergraduates, STEM degree completion among URM is not (Chang et al., 2014). Therefore, institutions need to do more to retain URM in STEM programs, even if their specific career aspirations (i.e., Doctor of Medicine (MD), Doctor of Osteopathic Medicine (DO), Doctor of Dental Surgery (DDS), Doctor of Veterinary Medicine (DVM)) change throughout enrollment in a STEM program. Chang et al. (2014) suggest that institutions leverage URM’s professional and/or clinical STEM degree aspirations to “hook” them into sciences early on in their studies, thereby broadening their knowledge and understanding about other potential careers for STEM graduates (p. 571). Chang et al. (2014) argue that “efforts related to providing more career guidance in STEM fields might improve students’ willingness to continue working toward a STEM degree rather than leave the sciences altogether when they abandon their aspiration to pursue a professional/clinical degree” (p. 571).

While these recommendations align with one of the findings of this study (i.e., there is a need for increased institutional support for Indo-Caribbean women in STEM), I argue that its benefits can be extended further than what Chang et al. (2014) explain. A sense of belonging and identity in STEM is shaped by the validation of meaningful others in the field (Carlone & Johnson, 2007; Hurtado et al., 2009; Ulriksen et al., 2010); validation that may come from involvement in the opportunities Chang et al. (2014)

mention. Therefore, not only can these opportunities teach URM how to navigate STEM majors (i.e., STEM capital) through mentorship, but they can also improve their sense of acceptance and belonging in STEM (i.e., STEM community), which in turn, might result in a stronger sense of identification with the field (i.e., stronger STEM identity), which may increase their likelihood to persist in STEM. Additionally, students are more likely to feel a sense of belonging in a field when they see their communities reflected within it (Ulriksen et al., 2010) (i.e., students are more likely to feel like a part of academia when they see their identities represented among faculty members (Posselt, 2018)). Thus, it is reasonable to believe that STEM identity and belonging would be increasingly positively impacted if that validation came from meaningful others whose identities (i.e., racial, ethnic, and cultural) were in alignment with their own. In other words, I argue that if Indo-Caribbean women in STEM had more opportunities to create connections with other Indo-Caribbean women in STEM, particularly Indo-Caribbean STEM educators (e.g., teaching assistants, instructors, professors, researchers), their STEM identity development may be doubly supported, causing an increase in STEM retention. Therefore, not only do the opportunities Chang et al. (2014) list provide the potential for increasing STEM capital by filling certain knowledge gaps (see [Chapter 3.4.4. Power](#)), they also have the potential to reinforce students' sense of acceptance, belonging, and identity (i.e., community), therefore, retention, within STEM.

This is important because, as previously discussed, developing feelings of membership and identification with the STEM community is often difficult for racialized communities due of the overwhelmingly white nature of the field (Wong, 2015); this also impacts the rate of retention of URM in STEM (Caxaj, et al., 2018; Chavous & Drotar,

2016). Therefore, mentorship opportunities within racial, ethnic, and cultural communities are likely an important tool for the success and well-being of racialized students in STEM. In other words, I believe that, generally, increasing mentorship opportunities for Indo-Caribbean women and girls in STEM has the potential to improve their STEM identity, as well as their feelings of acceptance and belonging within STEM. However, most important is forming mentor-mentee relationships between up-and-coming Indo-Caribbean women and girls in STEM and Indo-Caribbean women and girls currently in the field (i.e., education or career). Admittedly, pairing students with mentors that are similar in heritage may be difficult given the underrepresentation of WOC STEM faculty members (Finnie & Mueller, 2008). Additionally, asking WOC faculty to engage in mentorship with all racialized students is an issue of equity, as WOC faculty already report feeling as if they must do more work to be seen as valuable as their colleagues (Atwater & Simpson, 1984; Carlone & Johnson, 2007). Thus, undertaking a disproportionate number of WOC mentees would add to the already unfair amount of work WOC faculty have to do, which research shows has a negative impact on WOC faculty members' careers and research (Corneille et al., 2019). Additionally, placing the responsibility of mentorship without compensation on WOC faculty, without addressing what causes the lack of mentorship for WOC students in STEM in the first place, is further subjecting WOC faculty members to violence inherent in post-secondary educational institutions. Thus, institutions have more work to do, which Chang et al. (2014) address in their third recommendation.

Chang et al.'s (2014) last recommendation for institutions involves closely examining "how their educational context contributes to or obstructs from completing a

STEM degree” (p. 571). They argue that “by encouraging educators to look more closely at different educational environments, and by having institutions engage in self-examination, we may be able to gain greater insights into how to develop stronger and more inclusive ‘cultures of science’” (p. 571). Generally, these actions include: 1) hiring faculty and teaching staff that are better representative of their study body (DuBow et al., 2016; Posselt, 2018); 2) supporting the development of existing faculty and teaching staff’s knowledge regarding strategies needed to best support minoritized students and provide the same training to incoming faculty and teaching staff (Fries-Britt et al., 2010; Nahapetian et al., 2019; Speed et al., 2019); and 3) developing anti-deficit supports and policies that focus on supporting students, rather than blaming them for factors beyond their control (AAPT Committee on Diversity in Physics (ACDP), 2016; Hodari & Johnson, 2019; Samuelson & Litzler, 2016). To address institution-specific issues, internal reviews investigating sources of inequities (i.e., policies, programs, supports, culture) within institutions are recommended, as solutions to equity issues can only be strategized once they are identified (Chang et al., 2014; Lane, 2016; Maltby et al., 2016).

Another potential way to diversify, thereby strengthening the culture of STEM is through the inclusion of ethnic, racial, and cultural education in STEM education. Not only does this have the potential to strengthen STEM identity development among Indo-Caribbean women (and BIWOC, in general) in the field, but it has the potential to benefit non-racialized members of the STEM field, too. Including this type of education impacts non-racialized students and faculty in STEM by making them aware of the fact that they, too, have a certain race, ethnicity, and culture (Emdin et al., 2021). However, because non-racialized identities align with the dominant culture of the system (e.g., whiteness,

cis-heteronormativity), it is easy to forget that those aspects of their identities exist (Wong, 2015). Thus, incorporating ethnic, racial, and cultural education into STEM education provides opportunities for non-racialized students and faculty to learn, challenge, and change the current pervasive deficit-based, eurocentric, and white supremacist narratives underlying STEM culture (e.g., who belongs in STEM; what it takes to be successful in STEM; what STEM success looks like) (Emdin et al., 2021).

Lastly, it is important to note that while this research has focused on Indo-Caribbean women in STEM, the study's findings and implications have the potential to benefit communities beyond the scope of this study. In other words, I argue that this research benefits both the Indo-Caribbean community, specifically Indo-Caribbean women in STEM, as well as other racialized and underrepresented women in STEM. An example of how the benefits of this research can carry over into other demographics is as follows: most of the Indo-Caribbean women in STEM in this study are first-generation post-secondary students (i.e., they are the first individuals in their family's history to pursue post-secondary education). The work of Wofford et al. (2021) gives examples of what support for first-generation students in STEM might look like. They suggest mentorship for first-generation STEM students in which mentors (i.e., advisors) are advised to have "intentional conversations about their expectations" of their mentees (i.e., doctoral students) (see Lechuga (2011)), and vice versa (Wofford et al., 2021, p. 1026). This, they argue, is to account for their finding that "continuing-generation students articulate their expectations in more concrete ways—and in ways more aligned with what faculty inherently expect of students' independence" (Wofford et al., 2021, p. 1026). This communication is "crucial, as a misalignment in expectations can lead to dissatisfaction

and conflict, interfering with the learning and development that could potentially take place” (Wofford et al., 2021, p. 1026). Furthermore, Wofford et al. (2021) suggest that structural change is needed to provide equitable support for first-generation STEM doctoral students, therefore they recommend institutions “offer training to help faculty members explicate the informal knowledge, processes, and norms that lead to graduate student success (see Calarco, 2020)” (p. 1026).

While these suggestions are not specific to a certain demographic of first-generation students (i.e., the authors did not “discuss within-group variation when students had multiple marginalized identities”), they do provide a basis for which to begin interventions to support first-generation students, including, for example, first-generation Indo-Caribbean women in STEM (Wofford et al., 2021, p. 1020). Therefore, the benefits of increasing institutional support for first-generation students in STEM, regardless of race, ethnicity, and/or culture, has the potential to carry over, also benefiting Indo-Caribbean women in STEM (e.g., their STEM identity and STEM capital development). This does not mean that these supports are sufficient; more research is needed to understand the specific experiences of racialized first-generation students in STEM (Wofford et al., 2021). However, they provide the basis upon which further research can be conducted. Similarly, the findings of this study may benefit the current and future community of Indo-Caribbean women in STEM and beyond, while paving the way for future research regarding the STEM identity development of increasingly specific demographics within STEM.

6.6. Limitations

In this section, I discuss the limitations of the study specifically related to the overall research design, methods and sampling, and unanticipated obstacles.

6.6.1. Overall Research Design

This study used social media to recruit participants because I was interested in the experiences of Indo-Caribbean women in STEM who use social media and participate in online communities. While having a specific set of participant qualification criteria is common practice, I will acknowledge a potential equity issue that arose from the criteria specific to my study. It relates to the discussion of access (see [Chapter 3.4.1. Access](#)). While social media is very prevalent, I cannot assume that every Indo-Caribbean woman in STEM uses social media or has access to the resources needed in order to do so (e.g., a Smartphone or consistent internet access). And while the experiences of non-users would be irrelevant to the study's goals (i.e., how online social media groups support Indo-Caribbean women in STEM), it would have been interesting to explore the experiences of both groups. Of course, this would require a different research design altogether – one that would allow for a more robust, less skewed recruitment of participants that would result using the current research design. However, I think it would allow for a richer understanding of what the presence versus absence of social media in the participants' lives would mean for their STEM identity development.

Another issue this brings to mind is the online nature of semi-structured interviews. My plan to conduct the interviews always involved online conferencing (e.g., Adobe Connect, Google Meet, Zoom) because of the fully online nature of the graduate program offered by my faculty. However, this was made mandatory after the outbreak of

the COVID-19 pandemic to ensure the safety of all the people involved in this study. The online nature of the study was made explicit in the advertisements of the study. I realize that this could have been a limiting factor in potential participants' ability to participate in the study. Again, I cannot assume that every potential participant (i.e., Indo-Caribbean women in STEM who participate in online communities) has the necessary resources to take part in a 90-minute semi-structured interview (e.g., the necessary internet bandwidth or devices that are compatible with video conferencing). Therefore, potential participants who would have liked to participate in the study could have been denied the opportunity because of their lack of access. This is a commonly reported barrier for many demographics (Darling-Hammond, 1998) and perpetuates the exclusion of their experiences in academic literature in favour of the experiences of those who have the privilege of being able to partake in these opportunities (Cooke & Khotari, 2001). This, unfortunately, is the oppressive nature of academia in action; I, the activist researcher, also play the role of the oppressive researcher. This is why it is important to remember that we all can simultaneously play the role of the oppressor and the oppressed, in all situations and institutions (Freire, 1970).

Additionally, it was not made known to me if participants incurred any additional costs or loss of funds because of their involvement in the study (e.g., higher than average internet bill, or lost wages because of time spent in the interview(s)). There was an implication that the usage of these resources (i.e., time and internet) was necessary for this study because, as mentioned above, the online nature of the study was made clear in the study's advertisements, I feel that it could have been stated more explicitly. That said, in future research, I would like to make the potential of these events occurring explicitly

clear to all participants, by way of including it in the informed consent form, so they can make a more informed choice regarding their involvement in future studies.

6.6.2. Methods and Sample

In qualitative research, smaller sample sizes are common because qualitative research is concerned with the quality of analysis, rather than the number of results (Omona, 2013). This research acknowledges that small, qualitative studies are not generalizable in a traditional sense, but argues that the lived experiences and stories of these six Indo-Caribbean women in STEM offer valuable insights related to the systemic barriers and challenges they have faced. The aim of my research was not to be generalizable; I intentionally chose a very specific demographic of people to include in the study because I was interested in their lived experiences, and not interested in the experiences of people outside of the chosen demographic. I wanted to create visibility and, therefore, validation of the experiences of Indo-Caribbean women in STEM within the literature. Thus, I chose to focus on Indo-Caribbean women in STEM only; my results are not meant to be generalizable to populations outside of this.

That said, the findings obtained in this study are not representative of *all* Indo-Caribbean women in STEM. For the purposes of this study, I focused on a few aspects of identity that have been marginalized: race, ethnicity, and gender. However, unfortunately, there are many aspects of identity that are also marginalized, such as sexuality, gender identity, physical and mental ability, age, religion, and class. Participants in this study did not disclose how those other aspects of their identities impacted their experiences as Indo-Caribbean women in STEM. This is not to say that the participants did not also face discrimination on the basis of these other intersections of identity; they very well may

have. However, those experiences were not disclosed because I did not ask the participants about them. I would like to note that, just like their multifaceted identities, the participants' potential experiences related to those other aspects of their identities cannot be separated from their gender-based, race-based, and ethnicity-based experiences; that is the main argument of intersectionality (Crenshaw, 1989). However, in the interest of keeping the goals and scope of this specific study attainable, I necessarily only focused on race, ethnicity, culture, and gender.

Regarding the participant verification of transcripts, it could be argued that letting the participants alter the transcripts allowed for the loss of data or the falsification of data (Resnik & Kennedy, 2010). However, this absolutely was not the case. The changes that were made to the transcripts in this study were either to: (a) provide corrections (e.g., the correct spelling of a village's name); or to (b) provide clarification (e.g., a participant made it clear that the "they" they were referring to in a block of text was "Indo-Caribbean women" and not "women, generally"). In the event that a participant did decide to omit large amounts of the transcript, that was something I was aware of in the planning of this study. From a researcher's lens, this can be seen as a risk, yes. However, just like the participants of this study, I am not a single-axis person. I am a researcher-activist, and my priority was empowering the participants of this study by involving them in the process through a participatory research methodology. Therefore, changes to the transcript were welcome, even if that meant reporting a different set of results that omitted the parts of the transcripts that participants removed.

6.6.3. Unanticipated Obstacles

One unanticipated obstacle that I encountered during the research process was the pool of participants that expressed interest in the study. All six of the participants that ultimately took place in the study are Indo-Guyanese. Therefore, there was no representation of other Indo-Caribbean identities that exist (e.g., Indo-Trinidadian, Indo-Surinamese, Indo-Jamaican, etcetera). It cannot be assumed that Indo-Guyanese women's experiences are generalizable across all Indo-Caribbean identities; this would be on par with lumping the whole of Indo-Caribbean identities in with the entirety of the South Asian identity. Therefore, there remains a need for further research regarding the experiences of Indo-Caribbean women in STEM.

6.7. Future Research

First and foremost, I would like to see the study's limitations addressed in future research. Regarding the overall research design, future research is needed to explore two things. First, further research can be done to explore the experiences of Indo-Caribbean women in STEM who do not utilize online social media communities in the ways explored in this research. This would allow for a richer understanding of what the presence versus absence of social media in the Indo-Caribbean women participants' lives would mean for their STEM identity development. Furthermore, this research would contribute to the, at the time of writing, relatively small and/or hard-to-locate body of literature regarding Indo-Caribbean women in STEM. Future research should also make sure to explicitly communicate the potential for incurring any additional costs or loss of funds because of their involvement in the study (see [Chapter 6.6.1. Overall Research Design](#)), so that participants can make the most informed choice regarding their

involvement in future studies. Lastly, future research should consider offering solutions to barriers that may prevent potential participants from being able to take part in the study. This will allow for the collection of data (i.e., participants' experiences) that reflect a wider variety of contexts (i.e., differing socioeconomic statuses and/or classes) within the community of Indo-Caribbean women in STEM.

Second, further research is needed to address the methods and sample of this study. While it was my intention to use qualitative methods in this research (see [Chapter 6.6.2. Methods and Sample](#)), future research can be done to address traditional quantitative concerns such as the replication and generalizability of results, as well as the loss of data through participant involvement in transcript verification. Additionally, given that all the participants in this study happened to be Indo-Guyanese, future research is needed to examine the experiences of a more diverse group of Indo-Caribbean women in STEM. Furthering this, I would like to see this research expanded to include increasingly specific experiences (i.e., the experiences of queer, transgender, or non-binary Indo-Caribbeans; Indo-Caribbeans with visible and/or invisible disabilities; and more) in STEM. Also, more research can be done to include the experiences of multi-racial Indo-Caribbeans (i.e., individuals who are both Indo- and Afro-Caribbean; individuals who have Indian, African, and Indigenous ancestry; and more). Again, little to no published literature of this nature was able to be located at the time of writing this thesis. It is important to represent these communities in literature, thus providing this seminal research provides the groundwork for future Indo-Caribbean researchers to continue this work and make a space for our resilient community at the table that we have historically been denied.

Generally, more intersectional, and anti-deficit analyses regarding BIWOC's STEM experiences in Canada are needed for several reasons. First, more intersectional, and anti-deficit research will allow us to better understand the barriers facing specific communities of BIWOC in STEM. This is the first step in problem-solving as potential solutions can only be created once problem areas are identified. Furthermore, the importance of taking an anti-deficit approach to this research is to prevent perpetuating the many existing deficit narratives of BIWOC, and BIPOC, generally, in STEM. This includes, but is not limited to, the framing of BIWOC in STEM as lacking the qualities (e.g., access, achievement, identity, power) needed to be successful in STEM. The findings of this study clearly indicate that the participants of this study did not feel they were lacking anything due to their Indo-Caribbean identities. Rather, the conceptualization they applied to their identities was anti-deficit in nature; they looked at the ways their identities contributed to their academic STEM successes. Problems arose, however, when participants' perceptions of their identities were not mirrored by the STEM community (i.e., they were perceived through a deficit lens by the STEM community). To prevent the perpetuation of this perception, I argue that future research regarding the experiences of BIWOC in STEM – and in all contexts – should be anti-deficit in nature. The research methodologies that guide future anti-deficit research will be context specific. However, my final recommendation provides commentary on the methods and methodologies that guided this research.

Finally, I advocate for the continued use of research as a tool for activism. Interestingly, the participants' recommendations were inspired by their experiences with mentorship – or the lack thereof – in STEM, and not necessarily based on their

knowledge of research-backed strategies to support STEM success among racialized students. However, despite not being experts in the literature relevant to this research, their recommendations aligned well with the existing literature's recommendations for improving BIWOC's STEM success and well-being; their insights are very impressive. I believe this showcases the immeasurable importance of including minoritized communities' voices in research (e.g., through anti-deficit perspectives; intersectional and equity frameworks; phenomenological, narrative, and participatory research methodologies). Though they may not be experts in a Western, academic, colonial sense (i.e., they may not be well versed in literature, or they may not be formally educated), they are the experts of their own experiences. Therefore, including their voice in research contexts allows for the potential collection of rich and nuanced insights and context that may positively contribute to study findings and implications and/or recommendations for future research.

In this chapter, I presented my discussion of the results shared in [Chapter 5.0. Results](#). I explained each of the results in the context of this study's research questions, as well as the existing literature (see [Chapter 2.0. Literature Review](#)), through the frameworks and perspectives discussed in [Chapter 3.0. Theoretical Framing](#). I also discussed the potential implications and limitations of this study, and suggestions for future research, theory, and practice. In the next chapter, I provide a summary of this research project and my closing remarks.

Chapter 7.0. Conclusions

The overall objective of this study was to explore how online activity supported the identity development of Indo-Caribbean women in STEM (science, technology, engineering, and mathematics) fields of education in Canada. I explored this question through the frameworks of intersectionality and equity, with an overarching anti-deficit perspective. I employed the methodologies of phenomenology, narrative, and participatory research through the use of qualitative methods such as semi-structured interviews, qualitative coding, and thematic content analysis. This research process resulted in a number of findings that provide insight into how online social media groups impacted six Indo-Caribbean women's STEM identity development throughout their STEM education and careers.

The first key finding was that the participants experienced little to no institutional support regarding many aspects of their STEM education, particularly when it came to their Indo-Caribbean identities. Specifically, the participants reported feeling: 1) they were underrepresented in STEM; 2) they were denied a sense of community in STEM; and 3) they experienced numerous identity-based negative experiences and microaggressions. The second key finding was that participants' online social media groups supported them in many ways their institutions could not. Participants' online social media groups supplemented participants' STEM education by filling certain gaps the participants felt they had regarding their institutional STEM education and experiences. Specifically, the participants reported that their online social media groups filled gaps in relation to the following: 1) Indo-Caribbean representation in STEM; 2) feeling a sense of community in STEM; and 3) identity-based empowerment in STEM.

The third finding was that participants believed that incorporating their racial, cultural, and ethnic identity into STEM education would strengthen their STEM identity development. Participants expressed that they felt deep connections to their Indo-Caribbean heritage, which they often turned to in order to find strength and resiliency to endure in all aspects of their lives, including their STEM education. However, participants reported feeling frustrated that the things they viewed as assets in their lives (i.e., their racial, cultural, and ethnic identities) were not only considered irrelevant in STEM but considered hindrances to participants' STEM ability and, resultantly, STEM success. Finally, the fourth finding was that participants shared a number of examples regarding the ways they believed online social media groups might support the STEM capital development of their Indo-Caribbean women members. Generally, they include (a) increasing the representation of Indo-Caribbean women in STEM, (b) creating opportunities for networking and community building among Indo-Caribbean women in STEM, and (c) providing resources and mentorship for Indo-Caribbean women in STEM. Generally, this study increases the visibility of Indo-Caribbean women in academic literature. Specifically, this study contributes the experiences of six Indo-Caribbean women in STEM to the existing body of literature regarding STEM identity development in racialized women. Additionally, these findings increase the representation of Canadian research in a body of research that is largely dominated by U.S. studies and contexts.

There were some limitations to my research pertaining to the [overall research design](#), [methods and sample](#), and [unanticipated obstacles](#). However, several recommendations for policy, practice, and future research were made to address these limitations, thereby improving the quality and robustness of future research, and to

improve the culture of STEM for Indo-Caribbean women in the field. They include providing more extracurricular “earn and learn” opportunities for URM to meaningfully engage in their major subject, while earning money to meet their financial needs (Chang et al., 2014, p. 571). Additionally, institutions should monitor the aspirations and success of URM in STEM to ensure that rates of STEM enrollment are comparable to rates of STEM degree completion (Chang et al., 2014, p. 571). Addressing discrepancies in rates of enrollment versus degree completion can include leveraging URM’s professional and/or clinical STEM degree aspirations to “hook” them into sciences early on in their studies, thereby broadening their knowledge and understanding about other potential careers for STEM graduates and encouraging them to persist towards their academic and career aspirations (Chang et al., 2014, p. 571).

I also recommend the use of internal reviews to investigate sources of inequities (i.e., policies, programs, supports, culture) within institutions, as solutions to equity issues can only be strategized once they are identified (Chang et al., 2014; Lane, 2016; Maltby et al., 2016). Solutions to common institutional barriers include: 1) hiring faculty and teaching staff that are better representative of their study body (DuBow et al., 2016; Posselt, 2018); 2) supporting the development of existing faculty and teaching staff’s knowledge regarding strategies needed to best support minoritized students, and providing the same training to incoming faculty and teaching staff (Fries-Britt et al., 2010; Nahapetian et al., 2019; Speed et al., 2019); and 3) developing anti-deficit supports and policies that focus on supporting students, rather than blaming them for factors beyond their control (ACDP, 2016; Hodari & Johnson, 2019; Samuelson & Litzler, 2016). Furthermore, strengthening the culture of STEM can be achieved through the

inclusion of ethnic, racial, and cultural education in STEM education to benefit all members of the STEM field (Emdin et al., 2021; Wong, 2015). Recommendations for future research include the continued use of (a) intersectional, and anti-deficit analyses regarding BIWOC's STEM experiences in Canada; and (b) of research as a tool for activism. Including participants' voices in research contexts allows for the potential collection of rich and nuanced insights and context that may positively contribute to study findings and implications and/or recommendations for future research.

Lastly, throughout the process of conducting this research, I have been better able to understand how my personal experiences in STEM have been shaped by my identity, specifically, how the people around me have perceived my identity. This journey has been empowering for me in that I am now able to see my identity for the source of strength that it is. Through this research, I have learned that I am more powerful than I know, and just because that power is not always recognized by the people and institutions around me, does not mean that it is any less real. I also spoke at the beginning of this thesis about this project being inspired by my desire to heal the harm inflicted upon me by the world of STEM and STEM education. Thus, in addition to contributing to academic literature regarding improving the retention, success, and well-being of BIWOC in STEM, it is my hope that this thesis will also inspire all those who have been harmed by oppressive systems to find healing in ways that are meaningful to them; may they remember their power.

Chapter 8.0. References

- AAPT Committee on Diversity in Physics. (2016). Statement on Fisher v. University of Texas. *The Physics Teacher*, 54(379), 326–328.
<https://doi.org/10.1119/1.4961190>
- Adamuti-Trache, M., & Andres, L. (2008). Embarking on and persisting in scientific fields of study: Cultural capital, gender, and curriculum along the science pipeline. *International Journal of Science Education*, 30(12), 1557–1584.
<https://doi.org/10.1080/09500690701324208>
- Adiredja, A. P. (2019). Anti-deficit narratives: Engaging the politics of research on mathematical sense making. *Journal for Research in Mathematics Education*, 50(4), 401-435. <https://doi.org/10.5951/jresematheduc.50.4.0401>
- Advisory Committee for GPRA Performance Assessment. (2009). *Report of the Advisory Committee for GPRA Performance Assessment, Report 09–68*. National Science Foundation. <https://www.nsf.gov/pubs/2009/nsf09068/nsf09068.pdf>
- Alcoff, L. (1991). The problem of speaking for others. *Cultural Critique*, 20, 5–32.
<https://doi.org/10.2307/1354221>
- Ali, S. R., McWhirter, E. H., & Chronister, K. M. (2005). Self-efficacy and vocational outcome expectations for adolescents of lower socioeconomic status: A pilot study. *Journal of Career Assessment*, 13(1), 40–58.
<https://doi.org/10.1177/1069072704270273>
- Alkholly, S., Gendron, F., Dahms, T., & Pontes Ferreira, M. (2015). Assessing student perceptions of Indigenous science co-educators, interest in STEM, and identity as

- a scientist: A pilot study. *Ubiquitous Learning: An International Journal*, 7(3–4), 41–51. <https://digitalcommons.wayne.edu/nfsfrp/14/>
- Allahar, A., & Varadarajan, T. (1994). Differential Crealization: East Indians in Trinidad and Guyana. *Indo-Caribbean Review*, 1(2), 123–140.
- American Academy of Pediatrics. (2012). Early childhood adversity, toxic stress, and the role of the pediatrician: Translating developmental science into lifelong health. *Pediatrics*, 129(1), Article e224-31. <https://doi.org/10.1542/peds.2011-2662>
- American Psychological Association. (2017, July). *Education and Socioeconomic Status Factsheet*. American Psychological Association. <https://www.apa.org/pi/ses/resources/publications/education>
- American Psychological Association. (2020). *Publication manual of the American Psychological Association 2020: The official guide to APA style* (7th ed.). American Psychological Association.
- Ampaw, F. D., & Jaeger, A. J. (2011). Understanding the factors affecting degree completion of doctoral women in the science and engineering fields. *New Directions for Institutional Research*, 2011(152), 59–73. <https://doi.org/10.1002/ir.409>
- Andalibi, N. (2016). Social media for sensitive disclosures and social support: The case of miscarriage. In *GROUP '16: Proceedings of the 19th International Conference on Supporting Group Work* (pp. 461–465). Association for Computing Machinery. <https://doi.org/10.1145/2957276.2997019>
- Anderson, E., & Kim, D. (2006). *Increasing the success of minority students in science and technology*. American Council of Education.

- Archer, L., Dawson, E., DeWitt, J., Seakins, A., & Wong, B. (2015). “Science Capital”:
A conceptual, methodological, and empirical argument for extending
Bourdieuian notions of capital beyond the arts. *Journal of Research in Science
Teaching*, 52(7), 922–948. <https://doi.org/10.1002/tea.21227>
- Archer, L., DeWitt, J., & Willis, B. (2014). Adolescent boys’ science aspirations:
Masculinity, capital, and power. *Journal of Research in Science Teaching*, 51(1),
1–30. <https://doi.org/10.1002/tea.21122>
- Aschbacher, P. R., Li, E., & Roth, E. J. (2010). Is science me? High school students’
identities, participation and aspirations in science, engineering, and medicine.
Journal of Research in Science Teaching, 47(5), 564–582.
<https://doi.org/10.1002/tea.20353>
- Asiedu, E. (2020, July 29). *Canadian universities must collect race-based data*.
Macleans. <https://www.macleans.ca/opinion/canadian-universities-must-collect-race-based-data/>
- Atwater, M. M., & Simpson, R. D. (1984). Cognitive and affective variables affecting
Black freshmen in science and engineering at a predominately white university.
School Science and Mathematics, 84(2), 100–112. <https://doi.org/10.1111/J.1949-8594.1984.TB09530.X>
- Baboolal, A.A. (2016). Indo-Caribbean immigrant perspectives on intimate partner
violence. *International Journal of Criminal Justice Sciences*, 11(2), 159–176.
<https://www.sascv.org/ijcjs/pdfs/baboolalijcjs2016vol11issu2.pdf>
- Backhouse, C., Harris, R., Michell, G., & Wylie, A. (1995). The chilly climate for faculty
women at Western: Postscript to the Backhouse Report. In *The Chilly Collective*

- (Ed.), *Breaking Anonymity: The Chilly Climate for Women Faculty* (pp. 96–132). Wilfrid Laurier University Press. <https://ssrn.com/abstract=2263352>
- Barman, R. K. (2020). Casteism and Caste Intolerance in India: A Study on Casteism of Contemporary West Bengal. *Contemporary Voice of Dalit*, 12(2), 165–180. <https://doi.org/10.1177/2455328X19898451>
- Barrow, M., Thomas, S., & Alvarado, C. (2016). ERSP: A structured CS research program for early–college students. In *ITiCSE '16: Proceedings of the 2016 ACM Conference on Innovation and Technology in Computer Science Education* (pp. 148–153). Association for Computing Machinery. <https://doi.org/10.1145/2899415.2899436>
- Bartlett, K., & O'Barr, J. (1990). The chilly climate on college campuses: An expansion of the "hate speech" debate. *Duke Law Journal*, 1990(3), 574–586. <https://doi.org/10.2307/1372556>
- Basit, T. (2010). *Conducting research in educational contexts*. Bloomsbury Publishing.
- Baumeister, R. F., & Leary, M. R. (1995). The need to belong: Desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin*, 117(3), 497–529.
- Beasley, M., & Fischer, M. (2012). Why they leave: The impact of stereotype threat on the attrition of women and minorities from science, math and engineering majors. *Social Psychology of Education*, 15, 427–448. <https://doi.org/10.1007/s11218-012-9185-3>
- Beede, D. N., Julian, T. A., Langdon, D., McKittrick, G., Khan, B., & Doms, M. E. (2011). Women in STEM: A gender gap to innovation. *U.S. Department of*

Commerce: Economics and Statistics Administration, 4(11), 1–11.

<https://dx.doi.org/10.2139/ssrn.1964782>

Bement, A. (2009). *Comments to the Advisory Committee for the GPRA Performance Assessment (AC/GPA)*. National Science Foundation.

<https://www.nsf.gov/pubs/2009/nsf09068/nsf09068.pdf>

Berry, J. W., & Hou, F. (2016). Immigrant acculturation and wellbeing in Canada.

Canadian Psychology/Psychologie Canadienne, 54(4), 254–264.

<https://doi.org/10.1037/cap0000064>

Beyer, S., Rynes, K., Perrault, J., Hay, K., & Haller, S. (2003). Gender differences in computer science students. In *Proceedings of the 34th SIGCSE Technical Symposium on Computer Science Education*. Association for Computing Machinery. <https://doi.org/10.1145/792548.611930>

Birbalsingh, F. (1997). *From pillar to post: The Indo-Caribbean diaspora*. Toronto, Ontario: TSAR Publications.

Blickenstaff, J. C. (2005). Women and science careers: Leaky pipeline or gender filter? *Gender and Education*, 17(4), 369–386.

<https://doi.org/10.1080/09540250500145072>

Blustein, D. L. (2013). The psychology of working: A new perspective for career development, counseling, and public policy. In D. L. Blustein (Ed.), *The Oxford Handbook of the Psychology of Working* (pp. 1–26). Lawrence Erlbaum Publishers. <https://doi.org/10.1093/oxfordhb/9780199758791.013.0001>

- Borrero, N. & Sanchez, G. (2017). Enacting culturally relevant pedagogy: Asset mapping in urban classrooms. *Teaching Education*, 28(3), 279–295.
<https://doi.org/10.1080/10476210.2017.1296827>
- Bottorff, J. L. (1994). Using videotaped recordings in qualitative research. In J. M. Morse (Ed.), *Critical Issues in Qualitative Research Methods* (pp. 244–261). SAGE Publications.
- Bourdieu, P. (1986). The forms of capital. In J. Richardson (Ed.), *Handbook of theory and research for the sociology of education* (pp. 241–258). Greenwood Press.
<https://www.socialcapitalgateway.org/sites/socialcapitalgateway.org/files/data/paper/2016/10/18/rbasicsbourdieu1986-theformsofcapital.pdf>
- Brahmia, S. W. (2008). Improving learning for underrepresented groups in physics for engineering majors. *American Institute of Physics Conference Proceedings*, 1064(1), 7–10. <https://doi.org/10.1063/1.3021279>
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101.
<http://dx.doi.org/10.1191/1478088706qp063oa>
- Breitsohl, J., Kunz, W. H., & Dowell, D. (2015). Does the host match the content? A taxonomical update on online consumption communities. *Journal of Marketing Management*, 31(9–10), 1040–1064.
<https://doi.org/10.1080/0267257X.2015.1036102>
- Brewer, R. (1993). Theorizing race, class, and gender: The new scholarship of Black feminist intellectuals and Black women’s labor. *Race, Gender & Class*, 6(2), 29–47. <https://www.jstor.org/stable/41674884>

- Brickhouse, N. W., Lowery, P., & Schultz, K. (2000). What kind of a girl does science? The construction of school science identities. *Journal of Research in Science Teaching*, 37(5), 441–458.
[https://onlinelibrary.wiley.com/doi/10.1002/\(SICI\)1098-2736\(200005\)37:5%3C441::AID-TEA4%3E3.0.CO;2-3](https://onlinelibrary.wiley.com/doi/10.1002/(SICI)1098-2736(200005)37:5%3C441::AID-TEA4%3E3.0.CO;2-3)
- Brickhouse, N. W., & Potter, J. T. (2001). Young women’s scientific identity formation in an urban context. *Journal of Research in Science Teaching*, 38(8), 965–980.
<https://doi.org/10.1002/tea.1041>
- Brosseau, L. & Dewing, M. (2018). *Canadian Multiculturalism*. Ottawa: Library of Parliament.
- Brown, B. (2010). *The gifts of imperfection: Let go of who you think you’re supposed to be and embrace who you are*. Hazelden Publishing.
- Brown, J. (2012). The current status of STEM education research. *Journal of STEM Education: Innovations & Research*, 13(5), 7–11.
<http://d20uo2axdbh83k.cloudfront.net/20130901/7ca371e278462072cb5a217576f32f05.pdf>
- Brown, L. A., & Strega, S. (Eds.). (2015). *Research as resistance: Revisiting critical, Indigenous, and anti-oppressive approaches* (2nd ed.). Canadian Scholars' Press.
- Browne, I., & Misra, J. (2003). The intersection of gender and race in the labor market. *Annual Review of Sociology*, 29(1), 487–513.
<https://doi.org/10.1146/annurev.soc.29.010202.100016>
- Buchmann, C., & DiPrete, T. D. (2006). The growing female advantage in college completion: The role of family background and academic achievement. *American*

Sociological Review, 71, 515–541.

<https://doi.org/10.1177%2F000312240607100401>

Burke, M., Kraut, R., & Williams, D. (2010). Social use of computer-mediated communication by adults on the autism spectrum. In *CSCW '10: Proceedings of the 2010 ACM conference on computer supported cooperative work* (pp. 425-434). Association for Computing Machinery.

<https://doi.org/10.1145/1718918.1718991>

Burke, P. J., & Stets, J. E. (2009). *Identity theory*. Oxford University Press, USA.

<https://doi.org/10.1093/acprof:oso/9780195388275.001.0001>

Bybee, R. W. (2008). Scientific literacy, environmental issues, and PISA 2006: The 2008 Paul F-Brandwein Lecture. *Journal of Science Education and Technology*, 17(6), 566–585. <http://dx.doi.org/10.1007/s10956-008-9124-4>

Calabrese Barton, A., Kang, H., Tan, E., O'Neill, T. B., Bautista-Guerra, J., & Brecklin, C. (2013). Crafting a future in science tracing middle school girls' identity work over time and space. *American Education Research Journal*, 50, 37–75.

<https://doi.org/10.3102%2F0002831212458142>

Calarco, J. M. (2020). *A Field Guide to Grad School: Uncovering the Hidden*

Curriculum. Princeton University Press.

Cambridge Dictionary. (2022, February 16). *REPRESENTATION* | meaning in the

Cambridge English Dictionary. Cambridge Dictionary.

<https://dictionary.cambridge.org/dictionary/english/representation>

Campbell, T., Rodriguez, L., Moss, D. M., Volin, J. C., Arnold, C., Cisneros, L., Chadwick, C., Dickson, D., Rubenstein, J. M., & Abebe, B. (2021).

Intergenerational community conservation projects, STEM identity authoring, and positioning: The cases of two intergenerational teams. *International Journal of Science Education, Part B*, 11(2), 174–190.

<https://doi.org/10.1080/21548455.2021.1923081>

Canadian Human Rights Commission. (2021, November 17). *What is discrimination?*

Canadian Human Rights Commission. <https://www.chrc-ccdp.gc.ca/en/about-human-rights/what-discrimination>

Cappellini, B., & Yen, D. A. (2016). A space of one's own: Spatial and identity liminality in an online community of mothers. *Journal of Marketing Management*, 32(13–14), 1260–1283. <http://dx.doi.org/10.1080/0267257X.2016.1156725>

Carbado, D. W., Crenshaw, K. W., Mays, V. M., & Tomlinson, B. (2013).

Intersectionality: Mapping the movements of a theory. *Du Bois Review: Social Science Research On Race*, 10(2), 303–312.

<https://doi.org/10.1017/S1742058X13000349>

Carlone, H., Haun-Frank, J., & Webb, A. (2011). Assessing equity beyond knowledge- and skills-based outcomes: A comparative ethnography of two fourth-grade reform-based science classrooms. *Journal of Research in Science Teaching*, 48(5), 459–485. <https://doi.org/10.1002/tea.20413>

Carlone, H. B. (2004). The cultural production of science in reform-based physics: Girls' access, participation, and resistance. *Journal of Research in Science Teaching*, 41(4), 392–414. <https://doi.org/10.1002/tea.20006>

Carlone, H. B., & Johnson, A. (2007). Understanding the science experiences of successful women of color: Science identity as an analytic lens. *Journal of*

Research in Science Teaching: The Official Journal of the National Association for Research in Science Teaching, 44(8), 1187–1218.

<https://doi.org/10.1002/tea.20237>

Carneiro, P., & Heckman, J. J. (2002). The evidence on credit constraints in post-secondary schooling. *The Economic Journal*, 112(482), 705–734.

<https://doi.org/10.1111/1468-0297.00075>

Castro, E. L. (2014). “Underprepared” and “at-risk”: Disrupting deficit discourses in undergraduate STEM recruitment and retention programming. *Journal of Student Affairs Research and Practice*, 51(4), 407–419. <https://doi.org/10.1515/jsarp-2014-0041>

[2014-0041](https://doi.org/10.1515/jsarp-2014-0041)

Catts, E. (2019, October 14). *The difference between "belonging" and "fitting in"*.

Ideapod. <https://ideapod.com/belonging-fitting-in/>

Caxaj, C. S., Chau, S., & Parkins, I. (2018). How racialized students navigate campus life in a mid-sized Canadian city: ‘thrown against a white background’ but ‘comfortable enough to laugh’. *Race Ethnicity and Education*, 24(4), 503–522.

<https://doi.org/10.1080/13613324.2018.1511528>

Ceglie, R. (2020). Science faculty’s support for underrepresented students: Building science sapital. *International Journal of Science and Mathematics Education*, 19, 661–679. <https://doi.org/10.1007/s10763-020-10090-w>

Chang, M. J., Sharkness, J., Hurtado, S., & Newman, C. B. (2014). What matters in college for retaining aspiring scientists and engineers from underrepresented racial groups. *Journal of Research in Science Teaching*, 51(5), 555–580.

<https://doi.org/10.1002/tea.21146>

- Chappell, A.L. (2000). Emergence of participatory methodology in learning difficulty research: Understanding the context. *British Journal of Learning Disabilities*, 28(1), 38–43. <https://doi.org/10.1046/j.1468-3156.2000.00004.x>
- Chavis, D. M., & Lee, K. (2015). What is community anyway? *Stanford Social Innovation Review*. <https://doi.org/10.48558/EJJ2-JJ82>
- Chavous, T. M., & Drotar, S. (2016). Identity, motivation, and resilience: The example of Black college students in science, technology, engineering, and mathematics. In J. T. DeCuir-Gunby & P. A. Schutz (Eds.), *Race and ethnicity in the study of motivation in education* (pp. 127–142). Routledge.
- Chemers, M. M., Zurbriggen, E., Syed, M., Goza, B. K., & Bearman, S. (2011). The role of efficacy and identity in science career commitment among underrepresented minority students. *Journal of Social Issues*, 67(3), 469–491. <https://doi.org/10.1111/j.1540-4560.2011.01710.x>
- Cho, S., K, C., & McCall, L. (2013). Toward a field of intersectionality studies: Theory, applications, and praxis. *Signs*, 38, 785–810. <https://doi.org/10.1086/669608>
- Cieciuch, J., & Topolewska, E. (2017). Circumplex of identity formation modes: A proposal for the integration of identity constructs developed in the Erikson–Marcia tradition. *Self and Identity*, 16(1), 37–61. <http://dx.doi.org/10.1080/15298868.2016.1216008>
- Clark-Parsons, R. (2018). Building a digital Girl Army: The cultivation of feminist safe spaces online. *New Media & Society*, 20(6), 2125–2144. <https://doi.org/10.1177/1461444817731919>

- Codjoe, H. M. (2007). The importance of home environment and parental encouragement in the academic achievement of African-Canadian youth. *Canadian Journal of Education*, 30(1), 137–156. <http://dx.doi.org/10.2307/20466629>
- Cohoon, J. M., & Aspray, W. (Eds.). (2008). *Women and information technology: Research on underrepresentation*. MIT Press.
- Cole, E. R. (2009). Intersectionality and research in psychology. *American Psychologist*, 64(3), 170–180. <https://doi.org/10.1037/a0014564>
- Collins, K. H. (2018). Confronting color-blind STEM talent development: Toward a contextual model for Black student STEM identity. *Journal of Advanced Academics*, 29(2), 143–168. <https://doi.org/10.1177/1932202X18757958>
- Collins, P. H. (1999). *Black feminist thought: Knowledge, consciousness and the politics of empowerment*. Routledge.
- Collins, P. H. (2015). Intersectionality's definitional dilemmas. *Annual Review of Sociology*, 41, 1–20. <https://www.annualreviews.org/doi/abs/10.1146/annurev-soc-073014-112142>
- Collins, P. H., & Bilge, S. (2016). *Intersectionality*. Malden: Polity Press.
- Collins, P. H., & Chepp, V. (2013). Intersectionality. In *The Oxford handbook of gender and politics* (pp. 1–36). Oxford Handbooks Online. <https://doi.org/10.1093/oxfordhb/9780199751457.013.0002>
- Combahee River Collective. (1995). A Black feminist statement. In B. Guy-Sheftall (Ed.), *Words of fire: An anthology of African-American feminist thought* (pp. 232–240). The New Press.

https://americanstudies.yale.edu/sites/default/files/files/Keyword%20Coalition_Research_Leadings.pdf

Committee on STEM Education. (2013). *Federal science, technology, engineering, and mathematics (STEM) education, 5-year strategic plan*. National Science and Technology Council.

https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/stem_strategic_plan_2013.pdf

Committee on Underrepresented Groups and the Expansion of the Science and Engineering Workforce Pipeline. (2011). *Expanding Underrepresented Minority Participation: America's Science and Technology Talent at the Crossroads*. The National Academies Press. <https://doi.org/10.17226/12984>

The Conference Board of Canada. (2011, July). *Canadian Income Inequality: Is Canada becoming more unequal?* The Conference Board of Canada.

<https://www.conferenceboard.ca/hcp/hot-topics/canInequality.aspx>

Cooke, B., & Kothari, U. (Eds.). (2001). *Participation: The new tyranny?* Zed Books.

[http://dx.doi.org/10.1016/S0738-0593\(02\)00022-6](http://dx.doi.org/10.1016/S0738-0593(02)00022-6)

Corneille, M., Lee, A., Allen, S., Cannady, J., & Guess, A. (2019). Barriers to the advancement of women of color faculty in STEM: The need for promoting equity using an intersectional framework. *Equality, Diversity and Inclusion: An International Journal*, 38(3), 328–348. <https://doi.org/10.1108/EDI-09-2017-0199>

Cornell University Diversity and Inclusion. (n.d.). *Sense of Belonging*. Cornell University Diversity and Inclusion. <https://diversity.cornell.edu/belonging/sense-belonging>

- Council of Ministers of Education, Canada. (2021, April 15). *Trends in STEM and BHASE graduates, 2010 to 2018*. Council of Ministers of Education, Canada.
https://www.cmec.ca/Publications/Lists/Publications/Attachments/420/STEM_BHASE_graduates_report_Final_EN.pdf
- Coursaris, C. K., & Ming, L. (2009). An analysis of social support exchanges in online HIV/AIDS self-help groups. *Computers in Human Behavior*, 25(4), 911–918.
<https://doi.org/10.1016/j.chb.2009.03.006>
- Cova, B., & Cova, V. (2002). Tribal marketing: The tribalisation of society and its impact on the conduct of marketing. *European Journal of Marketing*, 36(5–6), 595–620.
<https://doi.org/10.1108/03090560210423023>
- Crenshaw, K. (1989). Demarginalizing the intersection of race and sex: A Black feminist critique of antidiscrimination doctrine, feminist theory and antiracist politics. *University of Chicago Legal Forum*, 1989(1), 139–167.
<https://chicagounbound.uchicago.edu/uclf/vol1989/iss1/8>
- Crenshaw, K. (1991). Mapping the margins: Intersectionality, identity politics, and violence against women of color. *Stanford Law Review*, 43(6), 1241–1299.
<https://doi.org/10.2307/1229039>
- Cresswell-Yeager, T. J., & Whitaker, II, R. W. (2020). Using student-centered engagement in the classroom to develop cultural intelligence. In L. O. Tripp & R. M. Collier (Eds.), *Culturally responsive teaching and learning in higher education* (pp. 262–279). Information Science Reference.
<https://doi.org/10.4018/978-1-5225-9989-0.ch012>

- Creswell, J. W. (2003). *Research design: Qualitative, quantitative. and mixed methods Approaches* (2nd ed.). SAGE Publications.
- Croft, R. (2013). Blessed are the geeks: An ethnographic study of consumer networks in social media, 2006–2012. *Journal of Marketing Management*, 29(5–6), 545–561.
<https://doi.org/10.1080/0267257X.2013.787113>
- Daignault, A. (2020, July 14). *On origin stories*. The Brown Girl Diary.
<https://www.browngirl diary.com/post/on-origin-stories>
- Dainton, F. S. (1968). The Dainton report: An inquiry into the flow of candidates into science and technology. HMSO.
- Darling-Hammond, L. (1998, March 1). *Unequal opportunity: Race and education*. Brookings. <https://www.brookings.edu/articles/unequal-opportunity-race-and-education/>
- Davis, B., Wilkins-Yel, K., & White, F. (2020). Supporting STEM identity development among women of color through engagement in a transformative counterspace. *ICLS 2020 Proceedings*, 797–798. <https://doi.org/10.22318/ICLS2020.797>
- Davis, T. (2010). Third spaces or heterotopias? Recreating and negotiating migrant identity using online spaces. *Sociology*, 44(4), 661–677.
<https://doi.org/10.1177/0038038510369356>
- De Loof, A. (2018). Only two sex forms but multiple gender variants: How to explain? *Communicative & Integrative Biology*, 11(1), Article e1427399.
<https://doi.org/10.1080/19420889.2018.1427399>
- Denzin, N. K., & Lincoln, Y. S. (Eds.). (1994). *Handbook of Qualitative Research*. SAGE Publications.

- Department of Justice Canada. (2021, April 13). *The Canadian Charter of Rights and Freedoms*. Department of Justice Canada. <https://www.justice.gc.ca/eng/csjsjc/rfc-dlc/ccrf-ccd/>
- DeWall, C. N., & Bushman, B. J. (2011). Social acceptance and rejection: The sweet and the bitter. *Current Directions in Psychological Science*, 20(4), 256–260. <https://doi.org/10.1177/0963721411417545>
- Diemer, M. A., & Ali, S. R. (2009). Integrating social class into vocational psychology: Theory and practice implications. *Journal of Career Assessment*, 17(3), 247–265. <https://doi.org/10.1177/1069072706294528>
- Diemer, M. A., & Blustein, D. L. (2007). Vocational hope and vocational identity: Urban adolescents' career development. *Journal of Career Assessment*, 15(1), 98–118. <https://doi.org/10.1177/1069072706294528>
- Doerschuk, P., Bahrim, C., Daniel, J., Kruger, J., Mann, J., & Martin, C. (2016). Closing the gaps and filling the STEM pipeline: A multidisciplinary approach. *Journal of Science Education and Technology*, 25, 682–695. <https://doi.org/10.1007/s10956-016-9622-8>
- DuBow, W., Kaminsky, A., & Weidler-Lewis, J. (2016). Multiple factors converge to influence women's persistence in computing: A qualitative analysis. *Computing in Science & Engineering*, 19(3), 30–39. <https://doi.org/10.1109/RESPECT.2016.7836161>
- Dweck, C. S. (1999). *Self-theories: Their role in motivation, personality, and development*. Psychology Press.

- Elias, P., Jones, P., & McWhinnie, S. (2006). Representation of ethnic groups in chemistry and physics. *Royal Society of Chemistry and Institute of Physics*, 1–43. <https://www.iop.org/sites/default/files/2020-08/Rep-ethnic-groups-chem-phys.pdf>
- Ellwood-Lowe, M. E., Foushee, R., & Srinivasan, M. (2020). What causes the word gap? Financial concerns may systematically suppress child-directed speech. *Developmental Science*, 25(1), 1–16. <https://doi.org/10.1111/desc.13151>
- Emdin, C., Adjapong, E., & Levy, I. P. (2021). On science genius and cultural agnosia: Reality pedagogy and/as hip-hop rooted cultural teaching in STEM education. *The Educational Forum*, 85(4), 391–405. <https://doi.org/10.1080/00131725.2021.1957636>
- Erikson, E. H. (1968). *Identity: Youth and crisis*. WW Norton and Company.
- Esquinca, A., Mein, E., & Mucino, H. (2021). Latinx students' sense of belonging in engineering/computer science at an HSI. *American Society for Engineering Education*, 1–13. <https://peer.asee.org/36105>
- Estrada, M., Woodcock, A., Hernandez, P. R., & Schultz, P. W. (2011). Toward a model of social influence that explains minority student integration into the scientific community. *Journal of Educational Psychology*, 103(1), 206–222. <https://doi.org/10.1037/a0020743>
- Farrell, E. (2017). *Losing the plot: A hermeneutic phenomenological study of the nature and meaning of psychological distress amongst third level students in Ireland*. [Doctoral dissertation, Trinity College Dublin]. Semantic Scholar. <https://api.semanticscholar.org/CorpusID:149733751>

- Farrell, E. (2020). Researching lived experience in education: Misunderstood or missed opportunity? *International Journal of Qualitative Methods*, *19*, 1–8.
<https://doi.org/10.1177/1609406920942066>
- Faught, E. L., Williams, P. L., Willows, N. D., Asbridge, M., & Veugelers, P. J. (2017). The association between food insecurity and academic achievement in Canadian school-aged children. *Public Health Nutrition*, *20*(15), 2778–2785.
<https://doi.org/10.1017/S1368980017001562>
- Fink, A., Frey, R. F., & Solomon, E. D. (2020). Belonging in general chemistry predicts first-year undergraduates' performance and attrition. *Chemistry Education Research and Practice*, *21*(4), 1042–1062. <https://doi.org/10.1039/D0RP00053A>
- Finnie, R., & Mueller, R. E. (2008). The backgrounds of Canadian youth and access to post-secondary education: New evidence from the Youth in Transition Survey. In R. Finnie, R. E. Mueller, A. Sweetman, & A. Usher (Eds.), *Who Goes? Who Stays? What Matters? Accessing and Persisting in Post-secondary Education in Canada* (pp. 33–61). School of Policy Studies, Queen's University. :
<https://www.researchgate.net/publication/228651268>
- Flowers III, A. M., & Banda, R. (2016). Cultivating science identity through sources of self-efficacy. *Journal for Multicultural Education*, *10*(3), 405–417.
<https://doi.org/10.1108/JME-01-2016-0014>
- Folsom, D. P., Hawthorne, W., Lindamer, L., Gilmer, T., Bailey, A., Golshan, S., Garcia, P., Unützer, J., Hough, R., & Jeste, D. V. (2005). Prevalence and risk factors for homelessness and utilization of mental health services among 10,340 patients with serious mental illness in a large public mental health system. *The American*

Journal of Psychiatry, 162(2), 370–376.

<https://doi.org/10.1176/appi.ajp.162.2.370>

Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2012). *How to design and evaluate research in education* (8th ed.). McGraw-Hill.

Franzosi, R. (1998). Narrative analysis – Or why (and how) sociologists should be interested in narrative. *Annual Review of Sociology*, 24, 517–554.

<https://www.jstor.org/stable/223492>

Fraser, H., & Jarldorn, M. (2016). Narrative research and resistance: A cautionary tale. In L. Brown & S. Strega (Eds.), *Research as resistance* (2nd ed., pp. 153–176). Canadian Scholars Press.

Fraser, N. (1990). Rethinking the public sphere: A contribution to the critique of actually existing democracy. *Social Text*, 25(26), 56–80. <https://doi.org/10.2307/466240>

Frenette, M. (2007). Why are youth from lower-income families less likely to attend university? Evidence from academic abilities, parental influences, and financial constraints. *Analytical Studies Branch Research Paper Series*, 2007(295), 1–39. Statistics Canada.

<https://www150.statcan.gc.ca/n1/pub/11f0019m/11f0019m2007295-eng.htm>

Freire, P. (1970). *Pedagogy of the oppressed*. Herder and Herder.

<https://envs.ucsc.edu/internships/internship-readings/freire-pedagogy-of-the-oppressed.pdf>

Fries-Britt, S., Johnson, J., & Burt, B. (2013). Black students in physics: The intersection of academic ability, race, gender, and class. In T. L. Strayhorn (Ed.), *Living at the*

- intersections: Social identities and Black collegians* (pp. 21–39). Information Age Publishing.
- Friese, S., Soratto, J., & Pires, D. (2018). Carrying out a computer-aided thematic content analysis with ATLAS.ti. *IWMI Working Papers*, 18(2), 7–29.
<https://doi.org/10.17617/2.2582914>
- Friere, P. (1970). *Pedagogy of the Oppressed*. Herder and Herder.
<https://envs.ucsc.edu/internships/internship-readings/freire-pedagogy-of-the-oppressed.pdf>
- Garmire, L. X. (2021). Mentorship is not co-authorship: A revisit to mentorship. *Genome Biology*, 22(2), 1–3. <https://doi.org/10.1186/s13059-020-02226-6>
- Gasiewski, J. A., Eagan, M. K., Garcia, G. A., Hurtado, S., & Chang, M. J. (2012). From gatekeeping to engagement: A multicontextual, mixed method study of student academic engagement in introductory STEM courses. *Research in Higher Education*, 53, 229–261. <https://doi.org/10.1007/s11162-011-9247-y>
- George, Y. S., Neale, D. S., Van Horne, V., & Malcom, S. M. (2001, December 1). *In pursuit of a diverse science, technology, engineering, and mathematics workforce: Recommended research priorities to enhance participation by underrepresented minorities*. American Association for the Advancement of Science. https://www.informalscience.org/sites/default/files/AGEP_report.pdf
- Geertz, C. (1973). *The interpretation of cultures*. Hutchinson.
- Gilgun, J. F. (2005). “Grab” and good science: Writing up the results of qualitative research. *Qualitative Health Research*, 15(2), 256–262.
<https://doi.org/10.1177/1049732304268796>

- Godwin, A., Potvin, G., & Hazari, Z. (2014, June). *Do engineers beget engineers? Exploring connections between the engineering-related career choices of students and their families* [Paper presented at American Society for Engineering Education Annual Conference & Exposition]. Indianapolis, IN.
- Gorard, S., & Huat See, B. (2008). Is science a middle-class phenomenon? The SES determinants of 16–19 participation. *Research in Post-Compulsory Education*, 13(2), 217–226. <https://doi.org/10.1080/13596740802141345>
- Gordon, B. M. (2012). "Give a brotha a break!": The experiences and dilemmas of middle-class African American male students in white suburban schools. *Teachers College Record*, 114(5), 1–26. <https://doi.org/10.1177/016146811211400502>
- Gosine, K. (2007). Navigating the Canadian university system: An exploration of the experiences, motivations, and perceptions of a sample of academically accomplished Black Canadians. *Journal of Contemporary Issues in Education*, 2(1), 3–21. <https://doi.org/10.20355/C5QP47>
- Government of Canada. (2020, October 16). *Facts and figures: Discrimination and hate crime statistics*. Government of Canada. <https://www.canada.ca/en/canadian-heritage/campaigns/federal-anti-racism-secretariat/facts-figures.html>
- Government of Ontario. (n.d.). *Human Rights Code, RSO 1990, c. H.19 - Laws*. Government of Ontario. <https://www.ontario.ca/laws/statute/90h19>
- Grimes, N. K. (2013). The nanny in the schoolhouse: The role of femme-Caribbean identity in attaining success in urban science classrooms. *Cultural Studies of Science Education*, 8, 333–353. <https://doi.org/10.1007/s11422-012-9476-1>

- Grue, J. (2016). The problem with inspiration porn: A tentative definition and a provisional critique. *Disability and Society*, 31(6), 838–849.
<https://doi.org/10.1080/09687599.2016.1205473>
- Gutiérrez, R. (2002). Enabling the practice of mathematics teachers in context: Toward a new equity research agenda. *Mathematical Thinking and Learning*, 4(2–3), 145–187. https://doi.org/10.1207/S15327833MTL04023_4
- Gutiérrez, R. (2007). Context matters: Equity, success, and the future of mathematics education. In T. D. S. Lamberg & L. R. Wiest (Eds.), *29th Annual Conference of the North American Chapter of the International Group for the Psychology of Mathematics Education Proceedings, Exploring Mathematics Education in Context* (pp. 1–18). University of Nevada.
<http://www.pmena.org/pmenaproceedings/PMENA%2029%202007%20Proceedings.pdf>
- Gutiérrez, R. (2009). Framing equity: Helping students “play the game” and “change the game”. *Teaching for Excellence and Equity In Mathematics*, 1(1), 4–8.
<https://www.todos-math.org/assets/documents/TEEMv1n1excerpt.pdf>
- Gutiérrez, R. (2012). Embracing Nepantla: Rethinking "knowledge" and its use in mathematics teaching. *REDIMAT – Journal of Research in Mathematics Education*, 1(1), 29–56. <https://doi.org/10.4471/redimat.2012.02>
- Hagedorn, L. S., & Purnamasari, A. (2012). A realistic look at STEM and community colleges. *Community College Review*, 40(2), 145–164.
<https://doi.org/10.1177/0091552112443701>

- Haley, K. J., Jaeger, A. J., & Levin, J. S. (2014). The influence of cultural social identity on graduate student career choice. *Journal of College Student Development*, 55(2), 101–119. <https://doi.org/10.1353/csd.2014.0017>
- Hall, R. (2000). Videorecording as theory. In A. Kelly & R. A. Lesh (Eds.), *Handbook of research design in mathematics and science education* (pp. 647–664). Lawrence Erlbaum Associates.
- Hanson, S. L. (2004). African American women in science: Experiences from high school through the post-secondary years and beyond. *NWSA Journal*, 16(1), 96–115. <https://www.jstor.org/stable/4317036>
- Harper, S. R. (2010). An anti-deficit achievement framework for research on students of color in STEM. *New Directions for Institutional Research*, 148, 63–74. <https://doi.org/10.1002/ir.362>
- Hernandez, H. A., Ketcheson, M., Schneider, A., Ye, Z., Fehlings, D., Switzer, L., Wright, V., Bursick, S. K., Richards, C., & Graham, T.C. N. (2014, October). Design and evaluation of a networked game to support social connection of youth with cerebral palsy. In *ASSETS '14: The 16th International ACM SIGACCESS Conference on Computers and Accessibility* (pp. 161–168). Association for Computing Machinery. <https://doi.org/10.1145/2661334.2661370>
- Hernandez-Ramdwar, C. (2009). Caribbean students in the Canadian academy: We've come a long way? In F. Henry & C. Tator (Eds.), *Racism in the Canadian university: Demanding social justice, inclusion, and equity* (pp. 106–127). University of Toronto Press. <http://dx.doi.org/10.3138/9781442688926-005>

- Hinterberger, A. (2007). Feminism and the politics of representation: Towards a critical and ethical encounter with "others". *Journal of International Women's Studies*, 8(2), 74–83. <https://vc.bridgew.edu/jiws/vol8/iss2/7/>
- Hodari, A., & Johnson, A. (2019). Mitigating challenges faced by women of colour in physics. *Scientia*. https://www.scientia.global/wp-content/uploads/Hodari_Johnson/Hodari_Johnson.pdf
- hooks, b. (1981). *Ain't I a woman: Black women and feminism*. South End Press.
- Howard, T.C. (2003). Culturally Relevant Pedagogy: Ingredients for Critical Teacher Reflection. *Theory Into Practice*, 42(3), 195–202. <https://doi.org/205.211.181.105>
- Hughes, B. E., & Hurtado, S. (2013, November). *Investing in the future: Testing the efficacy of socialization within undergraduate engineering degree programs*. Paper presented at the Association for the Study of Higher Education Annual Conference, St Louis, MO. <https://www.heri.ucla.edu/nih/downloads/ASHE2013-Investing-in-the-Future.pdf>
- Hurtado, S., Cabrera, N. L., Lin, M. H., Arellano, L., & Espinosa, L. L. (2009). Diversifying science: Underrepresented student experiences in structured research programs. *Research in Higher Education*, 50(2), 189–214. <https://dx.doi.org/10.1007%2Fs11162-008-9114-7>
- Institute of Education Sciences. (2011, April). *Web tables—Postsecondary awards in science, technology, engineering, and mathematics, by state: 2001 and 2009*. National Center for Education Statistics. <http://nces.ed.gov/pubs2011/2011226.pdf>

- Ireland, D. T., Freeman, K. E., Winston-Proctor, C. E., DeLaine, K. D., McDonald Lowe, S., & Woodson, K. M. (2018). (Un)Hidden figures: A synthesis of research examining the intersectional experiences of Black women and girls in STEM education. *Review of Research in Education, 42*, 226–254.
<https://doi.org/10.3102/0091732X18759072>
- Jackson, P. W. (1968). *Life in Classrooms*. Teachers College Press.
- James, S., & Busia, A. (1993). *Theorizing Black feminisms: The visionary pragmatism of Black women*. Routledge.
- Jenkins, E. W., & Pell, R. G. (2006). “Me and the environmental challenges”: A survey of English secondary school students’ attitudes towards the environment. *International Journal of Science Education, 28*(7), 765–780.
<https://doi.org/10.1080/09500690500498336>
- Jeynes, W. H. (2003). A meta-analysis: The effects of parental involvement on minority children's academic achievement. *Education and Urban Society, 35*(2), 202–218.
<https://doi.org/10.1177%2F0013124502239392>
- Jin, Q. (2021). Supporting Indigenous students in science and STEM education: A systematic review. *Education Sciences, 11*(9), 1–15.
<https://doi.org/10.3390/educsci11090555>
- Johnson, A., Brown, J., Carlone, H., & Cuevas, A. K. (2011). Authoring identity amidst the treacherous terrain of science: A multiracial feminist examination of the journeys of three women of color in science. *Journal of Research in Science Teaching, 48*(4), 339–366. <https://doi.org/10.1002/tea.20411>

- Johnson, A., & Elliott, S. (2020). Culturally relevant pedagogy: A model to guide cultural transformation in STEM departments. *Journal of Microbiology & Biology Education*, 21(1), 1–12. <https://doi.org/10.1128/jmbe.v21i1.2097>
- Johnson, A., Ong, M., Ko, L. T., Smith, J., & Hodari, A. (2017). Common challenges faced by women of color in physics, and actions faculty can take to minimize those challenges. *The Physics Teacher*, 55(6), 356–360. <https://doi.org/10.1119/1.4999731>
- Kaplan, L. S., & Owings, W. A. (2013). Chapter 5: Establishing a student-centered learning culture. In *Culture re-boot: Reinvigorating school culture to improve student outcomes* (pp. 137–174). SAGE Publications. <https://dx.doi.org/10.4135/9781452277974.n5>
- Katz, S., Allbritton, D., Aronis, J., Wilson, C., & Soffa, M. L. (2006). Gender, achievement, and persistence in an undergraduate computer science program. *ACM SIGMIS Database: The DATABASE for Advances in Information Systems*, 37(4), 42–57. <https://doi.org/10.1145/1185335.1185344>
- Kaur, R. (2020, October 23). *Role of faculty mentorship in exploring students' perceptions of science identity while pursuing STEM courses and programs* [Doctoral dissertation, Aurora University]. ProQuest Dissertations Publishing. <http://search.proquest.com.uproxy.library.dc-uoit.ca/dissertations-theses/role-faculty-mentorship-exploring-students/docview/2470639794/se-2?accountid=14694>

- Kerr, N. L., & Levine, J. M. (2008). The detection of social exclusion: Evolution and beyond. *Group Dynamics, 12*(1), 39–52. <https://doi.org/10.1037/1089-2699.12.1.39>
- Khan, R., Apramian, T., Kang, J. H., Gustafson, J., & Sibbald, S. (2020). Demographic and socioeconomic characteristics of Canadian medical students: A cross-sectional study. *BMC Medical Education, 20*(151), 1–8. <https://doi.org/10.1186/s12909-020-02056-x>
- Kim, A. Y., Sinatra, G. M., & Seyranian, V. (2018). Developing a STEM identity among young women: A social identity perspective. *Review of Educational Research, 88*(4), 589–625. <https://doi.org/10.3102/0034654318779957>
- King Miller, B. A. (2015). Effective teachers: Culturally relevant teaching from the voices of Afro-Caribbean immigrant females in STEM. *SAGE Open, 5*(3), 1–14. <https://doi.org/0.1177/2158244015603427>
- Klawe, M., Whitney, T., & Simard, C. (2009). Women in computing – take 2. *Communications of the ACM, 52*(2), 68–76. <https://doi.org/10.1145/1461928.1461947>
- Kozinets, R. (1999). E-tribalized marketing? The strategic implications of virtual communities of consumption. *European Management Journal, 17*(3), 252–264. [https://doi.org/10.1016/S0263-2373\(99\)00004-3](https://doi.org/10.1016/S0263-2373(99)00004-3)
- Kozinets, R. (2010). *Netnography: Doing Ethnographic Research Online*. SAGE Publications.
- Krapp, A. (2002). An educational-psychological theory of interest and its relation to SDT. In E. L. Deci & R. M. Ryan (Eds.), *Handbook of self-determination*

research (pp. 405–427). University of Rochester Press.

<https://api.semanticscholar.org/CorpusID:148628895>

Ladson-Billings, G., & Tate, W. (1995). Toward a critical race theory of education.

Teachers College Record, 97(1), 47–68. [https://doi.org/10.4324/9781315709796-](https://doi.org/10.4324/9781315709796-2)

[2](#)

Laffier, J., Gadanidis, M., Hughes, J., & Miller, B. (2021). Youth’s relationship with

social media: Identity formation through self-expression and activism. In S.

Gennaro (Ed.), *Young people and social media: Contemporary children’s digital*

culture (pp. 91–108). Vernon Press.

Lane, L. (2014, September). 'Am I being heard?' *The 'voice of' students with disability in*

higher education: A literature review [Conference Paper Presented at Inclusive

Higher Education]. National and International Perspectives.

Lane, T. B. (2016). Beyond academic and social integration: Understanding the impact of

a STEM enrichment program on the retention and degree attainment of

underrepresented students. *CBE—Life Sciences Education*, 15(3), 1–13.

<https://doi.org/10.1187/cbe.16-01-0070>

Lather, P. (1986). Research as praxis. *Harvard Educational Review*, 56(3), 257–278.

<https://doi.org/10.17763/haer.56.3.bj2h231877069482>

Lave, J. (1992, April). *Learning as participation in communities of practice*. Paper

presented at the American Education Researchers Association Annual

Conference, San Francisco, CA.

- Lave, J. (1998). The culture of acquisition and the practice of understanding. In D. Kirshner & J. A. Whitson (Eds.), *Situated cognition* (pp. 17-36). Lawrence Erlbaum.
- Leander, K. M., & Sheehy, M. (Eds.). (2004). *Spatializing literacy research and practice*. Peter Lang Publishing.
- Lechuga, V. M. (2011). Faculty-graduate student mentoring relationships: Mentors' perceived roles and responsibilities. *Higher Education*, 62(6), 757–771.
<https://doi.org/10.1007/s10734-011-9416-0>
- Lee, J. S., & Bowen, N. K. (2006). Parent involvement, cultural capital, and the achievement gap among elementary school children. *American Educational Research Association Journal*, 43(2), 193–218.
<https://doi.org/10.3102%2F00028312043002193>
- Leggett-Robinson, P., Villa, B., & Davis, N. (2018). Cultivating STEM identity & belonging through civic engagement: Increasing student success (self-efficacy and persistence) for the two-year college STEM student. *Science Education and Civic Engagement: An International Journal*, 10(1), 23–34. <http://new.seceij.net/wp-content/uploads/2018/03/Leggett.pdf>
- Leggett-Robinson, P. M. (2020). Celebrating transformations through STEM storytelling. In P. M. Leggett-Robinson & B. C. Villa (Eds.), *Overcoming barriers for women of color in STEM fields: Emerging research and opportunities* (pp. 54–81). IGI Global. <https://doi.org/10.4018/978-1-7998-4858-5.ch003>

- Lehman, A. F., Kernan, E., Deforge, B. R., & Dixon, L. (2006). Effects of homelessness on the quality of life of persons with severe mental illness. *Psychiatric Services*, 46(9), 922–926. <https://doi.org/10.1176/ps.46.9.922>
- Levya, L. A. (2016). An intersectional analysis of Latin@ college women’s counter-stories in mathematics. *Journal of Urban Mathematics Education*, 9(2), 81–121. <http://dx.doi.org/10.21423/jume-v9i2a295>
- Lewis, K., Stout, J. G., Pollock, S. J., Finkelstein, N. D., & Ito, T. A. (2016). Fitting in or opting out: A review of key social-psychological factors influencing a sense of belonging for women in physics. *Physical Review Physics Education Research*, 12(2), Article 020110. <https://doi.org/10.1103/PhysRevPhysEducRes.12.020110>
- Li, Y., Wang, K., Xiao, Y., & Froyd, J. E. (2020). Research and trends in STEM education: A systematic review of journal publications. *International Journal of STEM Education*, 7(11), 1–16. <https://doi.org/10.1186/s40594-020-00207-6>
- Lincoln, Y. S., Lynham, S. A., & Guba, E. G. (2011). Paradigmatic Controversies, Contradictions, and Emerging Confluences. In N. K. Denzin & Y. S. Lincoln (Eds.), *The SAGE Handbook of Qualitative Research* (4th ed., pp. 163-188). SAGE Publications.
- Lindhahl, B. (2007, April). *A longitudinal study of student’s attitudes towards science and choice of career*. Paper presented at the 80th NARST International Conference, New Orleans, Louisiana. <https://api.semanticscholar.org/CorpusID:142038260>
- Lindemann, D., Britton, D., & Zundl, E. (2016). “I don’t know why they make it so hard here”: Institutional factors and undergraduate women’s STEM participation.

International Journal of Gender, Science and Technology, 8(2), 221–241.

<http://genderandset.open.ac.uk/index.php/genderandset/article/view/435/791>

Liu, S. N. C., Brown, S. E. V., & Sabat, I. E. (2019a). Patching the “leaky pipeline”:

Interventions for women of color faculty in STEM academia. *Archives of*

Scientific Psychology, 7(1), 32–39. <https://doi.org/10.1037/arc0000062>

Liu, X., Pan, M., & Li, J. (2019b). Does sharing your emotion make you feel better? An

empirical investigation on the association between sharing emotions on a virtual

mood wall and the relief of patients’ negative emotions. *Telemedicine and e-*

Health, 25(10), 987–995. <https://doi.org/10.1089/tmj.2017.0327>

Loefler, I. (2006). Let's be fair about equity and equality. *British Medical Journal*,

332(7543), 735. <https://doi.org/10.1136/bmj.332.7543.735-a>

Lord, S. M., Camacho, M. M., Layton, R. A., Long, R. A., Ohland, M. W., & Wasburn,

M. H. (2009). Who's persisting in engineering? A comparative analysis of female

and male Asian, Black, Hispanic, Native American, and White Students. *Journal of Women and Minorities in Science and Engineering*, 15(2), 167–190.

<https://doi.org/10.1615/JWomenMinorScienEng.v15.i2.40>

Lui, J., & Wang, J. (2021). Users’ intention to continue using online mental health

communities: Empowerment theory perspective. *International Journal of*

Environmental Research and Public Health, 18(18), 9427.

<https://doi.org/10.3390/ijerph18189427>

Ma, Y., & Liu, Y. (2017). Entry and degree attainment in STEM: The intersection of

gender and race/ethnicity. *Social Sciences*, 6(89), 1–17.

<https://doi.org/10.3390/socsci6030089>

- MacLure, M. (2009). Broken voices, dirty words. In A. Y. Jackson & L. A. Mazzei (Eds.), *Voice in qualitative inquiry: Challenging conventional, interpretive, and critical conceptions in qualitative research*. Routledge.
- Madge, C., & O'Connor, H. (2006). Parenting gone wired: Empowerment of new mothers on the Internet? *Social & Cultural Geography*, 7(2), 199–220.
<https://doi.org/10.1080/14649360600600528>
- Maffesoli, M. (1996). *The time of the tribes: The decline of individualism in mass society*. SAGE Publications.
- Malcolm, S. M., Hall, P. Q., & Brown, J. W. (1976). *The double bind: The price of being a minority woman in science*. American Association for the Advancement of Science Publications. <https://web.mit.edu/cortiz/www/Diversity/1975-DoubleBind.pdf>
- Malik, S. H., & Coulson, N. S. (2011). A comparison of lurkers and posters within infertility online support groups. *Computers in Nursing*, 29(10), 564–573.
<https://doi.org/10.1097/NCN.0b013e318224b31d>
- Malone, K. R., & Barabino, G. (2009). Narrations of race in STEM research settings: Identity formation and its discontents. *Science Education*, 93(3), 485–510.
<https://doi.org/10.1002/sce.20307>
- Maltby, J. L., Brooks, C., Horton, M., & Morgan, H. (2016). Long term benefits for women in a science, technology, engineering, and mathematics living-learning Community. *Learning Communities: Research & Practice*, 4(1), 1–17.
<https://files.eric.ed.gov/fulltext/EJ1112850.pdf>

- Mancini, T., Caricati, L., Panari, C., & Tonarelli, A. (2015). Personal and social aspects of professional identity: An extension of Marcia's identity status model applied to a sample of university students. *Journal of Vocational Behavior*, 89, 140–150. <http://dx.doi.org/10.1016/j.jvb.2015.06.002>
- Manthei, L. P. (2016). *Cutting the deficit: An examination of factors contributing to the success of Black males seeking doctoral degrees at a predominantly white institutions* [Doctoral dissertation, Louisiana State University]. LSU Digital Commons. https://digitalcommons.lsu.edu/cgi/viewcontent.cgi?article=1182&context=gradschool_dissertations
- Marcia, J. E. (1966). Development and validation of ego identity status. *Journal of Personality and Social Psychology*, 3, 551–558. <https://doi.org/10.1037/h0023281>
- Margolis, J. (2008). *Stuck in the Shallow End: Education, Race, and Computing*. MIT Press.
- Martin, D. B. (2009). Researching race in mathematics education. *Teachers College Record*, 111(2), 295–338. <https://doi.org/10.5951/jresematheduc.44.1.0316>
- Maulucci, M. S. (2013). Emotions and positional identity in becoming a social justice science teacher: Nicole's story. *Journal of Research in Science Teaching*, 50(4), 453–478. <https://doi.org/10.1002/tea.21081>
- Mazzei, L. A. (2007). *Inhabited silence in qualitative research: Putting poststructural theory to work*. Peter Lang Publishing.

- McCormack, A. (2009). Individuals with eating disorders and the use of online support groups as a form of social support. *CIN: Computers, Informatics, Nursing*, 28(1), 12–19. <https://doi.org/10.1097/NCN.0b013e3181c04b06>
- McGee, E. O. (2016). Devalued Black and Latino racial identities: A by-product of STEM college culture? *American Educational Research Journal*, 53(6), 1626–1662. <https://doi.org/10.3102/0002831216676572>
- McGee, E. O., & Martin, D. B. (2011). “You would not believe what I have to go through to prove my intellectual value!” Stereotype management among academically successful Black mathematics and engineering students. *American Educational Research Journal*, 48(6), 1347–1389. <https://doi.org/10.3102/0002831211423972>
- McInroy, L. B., & Craig, S. L. (2020). “It’s like a safe haven fantasy world”: Online fandom communities and the identity development activities of sexual and gender minority youth. *Psychology of Popular Media*, 9(2), 236–246. <http://dx.doi.org/10.1037/ppm0000234>
- McLaughlin, K. A., & Sheridan, M. A. (2016). Beyond cumulative risk: A dimensional approach to childhood adversity. *Current Directions in Psychological Science*, 25(4), 239–245. <https://doi.org/10.1177/0963721416655883>
- McLeod, S. A. (2015, October 24). *Stereotypes*. Simply Psychology. <https://www.simplypsychology.org/katz-braly.html>
- Mehta, B (2020). Jahaji-bahin feminism: A de-colonial Indo-Caribbean Consciousness. *South Asian Diaspora*, 12(2), 179–194. <https://doi.org/10.1080/19438192.2020.1765072>

- Mejia, J., Revelo, R., Villanueva, I., & Mejia, J. (2018). Critical theoretical frameworks in engineering education: An anti-deficit and liberative approach. *Education Sciences*, 8(158), 1–13. <https://doi.org/10.3390/educsci8040158>
- Mistry, R. S., Benner, A. D., Tan, C. S., & Kim, S. Y. (2009). Family economic stress and academic well-being among Chinese-American youth: The influence of adolescents' perceptions of economic strain. *Journal of Family Psychology*, 23(3), 279–290. <http://dx.doi.org/10.1037/a0015403>
- Mizell, S., & Brown, S. (2016). The current status of STEM education research, 2013–2015. *Journal of STEM Education: Innovations & Research*, 17(4), 52–56. <https://api.semanticscholar.org/CorpusID:53793438>
- Mo, P. K., & Coulson, N. S. (2014). Are online support groups always beneficial? A qualitative exploration of the empowering and disempowering processes of participation within HIV/AIDS-related online support groups. *International Journal of Nursing Studies*, 51(7), 983–993. <https://doi.org/10.1016/j.ijnurstu.2013.11.006>
- Morgan, P. L., Farkas, G., Hillemeier, M. M., & Maczuga, S. (2009). Risk factors for learning-related behavior problems at 24 months of age: Population-based estimates. *Journal of Abnormal Child Psychology*, 37(3), 401–413. <https://doi.org/10.1007/s10802-008-9279-8>
- Mueller, R. E. (2008). Access and persistence of students in Canadian post-secondary education: What we know, what we don't know, and why it matters (R. Finnie, R. E. Mueller, A. Sweetman, & A. Usher, Eds.). In *Who goes? Who stays? What*

matters? (pp. 33-61). McGill-Queen's University Press.

http://scholar.ulethbridge.ca/mueller/files/mesa.may_.2008.pdf

Nahapetian, A., Huynh, V., Ruvalcaba, O., Alviso, R., & Melara, G. (2019). Music as the icebreaker for learning to code. In K. M. Mack, K. Winter, & M. Soto (Eds.), *Culturally responsive strategies for reforming STEM higher education: Turning the TIDES on inequity* (pp. 217–228). Emerald Publishing Limited.

<https://doi.org/10.1108/978-1-78743-405-920191013>

Nash, D. (2009). Contingent, contested and changing: De-constructing Indigenous knowledge in a science curriculum resource from the South Coast of New South Wales. *The Australian Journal of Indigenous Education*, 38(S1), 25–33.

<https://doi.org/10.1375/S132601110000079X>

Nasir, N. (2016). Why should mathematics educators care about race and culture? *Journal of Urban Mathematics Education*, 9(1), 7–18.

<https://doi.org/10.21423/jume-v9i1a298>

Nasir, N. S., & Shah, N. (2011). On defense: African American males making sense of racialized narratives in mathematics education. *Journal of African American Males in Education*, 2(1), 24–45.

<https://bma.issuelab.org/resources/22931/22931.pdf>

Naslund, J. A., Aschbrenner, K. A., Marsch, L. A., & Bartels, S. J. (2016). The future of mental health care: Peer-to-peer support and social media. *Epidemiology and Psychiatric Sciences*, 25(2), 113–122.

<https://doi.org/10.1017/s2045796015001067>

National Academies of Sciences, Engineering, and Medicine. (2016). *Barriers and opportunities for 2-Year and 4-Year STEM degrees: Systemic change to support students' diverse pathways*. The National Academies Press.

<https://doi.org/10.17226/21739>

National Center for Education Statistics. (2008). *Percentage of high school dropouts among persons 16 through 24 years old (status dropout rate), by income level, and percentage distribution of status dropouts, by labor force status and educational attainment: 1970 through 2007*. National Center for Education Statistics. https://nces.ed.gov/programs/digest/d08/tables/dt08_110.asp

National Science Board. (2008). *Science and Engineering Indicators, 2008* (Vol. 1-2).

National Science Foundation. <https://wayback.archive-it.org/5902/20160210152939/http://www.nsf.gov/statistics/seind08/>

National Science Board. (2016). *Science and engineering indicators, 2016*. National Science Foundation.

<https://www.nsf.gov/statistics/2016/nsb20161/uploads/1/nsb20161.pdf>

National Science Foundation. (2019, March 8). *Table 9.7: Employed scientists and engineers, by ethnicity, race, occupation, highest degree level, and sex: 2017. Women, Minorities, and Persons with Disabilities in Science and Engineering: National Center for Science and Engineering Statistics | NSF 19-304*.

<https://nces.nsf.gov/pubs/nsf19304/data>

National Science Foundation. (2020, January 15). *The state of US science and engineering 2020*. National Center for Science and Engineering Statistics.

<https://nces.nsf.gov/pubs/nsb20201>

- NPR Staff. (2013, November 19). 'Coolie Woman' rescues indentured women from anonymity. NPR. <https://www.npr.org/2013/11/19/246154506/coolie-woman-rescues-indentured-women-from-anonymity>
- Ogbu, J. U. (2003). *Black American students in an affluent suburb: A study of academic disengagement*. Routledge.
- Ogbu, J. U., & Simons, H. D. (1998). Voluntary and involuntary minorities: A cultural ecological theory of school performance with some implications for education. *Anthropology and Education Quarterly*, 29(2), 155–188.
<https://www.jstor.org/stable/3196181>
- Ogunkola, B., & Samuel, D. (2011). Science teachers' and students' perceived difficult topics in the integrated science curriculum of lower secondary schools in Barbados. *World Journal of Education*, 1(2), 17–29.
<https://doi.org/10.5430/wje.v1n2p17>
- Ogunkola, B. J. (2012). Improving science, technology and mathematics students' achievement: Imperatives for teacher preparation in the Caribbean colleges and universities. *European Journal of Educational Research*, 1(4), 367–378.
<https://doi.org/10.12973/eu-jer.1.4.367>
- Omona, J. (2013). Sampling in qualitative research: Improving the quality of research outcomes in higher education. *Makerere Journal of Higher Education*, 4(2), 169–185. <http://dx.doi.org/10.4314/majohe.v4i2.4>
- Ong, M. (2005). Body projects of young women of color in physics: Intersections of gender, race, and science. *Social Problems*, 52(4), 593–617.
<https://doi.org/10.1525/sp.2005.52.4.593>

- Ong, M., Wright, C., Espinosa, L. L., & Orfield, G. (2011). Inside the double bind: A synthesis of empirical research on undergraduate and graduate women of color in science, technology, engineering, and mathematics. *Harvard Educational Review*, 81(2), 172–208. <https://doi.org/10.17763/haer.81.2.t022245n7x4752v2>
- Ontario Human Rights Commission. (2017). *Under suspicion: Concerns about racial profiling in education*. Ontario Human Rights Commission. <https://www.ohrc.on.ca/en/under-suspicion-concerns-about-racial-profiling-education>
- Ontario Ministry of Education. (2010). *Growing success: Assessment, evaluation and reporting in Ontario's schools: Covering grades 1 to 12*. Ministry of Education. <http://www.edu.gov.on.ca/eng/policyfunding/growsuccess.pdf>
- Oppland-Cordell, S. B. (2014). Urban Latina/o undergraduate students' negotiations of identities and participation in an emerging scholars calculus I workshop. *Journal of Urban Mathematics Education*, 7(1), 19–54. <https://doi.org/10.21423/jume-v7i1a213>
- Osborne, J., Simon, S., & Collins, S. (2003). Attitudes towards science: A review of the literature and its implications. *International Journal of Science Education*, 25(9), 1049–1079. <http://dx.doi.org/10.1080/0950069032000032199>
- Osborne-Gowey, J. (2014). What is social media? *Fisheries*, 39(2), 55. <http://dx.doi.org/10.1080/03632415.2014.876883>
- Outar, L. (2018). Touching the shores of home: Guyana, Indo-Caribbeanness, feminism, and return. *Cultural Dynamics*, 30(1–2), 52–58. <https://doi.org/10.1177/0921374017751772>

- Owusu-Bempah, A., & Bernard, W. T. (2021, April 6). *Opinion: Canada needs race-based data*. National Post. <https://nationalpost.com/opinion/opinion-canada-needs-race-based-data>
- Paik, S. J. (2004). Korean and US families, schools, and learning. *International Journal of Educational Research*, 41(1), 71–90. <https://doi.org/10.1016/j.ijer.2005.04.006>
- Pang, V. O., Han, P., & Pang, J. M. (2011). Asian American and Pacific Islander students: Equity and the achievement gap. *Educational Researcher*, 40(8), 378–389. <https://doi.org/10.3102/0013189X11424222>
- Parsons, E. C. (1997). Black high school females' images of the scientist: Expressions of culture. *Journal of Research in Science Teaching*, 34(7), 745–768.
- Patton, M. Q. (2002). Two decades of developments in qualitative inquiry: A personal, experiential perspective. *Qualitative Social Work*, 1(3), 261–283. <https://doi.org/10.1177/1473325002001003636>
- Patton, M. Q. (2015). *Qualitative research & evaluation methods: Integrating theory and practice* (4th ed.). SAGE Publications.
- Patton Davis, L., & Museus, S. D. (2019). Identifying and disrupting deficit thinking. *National Center for Institutional Diversity*. <https://medium.com/national-center-for-institutional-diversity/identifying-and-disrupting-deficit-thinking-cbc6da326995>
- Payton, F., & White, S. (2003). *Perceptions of chilly IT organizational contexts and their effect on the retention and promotion of women*. In *SIGMIS CPR '04: Proceedings of the 2004 SIGMIS conference on computer personnel research*:

Careers, culture, and ethics in a networked environment (pp. 108–113).

Association for Computing Machinery. <https://doi.org/10.1145/982372.982399>

Pedersen, S., & Smithson, J. (2013). Mothers with attitude – How the Mumsnet parenting forum offers space for new forms of femininity to emerge online. *Women's Studies International Forum*, 38, 97–106.

<https://doi.org/10.1016/j.wsif.2013.03.004>

Perna, L., Lundy-Wagner, V., Drezner, N. D., Gasman, M., Yoon, S., Bose, E., & Gary, S. (2009). The contribution of HBCUS to the preparation of African American women for STEM careers: A case study. *Research in Higher Education*, 50(1), 1–23. <https://doi.org/10.1007/s11162-008-9110-y>

Persadie, R. (2020). “Meh just realize I’s ah Coolie Bai”: Indo-Caribbean masculinities, chutney genealogies, and qoolie subjectivities. *Middle Atlantic Review of Latin American Studies*, 4(2), 56–86. <https://doi.org/10.23870/marlas.287>

Phillips, N., & Broderick, A. (2014). Has Mumsnet changed me? SNS influence on identity adaptation and consumption. *Journal of Marketing Management*, 30(9–10), 1039–1057. <https://doi.org/10.1080/0267257X.2014.927899>

Pinder, P. J. (2012). Afro-Caribbean and African American students, family factors, and the influence on science performance in the United States: The untold story. *Education*, 132(4), 725–738.

<https://link.gale.com/apps/doc/A297135675/AONE?u=googlescholar&sid=bookmark-AONE&xid=5876698c>

Plaza, D. (2004). Disaggregating the Indo- and African-Caribbean migration and settlement experience in Canada. *Canadian Journal of Latin American and*

Caribbean Studies, 29(57–58), 241–266.

<https://doi.org/10.1080/08263663.2004.10816858>

Polkinghorne, D. (1983). *Methodology for the Human Sciences: Systems of Inquiry*. State University of New York Press.

Pompili, M., Lester, D., Innamorati, M., Tatarelli, R., & Girardi, P. (2008). Assessment and treatment of suicide risk in schizophrenia. *Expert Review of Neurotherapeutics*, 8(1), 51–74. <https://doi.org/10.1586/14737175.8.1.51>

Posselt, J. (2018). Normalizing struggle: Dimensions of faculty support for doctoral students and implications for persistence and well-being. *The Journal of Higher Education*, 89(6), 988–1013. <https://doi.org/10.1080/00221546.2018.1449080>

Powell, A. B., Francisco, J. M., & Maher, C. (2003). An analytical model for studying the development of learners' mathematical ideas and reasoning using videotape data. *The Journal of Mathematical Behavior*, 22(4), 405–435. <http://dx.doi.org/10.1016/j.jmathb.2003.09.002>

Prescott, J., Rathbone, A. L., & Brown, G. (2020). Online peer to peer support: Qualitative analysis of UK and US open mental health Facebook groups. *Digital Health*, 6, 1–17. <https://doi.org/10.1177/2055207620979209>

Quinn, D. M., & Cooc, N. (2015). Science Achievement Gaps by Gender and Race/Ethnicity in Elementary and Middle School: Trends and Predictors. *Educational Researcher*, 44(6), 336–346. <http://www.jstor.org/stable/24571502>

Ragelienė, T. (2016). Links of adolescents identity development and relationship with peers: A systematic literature review. *Journal of the Canadian Academy of Child*

and Adolescent Psychiatry, 25(2), 97–105.

<https://pubmed.ncbi.nlm.nih.gov/27274745/>

Raman, S. (2014). Sense of belonging. In A. C. Michalos (Ed.), *Encyclopedia of quality of life and well-being research*. Springer Netherlands.

https://doi.org/10.1007/978-94-007-0753-5_2646

Resnik, D. B., & Kennedy, C. E. (2010). Balancing scientific and community interests in community-based participatory research. *Accountability in Research*, 17(4), 198–

210. <https://doi.org/10.1080/08989621.2010.493095>

Riegle-Crumb, C., & King, B. (2010). Questioning a white male advantage in STEM: Examining disparities in college major by gender and race/ethnicity. *Educational Researcher*, 39(9), 656–664. <https://doi.org/10.3102/0013189X10391657>

Researcher, 39(9), 656–664. <https://doi.org/10.3102/0013189X10391657>

Riegle-Crumb, C., King, B., & Irizarry, Y. (2019). Does STEM stand out? Examining racial/ethnic gaps in persistence across postsecondary fields. *Educational Researcher*, 48(3), 133–144. <https://doi.org/10.3102/0013189X19831006>

Researcher, 48(3), 133–144. <https://doi.org/10.3102/0013189X19831006>

Rincón, B. E., & Rodriguez, S. L. (2021). Latinx students charting their own STEM pathways: How community cultural wealth informs their STEM identities.

Journal of Hispanic Higher Education, 20(2), 149–163.

<https://doi.org/10.1177/1538192720968276>

Ringland, K. E. (2019). “Autosome”: Fostering an autistic identity in an online Minecraft community for youth with autism. *The 14th International iConference Proceedings*, 132–143. https://doi.org/10.1007/978-3-030-15742-5_12

Proceedings, 132–143. https://doi.org/10.1007/978-3-030-15742-5_12

- Roberts, D., & Jesudason, S. (2013). Movement intersectionality: The case of race, gender, disability, and genetic technologies. *Du Bois Review*, *10*(2), 313–328. <https://doi.org/10.1017/S1742058X13000210>
- Robinson, K. A., Perez, T., Carmel, J. H., & Linnenbrink-Garcia, L. (2019). Science identity development trajectories in a gateway college chemistry course: Predictors and relations to achievement and STEM pursuit. *Contemporary Educational Psychology*, *56*, 180–192. <https://doi.org/10.1016/j.cedpsych.2019.01.004>
- Robnett, R. D., Ruvalcaba, O., Goza, B. K., Chemers, M. M., & Syed, M. (2020). Turning points in the pursuit of STEM careers: A mixed-methods analysis focusing on women of color. In N. Abdelrahman, B. J. Irby, J. Bellenger, & B. Polnick (Eds.), *Girls and women of color in STEM: Their journeys in higher education* (pp. 181–200). Information Age Publishing.
- Rodgers, K. A. (2016). Retention versus persistence: A self-determination analysis of students underrepresented in STEM. In J. T. DeCuir-Gunby & P. A. Schutz (Eds.), *Race and ethnicity in the study of motivation in education* (pp. 46–59). Routledge.
- Rodriguez, S. L., Bukoski, B. E., Cunningham, K. J., & Jones, A. (2020). Critiquing oppression and desiring social justice: How undergraduate Latina students in STEM engage in acts of resistance. *Journal of Women and Gender in Higher Education*, *13*(3), 251–267. <https://doi.org/10.1080/26379112.2020.1838297>

- Rodriguez, S. L., Cunningham, K. J., & Jordan, A. (2017). STEM identity development for Latinas: The role of self- and outside recognition. *Journal of Hispanic Higher Education, 18*(5), 1–19. <https://doi.org/10.1177/1538192717739958>
- Roopnarine, L. (2006). Indo-Caribbean social identity. *Caribbean Quarterly, 52*(1), 1–11. <https://www.jstor.org/stable/40654531>
- Roopnarine, L. (2014). Book review: Bindi: Multifaceted lives of Indo-Caribbean women. *Journal of International Women's Studies, 15*(1), 228–229. <http://vc.bridgew.edu/jiws/vol15/iss1/17>
- Roopnarine, L. (2015). East Indian women and leadership roles during indentured servitude in British Guiana, 1838–1920. *Journal of International Women's Studies, 16*(3), 174–185. <http://vc.bridgew.edu/jiws/vol16/iss3/12>
- Roschelle, J., & Lesh, R. A. (2000). Choosing and using video equipment for data collection. In A. E. Kelly (Ed.), *Handbook of Research Design in Mathematics and Science Education* (1st ed., pp. 709–731). Routledge. <https://www.researchgate.net/publication/269408248>
- Rouso, H. (2013). *Don't call me inspirational: A disabled feminist talks back*. Temple University Press.
- Ruiz, J. P., Gurel, P., Olds, W. H., Bankston, A., & McDowell, G. S. (2019). Inspiring and ethical mentorship in STEM: A meeting highlighting need for engagement, incentives, and accountability. *PeerJ Preprints, 7*, Article e27474v1. <https://doi.org/10.7287/peerj.preprints.27474v1>
- Salkind, N. J. (2010). *Encyclopedia of research design*. SAGE Publications. <http://dx.doi.org/10.4135/9781412961288>

- Samuelson, C. C., & Litzler, E. (2016). Community cultural wealth: An assets-based approach to persistence of engineering students of color. *Journal of Engineering Education, 105*(1), 93–117. <https://doi.org/10.1002/jee.20110>
- Sandler, B., & Hall, R. M. (1986, October). *The campus climate revisited: Chilly for women faculty, administrators, and graduate students*. Association of American Colleges. <http://files.eric.ed.gov/fulltext/ED282462.pdf>
- Santos, S. J., & Reigadas, E. (2002). Latinos in higher education: An evaluation of a university faculty mentoring program. *Journal of Hispanic Higher Education, 1*(1), 40–50. <https://doi.org/10.1177/1538192702001001004>
- Schlesinger, J. (2019, November 8). *The high price of higher learning*. The Globe and Mail. <https://www.theglobeandmail.com/featured-reports/article-the-high-price-of-higher-learning/>
- Schmidt, H. G. (2000). Assumptions underlying self-directed learning may be false. *Medical Education, 34*, 243–245. <https://doi.org/10.1046/j.1365-2923.2000.0656a.x>
- Seiler, N. (2003). Identifying racial privilege: Lessons from critical race theory and the law. *The American Journal of Bioethics, 3*(2), 24–25. <https://doi.org/10.1162/152651603766436153>
- Settles, I. H. (2006). Use of an intersectional framework to understand Black women's racial and gender identities. *Sex Roles, 54*, 589–601. <https://doi.org/10.1007/s11199-006-9029-8>
- Settles, I. H., O'Connor, R. C., & Yap, S. C. (2016). Climate perceptions and identity interference among undergraduate women in STEM: The protective role of

gender identity. *Psychology of Women Quarterly*, 40(4), 488–503.

<https://doi.org/10.1177/0361684316655806>

Shaikh, K. (2000). Science, technology and mathematics education: A global perspective.

Connect, 25(3–4), 1–28.

<https://unesdoc.unesco.org/ark:/48223/pf0000146293.locale=en>

Sherry, M., Thomas, P., & Chui, W. H. (2010). International students: A vulnerable student population. *Higher Education*, 60(1), 33–46.

<https://doi.org/10.1007/s10734-009-9284-z>

Siisiäinen, M. (2008). Symbolic power as a critical concept. In J. Houtsonen & A.

Antikainen (Eds.), *Symbolic power in cultural contexts: Uncovering social reality*

(pp. 11–22). Brill. https://doi.org/10.1163/9789087902667_003

Singh, S. (2019, August 12). *Equity in math education: It is a journey not a destination.*

Sunil Singh. <https://sunilsingh-42118.medium.com/equity-in-math-education-it-is-a-journey-not-a-destination-3cd34ca90ff6>

Soe, L., & Yakura, E. K. (2008). What's wrong with the pipeline? Assumptions about gender and culture in IT Work. *Women's Studies*, 37(3), 176–201.

<https://doi.org/10.1080/00497870801917028>

Solórzano, D., Villalpando, O., & Mitchell, T. (1998). Critical race theory, marginality, and the experience of minority students in higher education. In C. Torres (Ed.),

Emerging issues in the sociology of education: Comparative perspectives (pp.

211–224). State University of New York Press.

<https://www.jstor.org/stable/2696265>

- Sparks, D. M. (2017). Navigating STEM-worlds: Applying a lens of intersectionality to the career identity development of underrepresented female students of color. *Journal for Multicultural Education*, *11*(3), 162–175.
<https://doi.org/10.1108/JME-12-2015-0049>
- Speed, J., Pair, D. L., Zargham, M., Yao, Z., & Franco, S. (2019). Changing faculty culture to promote diversity, equity, and inclusion in STEM education. In K. M. Mack, K. Winter, & M. Soto (Eds.), *Culturally responsive strategies for reforming STEM higher education: Turning the TIDES on Inequity* (pp. 53–72). Emerald Publishing Limited.
- Stalker, K. (1998). Some ethical and methodological issues in research with people with learning difficulties. *Disability and Society*, *13*(1), 5–19.
<https://doi.org/10.1080/09687599826885>
- Statista Research Department. (2022, January 6). *Education in Canada - Statistics & facts*. Statista. https://www.statista.com/topics/2863/education-in-canada/#topicHeader_wrapper
- Statistics Canada. (2017, November 29). *Is field of study a factor in the earnings of young bachelor's degree holders?* Statistics Canada.
<https://www12.statcan.gc.ca/census-recensement/2016/as-sa/98-200-x/2016023/98-200-x2016023-eng.pdf>
- Statistics Canada. (2022a, January 7). *Table: 14-10-0335-01, Labour force characteristics by occupation, annual*. Statistics Canada.
<https://www150.statcan.gc.ca/t1/tb11/en/tv.action?pid=1410033501>

- Statistics Canada. (2022b, January 7). *Table: 14-10-0340-01, Employee wages by occupation, annual*. Statistics Canada.
<https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1410034001>
- Steele, C. M. (1992, April). *Race and the schooling of Black Americans*. The Atlantic.
<https://www.theatlantic.com/magazine/archive/1992/04/race-and-the-schooling-of-black-americans/306073/>
- Steele, C. M. (1997). A threat in the air: How stereotypes shape intellectual identity and performance. *American Psychologist*, 52(6), 613–629.
<https://doi.org/10.1037/0003-066x.52.6.613>
- Stets, J. E., & Burke, P. J. (2000). Identity theory and social identity theory. *Social Psychology Quarterly*, 63(3), 224–237. <https://doi.org/10.2307/2695870>
- Strauss, A., & Corbin, J. (1998). *Basics of qualitative research: Techniques and procedures for developing grounded theory* (2nd ed.). SAGE Publications.
- Strauss, V. (2016, May 10). *The problem with teaching “grit” to poor kids? They already have it. Here’s what they really need*. The Washington Post.
<https://www.washingtonpost.com/news/answer-sheet/wp/2016/05/10/the-problem-with-teaching-grit-to-poor-kids-they-already-have-it-heres-what-they-really-need/>
- Strayhorn, T. L. (2010). The role of schools, families, and psychological variables on math achievement of Black high school students. *High School Journal*, 93(4), 177–194. <https://www.jstor.org/stable/40865058>

- Subrahmanian, R. (2005). Gender equality in education: Definitions and measurements. *International Journal of Educational Development*, 25(4), 395–407.
<https://doi.org/10.1016/j.ijedudev.2005.04.003>
- Tai, R. H., Liu, C. Q., Maltese, A. V., & Fan, X. (2006). Planning early for careers in science. *American Association for the Advancement of Science*, 312(5777), 1143–1144. <https://www.jstor.org/stable/3846239>
- Tate, E. D., & Linn, M. C. (2005). How does identity shape the experiences of women of color engineering students? *Journal of Science Education and Technology*, 14, 483–493. <https://doi.org/10.1007/s10956-005-0223-1>
- Taylor, D. (2009). *The environment and the people, 1600s-1900s: Disorder, inequality, and social change*. Duke University Press.
- Tobias, S. (1990). *They're not dumb, they're different: Stalking the second tier*. Research Corporation.
- Tonso, K. L. (1999). Engineering gender-gendering engineering: A cultural model for belonging. *Journal of Women and Minorities in Science and Engineering*, 5, 365–405. <https://doi.org/10.1615/JWomenMinorScienEng.v5.i4.60>
- Tonso, K. L. (2006). Student engineers and engineer identity: Campus engineer identities as figured world. *Cultural Studies in Science Education*, 1, 273–307.
<https://doi.org/10.1007/s11422-005-9009-2>
- Travis, R. (2013). Rap music and the empowerment of today's youth: Evidence in everyday music listening, music therapy, and commercial aap Music. *Child and Adolescent Social Work Journal*, 30, 139–167. <https://doi.org/10.1007/s10560-012-0285-x>

- Traweek, S. (1988). *Beamtimes and Lifetimes: The World of High Energy Physicists*. Harvard University Press.
- Turnbull, S. M., Locke, K., Vanholsbeeck, F., & O’Neale, D. R. (2019). Bourdieu, networks, and movements: Using the concepts of habitus, field and capital to understand a network analysis of gender differences in undergraduate physics. *PLoS ONE*, *14*(9), 1–28. <https://doi.org/10.1371/journal.pone.0222357>
- Uden-Kraan, C. V., Drossaert, C., Taal, E., Seydel, E. R., & van de Laar, M.A.F.J. (2008). Self-reported differences in empowerment between lurkers and posters in online patient support groups. *Journal of Medical Internet Research*, *10*(2), Article e18. <https://doi.org/10.2196/jmir.992>
- Uden-Kraan, C. V., Drossaert, C., Taal, E., Seydel, E. R., & van de Laar, M.A.F.J. (2009). Participation in online patient support groups endorses patients’ empowerment. *Patient Education and Counseling*, *74*(1), 61–69. <https://doi.org/10.1016/j.pec.2008.07.044>
- Uden-Kraan, C. V., Drossaert, C., Taal, E., Shaw, B. R., Seydel, E. R., & van de Laar, M.A.F.J. (2008). Empowering processes and outcomes of participation in online support groups for patients with breast cancer, arthritis, or fibromyalgia. *Qualitative Health Research*, *18*(3), 405–417. <https://doi.org/10.1177/1049732307313429>
- Ulriksen, L., Madsen, L. M., & Holmegaard, H. T. (2010). What do we know about explanations for drop out/opt out among young people from STM higher education programmes? *Studies in Science Education*, *46*(2), 209–244. <https://doi.org/10.1080/03057267.2010.504549>

- Underwood, M., & Olsen, R. (2019). 'Manly tears exploded from my eyes, lets feel together brahs': Emotion and masculinity within an online body building community. *Journal of Sociology*, 55(1), 90–107.
<https://doi.org/10.1177/1440783318766610>
- Valencia, R. R. (2010). *Dismantling contemporary deficit thinking: Educational thought and practice*. Routledge.
- The WAC Clearinghouse. (2022). *Generalizability and Transferability*. The WAC Clearinghouse.
<https://wac.colostate.edu/resources/writing/guides/gentrans/#citation>
- Walberg, H. J. (1984). Improving the productivity of America's schools. *Educational Leadership*, 41(8), 19–27.
- Wang, D. B. (2004). Family background factors and mathematics success: A comparison of Chinese and US students. *International Journal of Educational Research*, 41(1), 40–54. <https://doi.org/10.1016/j.ijer.2005.04.013>
- Wang, Y., Yu, Q., & Fesenmaier, D. R. (2002). Defining the virtual tourist community: Implications for tourism marketing. *Tourism Management*, 23, 407–417.
[https://doi.org/10.1016/S0261-5177\(01\)00093-0](https://doi.org/10.1016/S0261-5177(01)00093-0)
- Wasburn, M., & Miller, S. (2006). Still a chilly climate for women students in technology: A case study. In M. F. Fox, D. G. Johnson, & S. V. Rosser (Eds.), *Women, gender, and technology* (pp. 60–79). University of Illinois Press.
- Wegner, E. (1998). *Communities of practice: Learning, meaning, and identity*. Cambridge University Press.

- Wesselmann, E. D., Cardoso, F. D., Slater, S., & Williams, K. D. (2012). To be looked at as though air: Civil attention matters. *Psychological Science*, 23(2), 166–168. <https://doi.org/10.1177/0956797611427921>
- Whitehead, K. (2016). Motherhood as a gendered entitlement: Intentionality, “othering,” and homosociality in the online infertility community. *The Canadian Review of Sociology*, 53(1), 94–122. <https://doi.org/10.1111/cars.12093>
- Wigfield, A., & Wagner, A. L. (2005). Competence, motivation, and identity development during adolescence. In A. J. Elliot, & C. S. Dweck (Eds.), *Handbook of competence and motivation, second edition: Theory and application* (pp. 222–239). Guilford Publications.
- Wiggan, G. (2008). From opposition to engagement: Lessons from high achieving African American students. *The Urban Review*, 40(4), 317–349. <https://doi.org/10.1007/s11256-007-0067-5>
- Williams, D. K. (2019). *An anti-deficit approach to the study of persistence: Factors influencing persistence among Black males attending community college* [Doctoral dissertation, Governors State University]. OPUS. <https://opus.govst.edu/capstones/373>
- Williams, J. C., Phillips, K. W., & Hall, E. V. (2016). Tools for change: Boosting the retention of women in the STEM pipeline. *Journal of Research in Gender Studies*, 6(1), 11–75. <https://doi.org/10.22381/jrgs6120161>
- Winston, J. A. (1991). Mirror, mirror on the wall: Title VII, Section 1981, and the intersection of race and gender in the Civil Rights Act of 1990. *California Law Review*, 79, 775–805. <https://doi.org/10.2307/3480835>

- Winzelberg, A. (1997). The analysis of an electronic support group for individuals with eating disorders. *Computers in Human Behavior*, *13*(3), 393–407.
[https://doi.org/10.1016/S0747-5632\(97\)00016-2](https://doi.org/10.1016/S0747-5632(97)00016-2)
- Wladis, C., Hachey, A. C., & Conway, K. M. (2015). The representation of minority, female, and non-traditional STEM majors in the online environment at community colleges: A nationally representative study. *Community College Review*, *43*(1), 89–114. <https://doi.org/10.1177/0091552114555904>
- Wofford, A. M., Griffin, K. A., & Roksa, J. (2021). Unequal expectations: First-generation and continuing-generation students' anticipated relationships with doctoral advisors in STEM. *Higher Education*, *82*, 1013–1029.
<https://doi.org/10.1007/s10734-021-00713-8>
- Womack, V. Y., Wood, C. V., House, S. C., Quinn, S. C., Thomas, S. B., McGee, R., & Byars-Winston, A. (2020). Culturally aware mentorship: Lasting impacts of a novel intervention on academic administrators and faculty. *PLoS ONE*, *15*(8), Article e0236983. <https://doi.org/10.1371/journal.pone.0236983>
- Wong, B. (2015). Careers "from" but not "in" science: Why are aspirations to be a scientist challenging for minority ethnic students? *Journal of Research in Science Teaching*, *52*(7), 979–1002. <https://doi.org/10.1002/tea.21231>
- Wong, B. (2016). Minority ethnic students and science participation: A qualitative mapping of achievement, aspiration, interest and capital. *Research in Science Education*, *46*(1), 113–127. <https://doi.org/10.1007/s11165-015-9466-x>

- Yosso, T. J. (2005). Whose culture has capital? A critical race theory discussion of community cultural wealth. *Race, Ethnicity and Education*, 8(1), 69–91. <https://doi.org/10.1080/1361332052000341006>
- Zavala, M. & Hand, V. (2017). Conflicting narratives of success in mathematics and science education: Challenging the achievement-motivation master narrative. *Race Ethnicity and Education*, 22(5), 1–19. <https://doi.org/10.1080/13613324.2017.1417251>
- Zevenbergen, R. (2002). Changing contexts in tertiary mathematics: Implications for diversity and equity. In *The teaching and learning of mathematics at university level* (Vol. 7, pp. 13–26). Kluwer Academic Publishers. https://doi.org/10.1007/0-306-47231-7_2
- Ziebland, S., & Wyke, S. (2012). Health and illness in a connected world: How might sharing experiences on the internet affect people’s health? *The Milbank Quarterly*, 90(2), 219–249. <https://doi.org/10.1111/j.1468-0009.2012.00662.x>

Appendices

Appendix A – Social Media Groups



List of Organizations

@coolie.women: <https://www.instagram.com/coolie.women/>

@lotustoronto1: <https://www.instagram.com/lotustoronto1/>

@tamarindbredren: <https://www.instagram.com/tamarindbredren/>

@browngirlrevolt: <https://www.instagram.com/browngirlrevolt/>

@thebgdiaries: <https://www.instagram.com/thebgdiaries/>

@thecoconutcollective_stories:
https://www.instagram.com/thecoconutcollective_stories/

@indenturedandremembered: <https://www.instagram.com/indenturedandremembered/>

@brukout.media: <https://www.instagram.com/brukout.media/>

@routedbyourstories: <https://www.instagram.com/routedbyourstories/>

@icaribbeanwomen: <https://www.instagram.com/icaribbeanwomen/>

Appendix B – Letter to Social Media Groups



[Date]

Dear moderators of [social media group's name],

My name is Keisha Deoraj and I am a member of [name of social media group]. I am writing to you today to request assistance with a thesis project I am conducting as part of my Master's degree in the Faculty of Education at Ontario Tech University. The title of my research project is "Online Identity Development of Coolie Womxn in STEM", which has been reviewed and received ethics clearance through the Ontario Tech University Research Ethics Board [insert REB assigned #] on [insert date].

The purpose of this study is to try to answer the question of how online activity has supported the identity development of Indo-Caribbean womxn in STEM (science, technology, engineering, and mathematics) fields of study? During this study, I will be conducting one-on-one interviews with Coolie womxn to collect their stories and experiences of participation in STEM learning and social media support.

To respect the privacy and rights of [name of social media page] and its community, I will not be contacting the members directly. What I am asking of you is to post five social media images containing the study's information on your social media feeds, for example, Instagram, Twitter, Facebook, etcetera. My contact information is contained on the social media images so that participants can email me directly with any questions they may have, or express interest in participating in the study.

If you have any questions regarding this study or would like additional information to assist you in deciding on participation, please contact me at keisha.deoraj@ontariotechu.net. You may also contact my supervisors, Dr. Robyn Ruttenberg-Rozen, at robyn.ruttenberg-rozen@ontariotechu.ca and Dr. Janette Hughes at janette.hughes@ontariotechu.net.

I hope that the results of my study will be beneficial to [name of social media page], your members and the Indo-Caribbean community as a whole. I very much look forward to speaking with you and thank you in advance for your assistance with this project.

With gratitude,

Keisha Deoraj
Masters of Arts in Education Student
Faculty of Education
Ontario Tech University

Appendix C – Participant Recruitment Images

This message is being sent on behalf of a [social media group] member and Ontario Tech University Faculty of Education student, Keisha Deoraj.



- ✓ Are you Indo-Caribbean or a part of the Indo-Caribbean diaspora?
- ✓ Do you identify as a womxn?
- ✓ Are you pursuing a science, technology, engineering, mathematics (STEM) career or education?
- ✓ Have you done some schooling in Canada?

If so, you are invited to participate
in a research study,
"Online Identity Development of
Coolie Womxn in STEM".



Participation in this research study will
include participation in one-on-one a
interview about the ways online
communities such as this one have
helped you see yourself as a womxn in
science, technology, engineering and
mathematics (STEM).



If you are interested in participating or
have any questions, please contact
Keisha Deoraj at
keisha.deoraj@ontariotechu.net.



This study has been reviewed by
the Ontario Tech University
Research Ethics Board, [insert REB
assigned #] on [date].

Appendix D – Pre-Planned Semi-Structured Interview Questions



Interview Questions

Getting to know/Getting Comfortable Questions

To get us started,

1. How are you doing today?
2. What part of the West Indies are you/your family from?
 - a. Possible follow-up questions:
 - i. Where were you born?
 - ii. When did you move to Canada?
 - iii. Have you ever visited (name of location)?
 - iv. When was the last time you visited?
2. What field of STEM are you pursuing?
 - a. Possible follow-up questions:
 - i. Do you have a goal for a future career in STEM?
 - ii. If so, will you share with me what that career goal is?

Background Social Media Questions

Now I'd like to understand more about how you use social media.

3. What are the main reasons that you use social media?
 - a. Possible follow-up questions:
 - i. What do you feel you gain from using social media?
 - ii. What platforms do you use? Instagram, Facebook, Twitter, etcetera?
 - iii. Do you like posts? Do you comment on posts? Do you direct message people? Do you create content for social media? Do you use some combination of these?

STEM & Identity Questions

Now I want to ask you about your identity as both a Coolie womxn and a womxn in STEM.

4. How have you navigated the world of STEM as an Indo-Caribbean womxn?
 - a. Possible follow-up questions:
 - i. Do you see these two identities as supporting one another, or do you see them as separate entities?
5. What challenges, if any, do you face in STEM that you feel are specific to your identity as an Indo-Caribbean womxn?
 - a. Possible follow-up questions:
 - i. Can you share some examples of this?
6. Has being a part of the online community helped you to navigate the challenges of being an Indo-Caribbean womxn in STEM?
 - a. Possible follow-up questions:
 - i. Can you share some examples of this?
 - ii. Have there been any times where your online community made you feel supported in your identity as an Indo-Caribbean womxn in STEM?
 - iii. Have you ever thought about leaving STEM?
 1. If so, what made you think this?
 2. Did you find your online community to be a support during this time?
 3. Why or why not?
7. Have there been any times that your online community has not been supportive, or that you have felt excluded, due to your identity as an Indo-Caribbean womxn in STEM?
 - a. Possible follow-up questions:
 - i. Can you share some examples of this?
8. Has your online community supported you in feeling like a part of the STEM community?
 - a. Possible follow-up questions:
 - i. Do you feel represented in your online communities as an Indo-Caribbean womxn in STEM?
 - ii. Why or why not?
9. How has your online community supported you in connecting with other Indo-Caribbean womxn in STEM?
 - a. Possible follow-up questions:

i. Can you give an example of this?

10. How or what else could your online community support you as an Indo-Caribbean womxn in STEM?

11. Is there anything else that you would like to share that we have not already discussed?

Appendix E – Informed Consent Form



Consent Form to Participate in a Research Study

Title of Research Study: Online Identity Development of Coolie Womxn in STEM

Name of Principal Investigator (PI): Dr. Robyn Ruttenberg-Rozen

PI's contact number(s)/email(s): robyn.ruttenberg-rozen@uoit.ca

Names(s) of Co-Investigator(s), Faculty Supervisor, Student Lead(s), etc., and contact number(s)/email(s):

Student Lead: Keisha Deoraj, keisha.deoraj@ontariotechu.net

Co-Investigator: Dr. Janette Hughes, janette.hughes@ontariotechu.ca

Departmental and institutional affiliation(s): Faculty of Education

Introduction

You are invited to participate in a research study entitled *Online Identity Development of Coolie Womxn in STEM*. You are being asked to take part in a research study. Please read the information about the study presented in this form. The form includes details on study's procedures, risks and benefits that you should know before you decide if you would like to take part. You should take as much time as you need to make your decision. You should ask the Principal Investigator (PI) or study team to explain anything that you do not understand and make sure that all of your questions have been answered before signing this consent form. Before you make your decision, feel free to talk about this study with anyone you wish including your friends and family. Participation in this study is voluntary. This study has been reviewed by the University of Ontario Institute of Technology (Ontario Tech University) Research Ethics Board (REB #15981) on September 22, 2020.

Purpose and Procedure:

The purpose of this study is to try to answer the question of how does online activity support the identity development of Indo-Caribbean womxn in STEM (science, technology, engineering, and mathematics) fields of education? Knowledge and information generated from this study may help other researchers understand the role that online communities play in supporting Indo-Caribbean womxn's pursuits of STEM education, careers and excellence in their personal and professional lives.

You have been invited to participate in this study because you identify as an Indo-Caribbean womxn who is pursuing education in the science, technology, engineering, and mathematics (STEM) fields. You are also a part of social media communities that focus on supporting Indo-

Caribbean womxn, thus can speak to the ways your involvement in such groups has supported your pursuit of your STEM education and/or career.

I aim to have 4-8 participants involved in this study. Participation in this study involves at least one meeting:

- After agreeing to take part in the study, I will schedule an approximately 90-minute, one-on-one interview with you. This interview will take place via a password-protected Zoom Video Conference, in which audio, video and chat recording will take place. The interview is semi-structured, meaning I will ask a few pre-planned questions. However, the conversation that develops is free to stray from the scripted questions. If at any point you feel uncomfortable with questions you may choose not to answer. Or if at any point you would like to end the interview, you may do so. If you so wish, the interview can continue at a later date and time that is convenient for you.

After the interview, we will transcribe the conversation. Once we have transcribed our interview, we will give you the opportunity to meet again. This meeting will give you an opportunity to review the interview transcript to make sure it accurately represents your thoughts. This approval process will give you the final say over what you choose to share with us. The total time for this part of the process will take approximately 2 hours as outlined in the table below.

We will also ask if you would agree to any follow-up interviews regarding this study. And if you agree to any follow-up interviews, we will follow the same approval process with you for the transcript.

Task	Study procedure/tests/interventions	Duration of task
One-on-one interview	- One-on-one interview	1.5 hours
Optional follow-up meeting	- Meeting to discuss and for you to approve interview transcript	0.5 hour
Optional additional follow-up meetings	- Possible follow-up interview - Subsequent meeting for approval of transcript	2.0 hours

Potential Benefits:

There are no direct benefits to participants for participating in this research. The purpose of this study is to try to answer the question of how has online activity supported the identity development of Indo-Caribbean womxn in science, technology, engineering, and mathematics (STEM)? Knowledge and information generated from this study may help us to understand the role that online communities play in supporting Indo-Caribbean womxn’s pursuits of STEM education, careers and excellence in their personal and professional lives. This is important as the Indo-Caribbean community in Ontario and Canada continues to grow, however, their contributions and struggles are rarely recognized as compared to other racialized communities.

Potential Risk or Discomforts:

There is potential that during the interview you may experience emotional discomfort when reflecting on the ways in which online communities have supported you, and in possibly sharing negative or positive experiences of participating in STEM education. You should not experience any more discomfort than you would experience in sharing your experiences through the forums online. Additionally, this research is based on an anti-deficit narrative approach (Adiredja, 2019), and participatory research where you will be given the final say over the transcripts and what you want to share.

In the event that you do experience emotional discomfort, you will be reminded that you have the right to "pass" any questions that you are uncomfortable answering. You will also be reminded that you will have the opportunity to review the transcripts after the interview. Should you require resources, we have compiled a list of resources that you may access to help you. In addition to being sent with this consent form, you will also receive this list of community resources at the time of your interview.

If you agree to participate in the study, you are agreeing to be video- and audio-taped for data collection purposes, and you are given a choice of how those clips may be used. You can choose separately whether to allow clips to be used in scholarly presentations or publications and/or in the researchers' teaching.

If you do agree to the public use of these clips, you will always be referred to by a pseudonym. Still, there remains a chance that you could be recognized by a member of the audience. Also, with the popularity of cell phone cameras, there is some risk that if data clips featuring you are shown in scholarly presentations, an audience member could make a personal recording of some or all of the presentation, and make this material viewable online.

Use and Storage of Data:

All information collected during this study, including your full name and email address, will be kept confidential and will not be shared with anyone outside the study unless required by law. You will not be named in any reports, publications, or presentations that may come from this study. All data will be stored on the university-affiliated, password-protected Google Drive folder that has unlimited storage.

Confidentiality:

Your privacy shall be respected. No information about your identity will be shared or published without your permission unless required by law. All names will be given pseudonyms in any

publications. Confidentiality will be provided to the fullest extent possible by law, professional practice, and ethical codes of conduct. Confidentiality cannot be guaranteed while data is in transit over the Internet. This is mainly relevant when in communication with the researchers, when sending your signed consent form to the researchers, and when receiving interview transcripts. We will ensure to password-protect all transcripts with unique passwords to ensure their safety. The unique passwords that will be used to access your individual transcripts will be provided to you at the time of your interview.

Voluntary Participation:

Your participation in this study is voluntary and you may partake in only those aspects of the study in which you feel comfortable. You may refuse to answer any question you do not want to answer, or not answer an interview question by saying, 'pass'. You may also decide not to be in this study, or to be in the study now, and then change your mind later. You may withdraw from this research project up until we begin to analyze the data, which will be after your approval of the transcript. You may withdraw from the study without affecting any existing or future relationship with Ontario Tech University.

Right to Withdraw:

If you withdraw from the research project before we begin analysis, any data that you have contributed will be removed from the study, and you do not need to offer any reason for making this request. In the event that you withdraw, any data collected will be deleted from the researcher's files. This includes recorded audio, video, and chat, as well as consent forms containing your signature(s).

Conflict of Interest:

Researchers have an interest in completing this study. Their interests should not influence your decision to participate in this study.

Debriefing and Dissemination of Results:

You may choose to receive a final report of the findings of the study. An option to consent to this is to be given at the end of this form.

2. I grant permission for excerpts of videotapes and audio clips in which I appear to be used publicly in scholarly presentations and conferences.

Participant must initial Yes: ____ No: ____

3. I grant permission for excerpts of videotapes and audio clips in which I appear for future analysis consistent with the objectives of this research study.

Participant must initial Yes: ____ No: ____

4. I wish for the videotapes and audio clips in which I appear to be destroyed once this study is complete.

Participant must initial Yes: ____ No: ____

5. I wish to receive a copy of the final report of the study.

Participant must initial Yes: ____ No: ____

Video data is complex and can require considerable time to analyze fully. Hence, data will be retained for as long as we require access to it for this or potential follow-up projects. If you answered "Yes" to Question 4, then we will destroy all video data after the analysis for this project is complete and I have published my last publication.

Your signature on this form indicates that you 1) have read the consent form and understand the study being described; 2) have had an opportunity to ask questions and those questions have been answered and I am free to ask questions about the study in the future; and 3) I freely consent to participate in the research study, understanding that I may discontinue participation at any time without penalty.

A copy of this consent form has been made available to me.

Print Study Participant's Name

Signature

Date

My signature means that I have explained the study to the participant named above. I have answered all questions.

Print Name of Person Obtaining

Signature

Date

c. Optional Secondary Use of Research for Future Research Purposes

At the end of the consent form, an optional section is required for studies that would like to obtain consent for potential secondary use of data for future research purposes. Researchers must obtain the participant's initial for this optional component of the study and the following statements must be included:

1. I understand the possible need for secondary research uses of my research data for future research use and provide consent for the use of my data to be used in future studies.
2. The research team has informed me that a separate REB application will be submitted for the secondary use of data for any future research purposes.

Participant must initial _____ Yes _____ No

Appendix F – List of Community Supports and Services



List of Community Counselling and Support Services

Please remember that you have the right to “pass” any question that you may be uncomfortable with. You are also able to continue the interview at a later date that is convenient for you should you become distressed at any point during the interview. There are several resources with which you can connect. Below are some of these resources:

- 1) Big White Wall website: <https://www.bigwhitewall.com/?lang=en-ca>
- 2) Durham Region Counselling website: <https://www.durham.ca/en/living-here/counselling.aspx>
- 3) Family Service Ontario: <http://familyserviceontario.org/>
- 4) Health Care in Ontario website: <https://www.ontario.ca/page/health-care-ontario>
- 5) Kids Help Phone website: <https://kidshelpphone.ca/>
- 6) Ontario Emergency: 911
- 7) Ontario Telehealth: 1-866-797-0000
- 8) Ontario Mental Health Helpline: 1-866-531-2600
- 9) Toronto Central Healthline website:
<https://www.torontocentralhealthline.ca/listservices.aspx?id=10232>

Appendix G – Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans Course on Research Ethics (TCPS 2: CORE) Certificate

