

Comparing Successful Education Approaches From the Global South and Canada

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Abstract

Educational reforms have been enacted to strategically address critical issues facing schools at the local (individual classroom, school, district) or systemic (provincial and national) level. At the systemic level, large educational change movements often present difficulties in the areas of sustainable success (Fullan, 2021). Across the globe, nations' economic success is strongly correlated to students' mathematics performance (Farrell et al., 2017). Therefore, the education of school-aged children in mathematics is an area of concern in both the Global North and Global South. Although many Canadian initiatives have addressed areas of improvement for mathematics education in schools over the last 10 years, limited research and few such initiatives have considered success stories beyond the Global North, thus overlooking new radical approaches for the core subjects, including mathematics (Farrell et al., 2017). This major research project conducted a comprehensive literature review exploring three Canadian mathematics education initiatives—Building Thinking Classrooms (Liljedahl, 2020), Math Minds (Davis et al., 2020), and Show Me Your Math (Lunney Borden, 2010)—as well as three alternatives from the Global South: Escuela Nueva (Colbert & Arboleda, 2016), Learning Community Project (Rincón-Gallardo, 2019), and Bangladesh Rural Advancement Committee Non-Formal Primary Education (Numan & Islam, 2021). Findings from this study can stimulate a flow of ideas between the Global South and Global North, with a detailed comparison between the Canadian and Global South approaches that can enhance mathematics education.

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Table of Contents

	Page
Abstract	ii
Acknowledgments.....	iii
List of Tables	v
CHAPTER ONE: INTRODUCTION TO THE STUDY	1
Background of the Problem.....	1
Purpose and Focus of the Study	2
Rationale and Significance of the Study	3
Research Questions	7
Terminology	8
Theoretical Framework	11
Critique of Education Colonialism.....	14
CHAPTER TWO: METHODOLOGY AND RESEARCH DESIGN.....	16
Conducting a Comprehensive Literature Review.....	16
Synthesis and Analysis.....	22
Strengths and Limitations.....	23
CHAPTER THREE: REVIEW OF CANADIAN MATHEMATICS EDUCATION INITIATIVES	26
Defining Canadian Mathematics Education Context	26
Identifying Successful Initiatives	28
Comparison between Approaches and Intersecting Areas of Success	31
Importance and Reasons for Success	39
CHAPTER FOUR: REVIEW OF GLOBAL SOUTH ALTERNATIVES	47
Identifying the Successful Alternatives.....	47
Comparison between Approaches and Intersecting Areas of Success	52
Defining and Representing Shared Success	54
Importance and Reasons for Success	56
Acknowledging Importance in Success.....	63
CHAPTER FIVE: DISCUSSION AND ANALYSIS	65
Comparisons	65
Potential to Integrate/Adopt Global South Approaches in Current Canadian Mathematics Education Context.....	78
CHAPTER SIX: CONCLUSIONS.....	82
Recommendations	82
Directions for Further Research	84
Conclusion.....	87
References.....	90

List of Tables

Table		Page
1	Description of the Canadian Mathematics Education Initiatives	32
2	Comparison of the Canadian Mathematics Education Initiatives	38
3	The Success of Canadian Mathematics Education Initiatives	45
4	Summary of the Global South Alternative Approaches	51
5	Comparing Success Between the Global South Alternatives.....	58
6	Deriving Reasons for Success: Explaining Common Features	63
7	Similarities Between the Global South Alternatives and Canadian Initiatives	72
8	Identified Differences or Gaps Between Approaches	77

CHAPTER ONE: INTRODUCTION TO THE STUDY

This introductory chapter will outline my research project that compares three Global South alternative approaches to education and three research-based Canadian mathematics education initiatives. I will first discuss the background of the problem, purpose, rationale and significance, and research questions for the study. Then I will provide further context to frame the rest of the study, offering terminology, the theoretical framework, and a critique of educational colonialism.

Background of the Problem

There are many critical issues facing schools and formal schooling today (Farrell et al., 2017). These include financial literacy proficiency, equitable assessment, and online education during the COVID-19 pandemic. Educational reforms are enacted to address one or more of these issues at a time, which can be strategically implemented at the local (individual classroom, school, district) level or further at the systemic (provincial and national) level. Often at the systemic level, large educational change movements present difficulties in the areas of sustainable success (Fullan, 2021). A reason for the difficulty in reforming education successfully is the scale and reach of the education sector. As educational reform pertains to everyone, everyone has an opinion about it, often with conflicting views toward promoting and participating in change (Schleicher, 2018). This is pertinent to Canadian provincial educational systems, especially in the more populous and geographically larger provinces.

Across the globe, a nation's economic success is directly correlated to students' mathematics performance (Farrell et al., 2017). The education of school-aged children in mathematics is an area of concern in both the Global North and Global South. Within

mathematics education, some concerns include cultural relevancy, the incorporation of technology, and numeracy literacy. Over the last 10 years, many Canadian initiatives have addressed areas of improvement for mathematics education in schools (Davis et al., 2020; Liljedahl, 2020; Lunney Borden & Wagner, 2022), although according to Farrell et al. (2017), few initiatives and research recognize or learn from success outside of the Global North, overlooking new radical approaches to core subjects such as math and language.

Purpose and Focus of the Study

The purpose of this SSHRC-funded study is to conduct a detailed comparison of three successful Canadian initiatives and three evidence-informed reforms of the Global South. My goal is to stimulate a flow of ideas—a dialogue—between the Global South and Global North for the enhancement of mathematics education, primarily in pedagogy. The focus of the study surrounds pedagogy, as I wish to emphasize the impacts of student learning within the classroom that are brought to life through curricula. Although the curriculum is important to discuss for mathematics education improvement, a set curriculum can still represent successful approaches, therefore I want to highlight and compare the aspects of the successful models surrounding the delivery of the curriculum.

The project provides summary descriptions and recognized results of success for each of the Global South alternatives and Canadian mathematics education initiatives. In Chapters 3 and 4, there will be a comparison and analysis made within each context (Global South context and Canadian context) attributed to the success of these insightful educational approaches, along with an examination of the aspects of relevant educational theories, teaching and learning materials, and pedagogical approaches. As the definitions

of success vary among each approach, in Chapter 5 there will be consideration and analysis for determining success and varieties of pedagogical success in mathematics education.

Rationale and Significance of the Study

I wish to first provide a personal background to bring my experience and context to this major research project. I acknowledge my heritage and upbringing that attribute to my internal biases and perceptions and introduce my identity as a second-generation Chinese woman and Canadian citizen. As a young Chinese Canadian, I have been raised by Chinese immigrant parents and have been in Canada for the majority of my life. I hold the generational wisdom and stories of my heritage close to my heart and continue to carry them with me throughout my teachings and research. I create awareness and understanding of the privileges and opportunities I have received from my generational, academic, personal, and lived experiences which have led to my position today.

As for my academic background, ever since I was a child, I have been proficient in the subject of mathematics. But from my Canadian education experience, often I would notice that my peers would neither excel nor seem to enjoy mathematics, and I would wonder what was different in our school mathematics experience. From then on, I decided to help my peers and understand the reason behind unsuccessful mathematics learning, with the possibility of pursuing teaching or the field of mathematics. When I was older, I began exploring mathematics teaching through tutoring and volunteering, even with the opportunity to teach international Chinese students. From these experiences, I was able to view mathematics education from a different perspective and could view the gaps far more clearly between learners and methods of mathematics

teaching in the education system. With my undergraduate studies in mathematics alongside my existing background in teaching and learning mathematics, I have become closer to my goal to address the concerns surrounding the gaps in mathematics education for K–12 learners.

In the summer of 2020, before starting my graduate studies in education, I read a book chapter by Farrell et al. (2017) called “Reinventing Schooling: Successful Radical Alternatives From the Global South.” In this chapter, the remarkable results of the emerging alternatives from the Global South are discussed, presenting impressive circumstances for educational change at the large-scale level and with the ability to bring up students who are the hardest to reach and hardest to teach. This reading made me curious about what their identified insights from the Global South radical approaches might offer to education systems of the Global North—more specifically, for the Canadian mathematics education systems. I discuss the features of the Canadian math education context in Chapter 3. The research study will benefit my interest to discover ulterior methods for the overall improvement of mathematics education in Canadian schools and strengthen my understanding of current breakthroughs in the field. The research in my master’s study would establish the solid groundwork to assist me in continued investigations and work towards my goal to help students thrive in mathematics learning.

Since educational reform for school improvement should question the basic/traditional model and the forms of formal schooling (rather than making minor alterations), we should consider what can be achieved by learning from new alternatives for pedagogy. The different approaches from the Global South share a cross-cultural core

for understanding human learning, with diverse perspectives and mindsets. The alternatives of the Global South carry potential with globalized ideas and methods of understanding education, mixed with civilizational literature and traditions of understanding teaching and learning, slowly developing very effective, locally appropriate ways of enabling effective learning, even among children who are hardest to reach and hardest to teach (Farrell et al., 2017). The Canadian initiatives that I have examined reframe mathematics learning from various perspectives, moving away from traditional and institutional education systems and redefining mathematics education reforms to support learners with diverse and varied needs. The current mathematics education initiatives in Canada may not be large-scale (and by this, I mean implemented province-wide or nation-wide) but may provide the contextual basis and frameworks to support successful learning for Canadian learners. Therefore, considering the integration of the Global South alternative approaches and the Canadian mathematics education initiatives has the potential to fill the necessary gaps to induce large-scale educational change in Canadian mathematics education. My research would contribute to the study of successful alternatives in response to the critical issues of current formal schooling reform in Western countries and offer an effective approach to math education.

The radical alternatives from the Global South discussed in this MRP are the Learning Community Project (LCP), Escuela Nueva, and the Bangladesh Rural Advancement Committee (BRAC) Non-Formal Primary Education program. They have been adopted in dozens of countries in the Global South. The success of the Global South alternatives is commendable, and we can learn a great deal from such successes in large-scale reforms (Farrell et al., 2017). As a result of these alternative approaches, students

have displayed significant progress in these schools evidenced by their test scores, performing as well as or even better than their counterparts in regular schools (typically in urban regions), and have achieved high completion rates for primary and middle-school level grades. These schools that implement the alternative models have also done so with limited funding and resources, and although the actual costs are lower than traditional schools, students are still able to study well and develop the self-confidence and self-esteem to carry on their education. These alternatives remain successful in their positive results for enrolment, retention, completion, and movement to the next level of school and measured academic success.

The Canadian mathematics education initiatives—Building Thinking Classrooms, Math Minds, and Show Me Your Math (SMYM)—offer different versions and measurements of educational success. Building Thinking Classrooms aligns its success with its goal to support student thinking, therefore the initiative has demonstrated success with increased student thinking in math classes for longer periods and with teachers' reports of student improvement (Liljedahl, 2020). Like Building Thinking Classrooms, the success of the SMYM program aligns with its goals (increasing community and mathematics learning connection through cultural practice) and displays success with teacher, student, and community improvement reports (Lunney Borden & Wagner, 2022). The Math Minds initiative supports success through comparison (seen with the Canadian Test of Basic Skills (CTBS) assessment) with the greatest improvements in conceptual understanding and problem solving in students' mathematics performance (Davis et al., 2020). As each innovative approach has different goals and definitions of success, all initiatives demonstrate perspectives on success in Canadian mathematics education,

forming reflections for the classification of success, the criteria and method of success, and the meaning of success applied in different contexts.

There is very limited research on these three Global South alternatives in the literature, so my research contributes to the study of these alternatives and offers an effective approach to mathematics education, further transforming the landscape of dominated Eurocentric education in Canada. Additionally, there are no reports on the use of these alternatives in the Global North (e.g., Canada) and thus, this project provides a guide to educational changes and practical support in Canadian school math classrooms. Through the initiation of flow from Global South to Global North for the enhancement of mathematics education, there is a consideration for an integrated approach of the Global South alternative frameworks within the current Canadian mathematics education context. As an aside, a limitation of the study is that it may not be representative or inclusive of the other successful alternatives and initiatives in current educational change, as I have only selected three Global South alternatives and three Canadian initiatives.

Research Questions

To guide the process of the current study, I considered three research questions:

1. What are the characteristics/features related to the success (in the aspects of pedagogy, students, and teachers) among three Global South alternative approaches to learn from?
2. What are the major components of the Canadian initiatives that are currently unaddressed from the Global South alternatives and vice versa?
3. What aspects of the Global South alternatives might be integrated to enhance math education in Canadian school contexts?

Terminology

To ensure clarity, I define the terms that will appear throughout this research project. These terms include *educational colonialism*, *educational change* (or *reform*), *Eurocentrism*, *Global North*, and *Global South*.

Educational Colonialism

As colonialism is apparent in many facets of ongoing societal and cultural structures, colonialism in education still lives on within classrooms, curricula, and policies. Educational colonialism represents the forms of colonization and colonial oppression that exist within our education systems (Kempf, 2009). Eurocentric models spread through colonialism and organize current schooling to ignore other ways of knowing (Brissett, 2020). With educational colonialism, the dominant groups create accessibility to their education, but the representation and abilities in the system of certain groups are suppressed, ignored, and unrecognized (Aman, 2017). The effects of educational colonialism do not just exist in the Global South; they also continue to hold and spread past the borders of the Global North (Brissett, 2020). For example, educational colonialism exists in Canada, prominent in marginalizing Indigenous groups, with a history of residential schooling and excluding Indigenous worldviews (Wiseman et al., 2020).

Educational Change/Reform

For the sake of this major research project, educational change and educational reform will be used interchangeably, since the context is about creating change in large systemic education (Fullan, 2021; McEwan, 2008). When discussing educational reform, this is beyond simply making changes within a school or a classroom, with the intent to find changes within an educational system that will sustain success. The Global South

approaches focus on system-wide education reform (especially in rural regions), acknowledging the dynamic processes and stakeholders involved in education to produce changes toward economic and social development (McEwan, 2008; McEwan & Benveniste, 2001; Rincón-Gallardo & Elmore, 2012). In the Canadian context of educational initiatives, educational change is different at the systemic level. There are concerns surrounding provincial sectors dividing educational systems and the educational reforms are promoted in areas of curriculum, pedagogy, and policy not motivated for national economic and social development (Fullan, 2021; Schleicher, 2018). In this way, the identified contextual differences in educational reform are addressed based on the greatest relevant educational issues and structure of educational institutions.

Eurocentrism

Eurocentrism can describe how Europe has significantly determined the overall character of world politics, distinctive in terms of historical, political, social, and developmental power (Sabaratnam, 2013). Eurocentrism has been attributed to the ways the West exercises power over the rest, attributing to the Global North and Global South divide (Nilsen, 2016). Eurocentric worldviews exist within the Global North, as in Canada, they have suppressed the Indigenous ways of knowing and social systems. Eurocentric knowledge has forced assimilation and education through modern governments and systems. By only focusing on Eurocentric perspectives, without respect for the inclusion of history, worldviews, and cultures of the Indigenous and the Other, the Canadian education system will maintain flaws (Neeaganagwedgin, 2013).

Global North

The North–South divide was first signified by the Brandt Line from Willy Brandt,

with the purpose to represent epistemological inequalities and global inequities. The split resulted in labels separating the Global North and Global South, indicating variability in economic and knowledge development (Kaess, 2018). The regions of the Global North are also known as the developed countries (e.g., Canada, Australia, United States), areas with dominating political, economic, and societal power often recognized as historic colonizers. The power dynamic between the Global North and Global South presents itself as the dominating Global North creating a system of one-way transfers to the Global South, resulting in dependency on areas such as political economy, knowledge, and educational systems (Kaess, 2018; Nilsen, 2016).

Global South

The Global South is often referred to as the developing countries or the Third World, but extensively represents the historically colonized parts of the world (Rincón-Gallardo, 2019). The recent popularization of the term Global South also tries to move away from the problematic term *developing*, as *developing* insinuates that some countries need to build and improve their societies and through the progress of colonialism, can be considered *developed*. The Global South has been shaped in the historic context of colonialism through the processes of exploitation and inequitable power relations affecting international development and education (Brissett, 2020). The division between the Global North and Global South represents the global disparities in economic and political development, not necessarily based on location, as Australia and New Zealand are situated in the Southern hemisphere but are still considered part of the Global North (Kaess, 2018).

Theoretical Framework

For the theoretical framework, the appropriate overarching layout of this comparative work is crucial; therefore, I draw inspiration from multiple frameworks. The overall theoretical foundation of this project draws perspectives from both critical mathematics approaches (Bullock, 2018; Chronaki & Yolcu, 2021) and educational reform approaches (Fullan, 2021; Schleicher, 2018). I include the core features of a critical communities framework (Rincón-Gallardo, 2019), a critical mathematics education framework (Avci, 2021; Skovsmose & Borba, 2006), and an anti-colonial framework (Dei & Asgharzadeh, 2001) in my theoretical framework.

A critical mathematics education framework can capture and represent the current trends and strides in mathematics education in Canada, following the relevancy, currency, and newfound developments in math education. The point of view of the educational change is noted by the three alternatives, as three forms of large-scale reform and active successful pedagogical approaches from the Global South, well represented by the critical communities framework. The theoretical framework embodies these two frameworks in the study, filling in the gaps and creating intersections of connection between mathematics education and educational change. Additionally, the anti-colonial framework provides further theoretical background, encouraging active awareness and resistance against educational colonialism and the dominant Eurocentric structures in education.

In Rincón-Gallardo's (2019), *Liberating Learning: Educational Change as a Social Movement*, he notes critical communities that embody the definitions of powerful learning and effective pedagogy. Although these strong schooling initiatives and

networks vary in aspects of context, purpose, and philosophy, each display eight common core features (attributing to a built critical communities framework): (a) relevance from the point of view of the learner, (b) student-led, (c) precision of purpose, (d) liberating learning as a point of depart and point of arrival, (e) transparency of the practice of learning, (f) high expectations of all students embodied in the everyday practice of educators, (g) depth over breadth, and (h) public demonstration of mastery. Because the goal of this paper is to recognize, compare, observe, and analyze successful models and approaches for educational change, the eight common core features of critical communities therefore provide a compatible theoretical framework for this project.

In relatively recent developments in mathematics education investigations, research methodology has grown to include critical mathematics education (Avci, 2021). Critical mathematics education addresses the concerns in the social and political areas of learning mathematics, in which there is a susceptibility to exclusion and suppression (Bullock, 2018; Skovsmose & Borba, 2006). Through the critical mathematics education framework, the structure of the project hits topics surrounding inclusion, identity, and context that are relevant to the educational systems and research done in the field of mathematics education. The critical mathematics education framework well captures these crucial topics in the literature review and discussions, as it can create connections within and between each Canadian initiative. Each mathematics education initiative has its own goals, targeting different types of concerns but generally related to social and political areas of learning mathematics. As well, the research represented by critical mathematics education considers the various perspectives and connections made in mathematics learning, while also applicable to theoretical and actual research

(Skovsmose & Borba, 2006). Therefore, the adaptability and currency of the critical mathematics education framework allow it to act as a mould to connect the new mathematics education initiatives and approaches from the Global South despite the differences in context and applications in research.

As a background framework, the anti-colonial framework demonstrates the project as actively aware and resisting the notions of colonialism and Eurocentric views, described as important terms in the previous section. From George J. Sefa Dei (2017; Dei & Asgharzadeh, 2001), the anti-colonial framework forms a counter-discourse to colonial oppression, questioning the colonial relations and imperial structures of knowledge, power, resistance, subject agency, and the place of Indigenous insurgence and resurgences in promoting new futures (Shahjahan, 2005). The anti-colonial framework continuously works against the Eurocentric ways of knowledge around the world and has a foundation in anti-colonial education. This project outlines the alternative approaches from the Global South that come from areas that were once colonized, and although their success is recognized, these Global South models are subjected to colonialist education systems of the Global North. As well, Canadian educational colonialism is prevalent in suppressing and ignoring Indigenous ways of knowing that are addressed and critiqued in the Canadian initiatives (Madjidi & Restoule, 2017). When considering the Canadian education systems that have embedded colonialist and Eurocentric perspectives, considering the anti-colonial framework will address and engage in processes against historical and existing colonialism within our systems.

Critique of Education Colonialism

The connotations of educational colonialism are recognized in the project, as there are colonial models of education that have been imposed across the Global South. With the awareness of the flow of educational ideas/systems from Global North to Global South, it is crucial to discuss the overlooked generated knowledge of the Global South in Northern education systems, policies, and practices. Therefore, the proposed research may include conducting an overview of the existing colonial models in the Southern education systems and possible reframing with the anti-colonial framework.

Additionally, this proposed research will be mindful of the assumptions of resource extraction and educational colonialism when exploring the possible routes towards change in mathematics education systems. The project hopes to bring further awareness to the approaches to the Global South without criticizing existing models and provide an overarching analysis of the available academic literature. Thus, the intended purpose does not promote the extraction of materials and approaches from third-world countries. I am not attempting to make them *Canadian*, but rather to bring to light potentially valuable aspects from culturally significant areas. By respectively observing through an alternate lens, the approaches from the Global South can be learned from and derive new inspired understandings and connections for success in mathematics education. This study strongly recognizes the differences in contexts between the Global South and Canadian education and supports the open flow of knowledge to actively deconstruct educational colonialist systems and cultural exploitation.

From this introductory chapter, I established the necessary reasoning and perspectives for conducting research on the Global South alternatives and Canadian

mathematics education initiatives. In the next chapter, I will continue to frame the project by discussing my research methodology. As I have provided the research background, purpose, significance, and framework, I can detail the methods and directions used to conduct my analysis and arrive at my findings.

CHAPTER TWO: METHODOLOGY AND RESEARCH DESIGN

In the previous chapter, I outlined the background, purpose, rationale, significance, and research questions of the research study. In addition, the sections on terminology, theoretical framework, and critique of education colonialism set up the context and organization for the rest of the project. In this chapter, I will discuss the research methodology. I describe the steps of the research process, including the choice of research design, the collection of data, and the analysis and reports of the data. The research design is a set of procedures for collecting, analyzing, and reporting data in a research study, which can be quantitative, qualitative, or a combination of both. A specific example of a type of research design is a narrative research design, classified as a qualitative research design, in which researchers use sets of qualitative procedures to describe the lives of individuals, their stories, narratives, and experiences (Plano Clark & Creswell, 2014). As part of this chapter, I will describe and justify my choice of research design, review strategies and selection, discuss synthesis and analysis, and the limitations of the literature reviewed for this research project.

Conducting a Comprehensive Literature Review

My research design is primarily a comprehensive review of the literature and analytic discussion and argument. A literature review can be considered a type of qualitative research design, which involves collecting, analyzing, and synthesizing literature as sources for data, with the goal of either writing summaries/critiques about past and current issues or providing new information or perspectives on existing topics. A comprehensive literature review is a specific style of literature review that collects the most relevant literature on a topic of interest, generally to target key concepts and

arguments, join in existing conversations, and conduct comparative studies on various topics (Huff, 2009).

To ensure quality and reliability, the literature search of this project involved multiple sources including academic databases (e.g., peer-reviewed publications, books), the professional websites of the three Global South alternatives (BRAC Non-Formal Primary Education, Escuela Nueva, and LCP), the professional websites of the Canadian mathematics initiatives (Building Thinking Classrooms, Math Minds, and SMYM), online information and resources surrounding these three alternatives, and Canadian initiatives (e.g., relevant videos, school interactions/experiences, research studies referencing class projects and practice). Examining these multiple sources helps to increase the validity and reliability of the literature search and analysis. The literature review generated the background knowledge and comparative observations that support the integration of alternatives and initiatives from the Global South and Canada. There were also ethical considerations to consider when reviewing the literature. While conducting this literature review, I ensured an accurate representation of the studies involved, provided the appropriate number of contextual details, and managed proper citation and formatting. In the search and selection process of literature, I brought awareness to my own choices in the inclusion and exclusion of literature. As there are topics surrounding the Global South, educational colonialism, and Eurocentrism, there also are ethical considerations concerning the socio-political nature of literature, in which I took accountability by consistently evaluating whether certain literature is relevant and pertained to the study.

As I conducted a comprehensive literature review, there was no location for investigation and the study is not applicable for the involvement of human participants. There was an analysis of the commonalities within and between initiatives and alternative approaches. Specifically, the study highlights the topics of student and teacher roles, classroom environments, and community in their appropriate contexts. Although there were no participants, these factors were extensively explored in terms of successful commonalities, first within the context of Global South alternatives, then within the context of Canadian mathematics education initiatives, and finally in the comparison between both contexts.

Justification of Methodology Format

There were several reasons to justify the choice of conducting a comprehensive literature review for this research project. There is a need to identify the Global South alternatives with an overview of their available literature and generate a stronger knowledge base within literature circles, as current research accessibility and resources are not provided regarding the topic. The literature review format supported the context of alternatives that can be used for future research projects and innovation models in Canadian classrooms, gaining a prior foundation before carrying out further investigations and practices. This type of investigation establishes and gains recognition for some of the less widespread approaches in current research in mathematics education. The comparisons between the success of alternatives and initiatives found from an expansive review of literature can form and emphasize unprecedented/new connections to mathematics education. The project is intended to provide comprehensive work for researchers and educators, generating growth in awareness and relevancy of the research

topic, creating new understandings of the research already done, and exploring previously unknown research/projects. The choice of conducting a comprehensive literature review over other types of literature reviews (e.g., systematic review, meta-synthesis review), was due to the project topic's level of depth and structure. Although a systematic review was considered, the rigorous approach to reviewing the literature is not necessary and may take away from the goals of the study. This type of research design drew more detailed comparisons and generated new reflective ideas, therefore it better related to the study's purpose of conducting comparisons and stimulating a flow of ideas between the Global South and Canada in mathematics education and pedagogy. Additionally, the comprehensive literature review style allowed for the study to gain more freedom to explore the topic across various research areas, with the ability to focus on the research questions, identify gaps in the literature, and highlight new research opportunities (Huff, 2009).

Strategies in Search and Selection

When conducting this comprehensive literature review, the search and selection process was twofold. First, the start of my literature search focused on the three Global South alternative approaches (Escuela Nueva, BRAC, and LCP), as well as topics surrounding the Global South in the field of educational change/reform. After the Global South alternatives, I searched for literature surrounding the Canadian mathematics education initiatives (Building Thinking Classrooms, Math Minds, and SMYM), and background literature about Canadian mathematics education.

For the literature search portion, the main online search engines I used are Google Scholar and the OMNI academic search tool from the Brock University Library.

Additionally, I found literature through the websites for each of the Global South alternatives and Canadian mathematics initiatives, particularly through the publication or reference sections. As this is a comprehensive literature review, my focus for the search was to find the major works that held the relevant key concepts for the study, while also indicating the possible gaps and limitations in finding the areas where there was little to no related literature.

I started my search from the book chapter by Farrell et al. (2017), “Reinventing Schooling: Successful Radical Alternatives From the Global South,” reviewing the suggested and referenced literature and resources. This led me through my search for each of the Global South alternatives’ online presence, finding their official websites. Using search tools, I first searched tags for *Global South* and *Educational Change* (or *Educational Reform*), which came up with just over 1,000 results. Then after a general search, I dug deeper into each of the alternative approaches with their full or abbreviated titles, *Escuela Nueva* (returning 1,489 results), *Learning Community Project (LCP)* (returning 580 results), *BRAC Non-Formal Primary Education Program* (returning 12,965 results). To narrow down the search, I added tags with each Global South alternative, often searching with the originated country. In addition, I put publication date limits for more recent literature, ranging from 2010 to the present, and then added subject limits to *Education*, *Educational Change* (or *Educational Reform*), *Pedagogy*, *Teaching*, and *Learning*. As there were claims that the three Global South alternatives go unrecognized from the Global North (and Canada), I also searched for the international use of the approaches Escuela Nueva, LCP, and BRAC. This was accomplished using multiple tags with each alternative, such as *Global North*, *Canada*, and *International*, as

well as searching through each of the websites and previous literature for the countries which have implemented the models of the alternatives from the Global South. From the search into the Global South alternatives, I was able to narrow down the amount of literature to review. This resulted in 38 of the most relevant works.

The literature search for the Canadian mathematics education initiatives was done similarly to the Global South alternatives. I first found the official websites for each mathematics education initiative and reviewed the literature in the referenced work or publication sections. To continue the search for additional literature, I did a general search for literature relevant to Canadian mathematics education through OMNI or Google Scholar. I used tags for *Canada* and *mathematics education* (or separately, *mathematics* and *education*) returning over 70,000 results, and sometimes I specified tags for *history* and *system* (returning over 30,000). For each of the initiatives, I also searched their full names of *Building Thinking Classrooms* (returning 21 results), *Math Minds* or relevant terms of *structuring inquiry* or *RaPID model* (returning more than 300 results), and *Show Me Your Math* (returning 62 results).

Like in the search for Global South alternatives, I narrowed the search and put publication date limits from 2010 to the present, and then added subject limits of *Education*, *Mathematics Education*, *Pedagogy*, *Teaching*, and *Learning*. As the initiatives are in development or relatively new as educational approaches, I also added the search tags of the main researchers/developers for each of the initiatives, including *Peter Liljedahl* (Building Thinking Classrooms), *Brent Davis* (Math Minds), and *Lisa Lunney Borden* (Show Me Your Math). In the field of Canadian mathematics education, I also searched for educational reform, with the tags *Canada*, *mathematics*, *education*, and

reform (or change). In total, I was able to narrow the search and find 24 of the most relevant sources for this research project about Canadian mathematics education and the three initiatives.

For the selection process of the literature, I recorded and downloaded the relevant resources into files or on Zotero (research reference management software). The selection for the final choice of literature was based on factors surrounding relevance to the research questions and purpose, currency to the field of mathematics education (in Canada) and educational change, providing crucial background for the readers (research or education in Canada and the Global South), and relevance to the initiatives/alternatives, and providing details towards making contextual and pedagogical comparisons between initiatives/alternatives. Based on these factors, all literature was ranked based on the importance or likelihood that it would be referenced in the research study, including the major works in the fields of mathematics education and educational change, as well as the key resources from each of the Canadian initiatives and Global South alternatives.

Synthesis and Analysis

When conducting this comprehensive literature review, there were two parts to the review process. Because I first had a growing interest in the Global South alternatives, particularly from the book chapter by Farrell et al. (2017), the first part of my literature search and review started with the topic of educational change in the Global South and each of the alternatives, in the order of Escuela Nueva, BRAC, and LCP. When reviewing the literature, I organized and sequenced all works based on provided key information and relevance to the study, then recorded and summarized the main points for the comparison portions of the research project. Similarly, I would conduct the

second part of the literature review in the same format as the Global South alternatives, but instead, focusing on Canadian mathematics education with a general search and individual search of the initiatives. Unlike the first part of the literature review (focused on the Global South), it was also necessary to find literature associated with the history and current systems of mathematics education in Canada.

When reviewing the literature, I extrapolated the elements from each of the Global South alternatives and Canadian mathematics education initiatives for a comparative study. Doing so, I was able to recognize the key pedagogical elements from every approach and analyze the main features, similarities, differences, areas that represent success, and areas for improvement. While organizing the literature and recording discerning elements, comparisons are easily drawn out to address possible areas that we might learn from. While having the ability to recognize the key elements that are relevant to the comparative study, I also identified the components that are not necessary for the study and excluded them based on the irrelevant/excess information for drawing comparisons and providing new insights.

Strengths and Limitations

From the methods of literature search and selection, there were several findings based on the type and amount of literature that was kept for the research study. In terms of results for the Global South alternatives, there were plenty of articles, journals, and book chapters that recognized the three approaches as strong examples for large-scale educational change. Although there were lots of results of literature in the native language to support each of the alternative approaches, there was more than a sufficient number of publications and online resources in English (over 500 for each approach).

Two of the official websites were available (in English), which included the Fundación Escuela Nueva¹ and the BRAC education program² education page. Through analyzing the literature from the Global South alternatives, the approaches had literature written in English, and published by strong researchers in the field of educational change/reform (e.g., Vicky Colbert, Santiago Rincón-Gallardo). Although most of the alternative models originate from the 1970s, their research/academic recognition is recent (Farrell et al., 2017). Even with this recent recognition, when searching for other countries that have implemented the alternative approaches, there were no results or findings indicating implementation in the Global North nor recognition within Global North education systems. For the alternative approaches that spread at the international level, the literature showed that implementation of the alternative models only remained in countries from the Global South. For BRAC, the education program spread to several African countries including Liberia and Uganda, and Asian countries including Sri Lanka and Afghanistan (Cronin, 2008; Hossain & Sengupta, 2009; Islam & Anwar, 2012). For Escuela Nueva, there were publications on the international impact of the model that has grown in countries like Vietnam and Spain (Jorrín Abellán et al., 2013; Le, 2018), both considered countries of the Global South.

For the three Canadian mathematics initiatives, the appearance of the literature type was vastly different from the three alternatives from the Global South. Mainly, there was much more research that provided background and indicated research beginnings, rather than research studies that recognized the potential or success of the initiatives. All three initiatives had easily accessible resources, with clearer search results in terms of

¹ See <https://escuelanueva.org/en/>

² See <http://www.brac.net/program/education/>

familiarity with the formatting of literature and modern online journals/systems. These online resources include official websites with referenced research publication sections.³ From the search, there were only 12 pieces of peer-reviewed (relevant) literature written apart from the developers for the Canadian initiatives compared to the Global South approaches. Although the developing researchers are well known in the field of mathematics education, their models and frameworks were subject-specific and did not appear to be well-known in other fields of research. For Building Thinking Classrooms and Math Minds, nearly all of the works were by the original developer or developing team (Dr. Peter Liljedahl with Dr. Judy Larson and the research team of Dr. Brent Davis, Dr. Armando Paulino Preciado-Babb, Dr. Martina Metz, and Dr. Soroush Sabbaghan). For SMYM, there was more literature from outside researchers than the other two initiatives (possibly as it is an older project), but most articles and book chapters are from Dr. Lisa Lunney Borden.

Perhaps due to the recent development of these mathematics education initiatives, not enough time has passed to catch up with the current strides that are happening within the field. As well, the resistance and pace of change within education systems could be attributed to the amount of peer-reviewed literature available, perhaps due to Canadian systems having stronger incentives to retain the status quo. These factors can be considered as contextual differences in the scale of educational impact, in addition to the provincial segregation of education systems in Canada, given the time for innovation and implementation in provinces can affect the amount of literature available and research recognition.

³ See <https://buildingthinkingclassrooms.com/> for Building Thinking classrooms; <https://www.structuringinquiry.com/> for Math Minds; and <http://showmeyourmath.ca/> for SMYM.

CHAPTER THREE: REVIEW OF CANADIAN MATHEMATICS EDUCATION INITIATIVES

The background, significance, purpose, and methodology of the project were discussed in the previous two chapters. This chapter will outline three Canadian mathematics education reform initiatives. I will draw comparisons between these initiatives and analyze the areas of success.

Defining Canadian Mathematics Education Context

As a country, Canada is well-known for its multicultural society. It is open to immigrants from across the globe and allows them to continue to live true to themselves and their origins. The multiculturalism of Canada is not only attributed to immigrants who enter the country but also to the First Nation, Métis, and Inuit peoples who have played a part in Canadian history and systems (Reid et al., 2014). The social diversity of Canada is an element that presents challenges to national unity. Also presenting a challenge to Canada's unified view is the way education is administered. The education systems in Canada are the responsibility of the respective provincial governments. This means there are no national curricula, examinations, or teacher certifications that function across all provinces and that there is not one national ministry of education to enforce policies across the nation (Kilpatrick, 2014; Simmt, 2015).

From a national perspective, mathematics education in Canada must be considered provincially (regionally), as there is not one all-encompassing mathematics education system to follow. There are also high rates of geographic mobility that can result in students experiencing different mathematics programs when moving across provinces (Kilpatrick, 2014). Before the 1990s, each Canadian province had its

jurisdiction to set certain education standards, with differences in mathematics education policy, curriculum, and teacher preparation. Today, three main regions represent mathematics education frameworks in Canada (often each with its own curricula): the WNCP (Western & Northern Canadian Protocol), Ontario, and Quebec. The WNCP is comprised of Western and Northern provinces, but the WNCP Common Curriculum Framework (CCF) for mathematics is used by the Atlantic provinces. The CCF currently is administered in Nunavut, Northwest Territories, Yukon Territory, British Columbia, Alberta, Saskatchewan, Manitoba, New Brunswick, Prince Edward Island, Nova Scotia, and Newfoundland and Labrador. Although there are clear distinctions in the three regions of education frameworks, often there are influences drawn from the CCF across Ontario and Quebec (Simmt, 2015). As for Ontario, mathematics education research, policy, and practice are known to involve a very engaged collaborative community. In Quebec, the mathematics education field is greatly influenced by international perspectives, rooted in their strong, long-standing mathematics education research community (Kilpatrick, 2014).

Although it may be difficult to imagine large-scale reform at the national level, the most well-known movements surrounding mathematics curricula in Canada can be considered forms of large reforms. The interpretation of the mathematics education curricula movements as reforms in curricula remain disputed. These disputes are displayed in the doubts surrounding *new math* (modern discovery math) and/or *back-to-basics math* (traditional math). Regarding new math, many educators and researchers believe that *new math* as reform has failed the Canadian mathematics classrooms, influencing provinces like Alberta to revert to a curriculum with revisions in favour of

back-to-basics math (Chernoff, 2019). The views considering *new math* as a mathematics reform argue that there are great changes in curricula, and it was an unexpectedly difficult task to develop and support the complex problems. Opponents do not view *new math* as a reform because it consisted of too many programs, had small-scale implementation, and only proved successful when implemented exactly as designed (Kilpatrick, 2014).

The mathematics education initiatives that will be outlined in this research project are not considered to be large-scale provincial reforms (at this time) but can be considered as potential successful candidates for implementation on a larger scale as they are evidence-based. Each approach offers a variety of relevant perspectives within the field of mathematics education and provides context to the strides made in Canadian mathematics education research. The initiatives are based in the provinces of British Columbia (BC), Alberta, and Nova Scotia, which all fall under the WNCPE education system that generally follows the mathematics education CCF.

Identifying Successful Initiatives

From a Canadian context there have been several recognized mathematics education initiatives, such as the Math Minds (Davis et al., 2020), Building Thinking Classrooms (Liljedahl, 2020), and Show Me Your Math (Lunney Borden & Wagner, 2022) programs that are currently making drastic improvements toward enhancing student learning across the country. The Building Thinking Classrooms initiative was founded by Liljedahl (2020) in British Columbia, with the goal to break institutional classroom norms and start the facilitation of rich thinking classrooms. This initiative began with the realization that there are common elements in mathematics classrooms

that hinder students' learning and thinking, including negative student behaviours, an uninviting environment, and a generalized school structure. The initiative emphasizes that the encouragement of student thinking is crucial to mathematical problem solving to gain success in generating individual understanding.

The Building Thinking Classrooms framework is based on 14 practices that focus on the aspects that generate student thinking within the classroom. These are considered project features geared toward creating successful changes, including organizing collaborative groups, change of classroom atmosphere and arrangements, facilitating student learning tasks (design, implementation, procedure, specifications, etc.), encouraging student autonomy, formative assessment and evaluation, lesson consolidation, and appropriate student notetaking (Liljedahl, n.d.). The framework that Liljedahl has developed provides a more applicable approach that breaks down his research into understandable and agreeable key elements directed toward teachers (Liljedahl et al., 2021). The research studies for Building Thinking Classrooms have involved more than 300 participants in learning teams and workshops from the elementary, middle, and secondary levels (Liljedahl, 2016). The current result of this initiative has expanded into several workshops, presentations, and a book, *Building Thinking Classrooms in Mathematics, Grades K–12: 14 Teaching Practices for Enhancing Learning* (Liljedahl, 2020), popularizing the project and its spread across Canada.

The Math Minds initiative was founded on the partnership between Werklund School of Education, the University of Calgary, and JUMP Math (a Canadian educational charity), along with various school districts. The main goal of this initiative is to support

numeracy for students from Grades K–12, by offering a free online course and an online community for educators. The course is offered as a three-part series, separated into units, informing teachers of the initiative’s model and principles, trial lessons to analyze, and tips for designing and teaching lessons. From Math Minds, educators are taught the foundational aspects to make long-term changes for teaching mathematics, providing advice, support, and strategies in their research-based approach (Davis et al., 2020).

In terms of educational reforms, the approach of Math Minds is not considered a reform or traditional approach; instead, it is oriented toward sense-making and essential mathematics learning for all (Metz et al., 2016). The innovative approach of Math Minds offers various instructional methods to improve student learning, including: finding the entry points of learning, filling in gaps of understanding, and fulfilling a growth mindset. Math Minds utilizes the RaPID framework, which draws insights from ideas such as limits of the working memory (Clark et al., 2012), Mastery Learning (Guskey, 2010), and the Variation of Theory of Learning (Marton, 2015) framework to engage learners in mathematics processing and sense-making (Preciado-Babb et al., 2019). The course is also designed in a manner that acknowledges the ways in which people learn, as the main principles include highlighting critical features of mathematics concepts and appropriately prompting students to guide them based on their previous knowledge (Preciado-Babb, Metz, et al., 2016; Preciado-Babb et al., 2019).

The Show Me Your Math (SMYM) initiative was developed by Dr. Lisa Lunney Borden and Dr. David Wagner alongside members of the Mi’kmaq Kina’matnewey community in Atlantic Canadian schools. The goal of the project is to support Aboriginal students to learn mathematics through their community and cultural practices. There are

critical alignments in the project attributing to Indigenous mathematics education and engaging students to discover mathematics in their day-to-day lives (Lunney Borden, 2010).

The SMYM initiative includes ethnomathematics and culturally based inquiry projects and resources, committed to Indigenous students' experiences in learning mathematics for greater achievement and subject interest. The involvement of the community is crucial to the initiative, creating connections for students to explore local and familial culture through important mathematical concepts and ideas (Lunney Borden & Wagner, 2022). There are also SMYM events held annually that showcase student work, bringing together community representatives (such as elders), students, and teachers. These events not only encourage students to apply their mathematics learning to real-world problems but also boost students' confidence in their mathematics knowledge and understanding through the incorporation of personal ties to culture and community (Courtney et al., 2014; Wiseman et al., 2020).

Comparison Between Approaches and Intersecting Areas of Success

When comparing the three mathematics education initiatives, there are distinct similarities and differences attributed to their unique approaches. The similarities or areas of intersection are seen in the strong connections between research and pedagogical practice, as well as through the focused support towards the process of students' mathematics learning. The differences lie in the changed aspects from the traditional classroom that were transformative, with varied perspectives on the changes that need to be made and contrasting ideologies to fulfill successful goals for change in mathematics education. Table 1 provides an overview of the Canadian mathematics education initiatives.

Table 1*Description of the Canadian Mathematics Education Initiatives*

Aspects	Initiative		
	Building Thinking Classrooms	Math Minds	Show Me Your Math (SMYM)
Origins: Researchers and teams (province)	Dr. Peter Liljedahl (British Columbia)	Werklund School of Education, University of Calgary, and JUMP Math (Alberta)	Dr. Lisa Lunney Borden and Dr. David Wagner (Nova Scotia)
Goals	Facilitating rich thinking classrooms	Support student numeracy by offering a free online course and community for educators	Support Aboriginal students to learn mathematics through their community and cultural practices
Pedagogical features	Organizing collaborative groups, classroom atmosphere, student learning tasks	Finding the entry points of learning, gaps of understanding and sense-making, growth mindset	Exploring local and familial cultures in learning mathematics projects and resources
Pedagogical frameworks or models	14 practices/features of Building Thinking Classrooms	Structuring inquiry (RaPID Model)	Culturally relevant pedagogy, community/culturally based inquiry projects
Informing learning (or other) theories	N/A	Mastery learning; working memory; variation of theory of learning; intrinsic motivation	Ethnomathematics

Similarities in Supported Strong Research in Mathematics Education

From each Canadian mathematics education initiative, there is a strong theoretical basis supported by the top scholars in the mathematics education research field. Dr. Peter Liljedahl from Simon Fraser University in British Columbia has conducted 15 years of

research to produce a teacher guide with evidence-based practices for the Building Thinking Classrooms initiative (Liljedahl et al., 2021). Several of the top mathematics education researchers from the University of Calgary in Alberta, including Dr. Brent Davis, Dr. Martina Metz, Dr. Armando Paulino Preciado-Babb, and Dr. Soroush Sabbaghan, have published multiple research papers either to provide evidenced background in the production of Math Minds or about the progress of Math Minds (Preciado-Babb et al., 2019). Dr. Lisa Lunney Borden from St. Francis Xavier University in Nova Scotia partnered with Dr. David Wagner from the University of New Brunswick, in work to decolonize the mathematics curriculum and apply research on ethnomathematics and holistic practices of Indigenous education through the SMYM initiative (Wiseman et al., 2020).

These initiatives are supported by well-known Canadian mathematics education researchers, and with the strong research background in the development of these projects, there are strong relationships built between researchers and educators. With these relationships, there is more fluidity of relevant research in the field and direct practical application transferred into the classroom. This flow between research and pedagogical practice is reciprocal in the sense of educators providing a research environment to work with, and then in return, researchers directly apply these findings in the field.

The research for the Building Thinking Classrooms project started by observing multiple classrooms and schools used to find the successful elements of thinking classrooms with a collection of teacher practices. When the research was conducted, the findings of the unsupportive factors of the traditional classroom were identified,

modified, then re-applied to the classroom, developing a method and a set of tools that can benefit and encourage student thinking in all math classrooms (Liljedahl, 2016, 2018).

For the Math Minds project, the RaPID framework was produced from supported research of other conceptual frameworks (e.g., variation theory of learning, limits of working memory). As a result of the RaPID framework (and Math Minds as a whole), there are several works for pedagogical approaches but also other branches of research commenting on topics such as the reform and traditional dichotomies in mathematics education (Metz et al., 2016), the relationship between mathematics knowledge for teachers and curriculum (Preciado-Babb et al., 2015), the methods of scaffolding the classroom (Preciado-Babb, Metz, et al., 2016), forms of differentiation from the RaPID framework (Sabbaghan et al., 2015), and difficulties in mathematical extensions (Preciado-Babb et al., 2019). In addition, the study designed for Math Minds involved a university in Alberta and JUMP Math (a teaching material developer program), which collaborated in professional development and research for developing the model, leading to the online community that continues to communicate insights for the model and course (Preciado-Babb et al., 2019).

The SMYM initiative is based upon and is connected to several current research developments in mathematics education, including but not limited to theories of ethnomathematics, community-based practices, culturally relevant pedagogy, positioning theory, equitable mathematics education, and holistic pedagogy (Wiseman et al, 2020). As well, this initiative links mathematics education research and pedagogy uniquely, encouraging the students to conduct research investigations using mathematics. Through

these investigations, students grow interested in mathematics learning and independent research, contributing to the community and partnerships between researchers and math learners. The importance of attaching theory to practice is a strong message of the project, helping students recognize the cultural aspects and intergenerational wisdom of the community and elders in their mathematics learning (Wagner & Lunney Borden, 2011).

These initiatives are built on and actively represent the current strides and issues in mathematics education in Canada. Each initiative informs praxis as school educators and programs have worked alongside researchers within mathematics classrooms.

Differences Towards Focused Change

When observing the three Canadian mathematics education initiatives, there are commonalities regarding the strong research background driving their goals for success. But upon examining the types of changes that are made to attain these versions of success, are there any commonalities? I have previously identified the goals and definitions of success for the initiatives, as each project leads with different concerns. But I wonder, where were these educational changes (or focused areas of change) made within the pedagogical approaches?

The Building Thinking Classrooms initiative has a clear intent of where the primary changes should be made—in the classroom. In the pedagogical aspects of Building Thinking Classrooms, it is indicated that to support student thinking, the classroom should change as a whole. These include alterations of the environment, classroom movement, teaching methods and leadership, student formations (in groups), student tasks and notetaking, and assessment (Liljedahl et al., 2021). For building a

thinking classroom in mathematics, the framework consists of 14 factors of classroom practices that move away from the traditional classroom, considering the types of tasks used; the formation of collaborative groups; where students work; the arrangement of the furniture; the ways of answering student questions; the tasks given and the methods of giving tasks; the homework; ways of fostering student autonomy; ways of giving hints and extensions; methods of consolidating a lesson; student note-taking; methods of evaluation; using formative assessment; and methods of grading (Liljedahl, 2020). From observing these 14 practices, the implemented changes are directed toward transforming the existing structures of traditional classrooms in the physical, social, and environmental aspects in which teachers are required to facilitate student mathematical learning and thinking.

The goals of Math Minds have a different perspective on changes made within the classroom. Although the initiative aims to break down norms of the traditional classroom as well, rather than focus on the classroom as a whole, the changes rely on the teaching content and delivery. The primary responsibility of teachers is emphasized in the structuring inquiry framework (or RaPID model), as instruction is structured in a way to follow student understanding and is responsive to students' recognition of mathematical concepts (Preciado-Babb et al., 2019). Therefore, Math Minds is based on teacher/lesson change and the online course is organized as such. The Math Minds initiative believes in the strong directive role of the teacher, following the RaPID model to be attentive to the critical discernments of mathematical content and understanding student working memory to lead with successful prompting (Preciado-Babb et al., 2019). It is important to note that, unlike typical mathematics education projects, the Math Minds initiative is not

associated with introducing new reform approaches and replacing the traditional approaches to teaching mathematics, nor is it a balance of both. Instead, the theoretical dichotomy of traditional and reform approaches to mathematics learning is ignored for developing change with an alternative approach. Outside of the dichotomy, the alternative approach has various supporting frameworks, working toward the student focus to attend to one idea at a time (Marton, 2015; Metz et al., 2016).

Rather than directing specific lesson planning and environmental changes within the classroom, SMYM discusses alternatives in methods that can be utilized to support Indigenous (Mi'kmaw Kina'matnewey) students extending beyond the classroom. Thus, SMYM focuses on a wider spectrum of community/school change, inclusive of the community and elders as key members of learning, creating links between the school/classroom and the larger Indigenous community. The SMYM initiative presents its goal for wholeness in quality mathematics education for Indigenous students primarily in the aspects of community involvement, which are often disregarded when meeting mathematics performance standards (Wagner & Lunney Borden, 2011). In the fundamental framework behind SMYM, interpersonal positioning for the greater community is what drives the ethnomathematics interactions between researchers, teachers, and students. Therefore, the changes made from the initiative are often inspired by the community culture, addressing transformations to introduce the significance of learning the native language, differences between traditional school and Indigenous concepts of mathematics, alternative ways of learning and knowing, and linking ethnomathematics in student learning (Lunney Borden, 2010). In this process, the areas of change include altering the format and intentions of school projects and activities (e.g.,

beadwork, making hand drums, paddle making). In making these changes, the differences from the traditional approaches are less about the individual methods that teachers take to improve mathematics learning but are instead about supporting the overall changes linking community practice and culturally relevant material inside and outside the classroom (Wiseman et al., 2020).

Table 2

Comparison of the Canadian Mathematics Education Initiatives

Areas of difference	Initiative		
	Building Thinking Classrooms	Math Minds	Show Me Your Math (SMYM)
Focused area for change	Classrooms	Teacher Instruction	School and community
Association with goal	Features of the classrooms are altered to facilitate student thinking in mathematics (physical, social, environmental, behavioural features)	Instruction should direct student understanding and response/recognition of mathematical concepts (teaching content and delivery)	Create links to the Indigenous community significant to Indigenous concepts of mathematics, ways of learning and knowing (include key community members, culturally based inquiry projects)

Importance and Reasons for Success

After analyzing the differences and similarities between the mathematics education initiatives, I will examine the various definitions of success from each initiative and evaluate their common areas of success. When observing the diverse versions of success, there is room to contemplate how success was represented (what were the projected outcomes from educators or researchers), the level of impact that was achieved, and the main reasons/pathways that led to their success. When examining the initiatives' overall success, I attempt to be transparent in uncovering their benefactors and significance in the field of mathematics education.

Individual Versions of Success

Each of the mathematics education initiatives views success differently. For Building Thinking Classrooms, success was defined in the increased student thinking in math classes for longer periods of time. The goals projected this success of long-term learning through methods of promoting and sustaining student thinking, measured based on the length of time to finish, persevere, remain engaged, and participate in math work (Liljedahl, 2020). The formative assessments also support these goals with more subjective and self-set criteria for student learning in math classrooms (Liljedahl et al., 2021). Through the Building Thinking Classrooms framework, success was primarily displayed through education stakeholder reports on improved success in their classrooms. These reports consider teachers, professors, and board members across provincial districts in Canada and extending to the United States. Outside of the 40 classrooms involved in the research process of the initiatives, reports capture a small portion of countless (undocumented) changed classrooms that have had positive experiences with

the Building Thinking Classrooms framework (Liljedahl, 2016, 2020). Generally, these reports inform significant classroom changes in increased student performance and engagement in mathematics learning, generating independent, creative, and responsive students with thinking mindsets (Liljedahl, 2020).

From Math Minds, they inform their recent success for their approach through evidence of learners showing improvement using the Canadian Test of Basic Skills (CTBS) as their instrument. In the CTBS test results (spanning over 5 years), there was an improvement in overall mathematics scores with a national percentile rank score of 27 in Year 1 to a national percentile rank score of 55 in Year 5. The largest improvements were in the areas of mathematical conceptual understanding and problem-solving, increasing from a national percentile rank score of 25 to 57 and 39 to 59, respectively (Davis et al., 2020). The structure of the RaPID model achieved its main goals to primarily support these areas of mathematics learning, and the success of this initiative is most prominent for the greatest progress of lower-performing students (Preciado-Babb et al., 2015). The impact of Math Minds extends beyond the studies conducted within classrooms, as the Structuring Inquiry website provides courses for educators online to be accessed from anywhere. The success of the accessible courses can be observed in teacher reports and forum postings, through the open online community for Math Mind members, discussing positive results in student mathematics learning in classrooms across Canada (Davis et al., 2020).

The success of the SMYM program is noted by the provided support for over 1,000 children from five different communities, with a major impact within the Mi'kmaw Kina'matnewey community. The program has members of the community and family

who report positive feedback from the initiative and are more invested in their children's learning within the classroom (Lunney Borden & Wagner, 2022). This has resulted in the growth of enthusiasm from teachers and students in classrooms, and the building of meaningful personal connections within and between mathematical thinking and the community cultural practices (Lunney Borden, 2010). Consequently, the success of growth and long-lasting community participation can also be considered evidence of success, as SMYM continues to hold events to represent and celebrate student achievements every year (Wiseman et al., 2020).

Based on observing these areas of success, it is important to think about what aspects lead to the success and the benefactors of the types of success displayed. The differences in changes were noted previously, and the areas of improvement seem to follow the level of change that each initiative aimed to achieve. The benefactors in Building Thinking Classrooms seem to rely on the classroom changes, primarily reporting back improvements from teachers and students in attitude, behaviour, environment, and experience (Liljedahl, 2020). Similarly, the benefactors of Math Minds, both students and teachers, display overall improvements in attitude and structure, but students are reported to have significant improvements based on performance (Davis et al., 2020). Unlike the other initiatives, SMYM works at a community level, where there is the inclusion of family and community members working within the initiative and their involvement stems from the children's learning in the classroom (Lunney Borden & Wagner, 2022). Although each initiative impacts different levels of success, the primary level of success is student-focused mathematics learning. This may be understandable,

but it is important to note, as the shared goal is significant for distinguishing current mathematics education in Canada.

As each initiative views success differently, there are certain implications for Canadian mathematics education. The varying views of success can attribute to concerns about maintaining a unified perspective on mathematics education across the nation. Especially in Canadian education systems that are already divided, displaying multiple views of success can continue to segregate waves of change. While the goals and motives may be oriented toward different paths for success, there are chances to create misunderstandings as core beliefs are questioned as to what defines success and the prioritizing methods to achieve said success.

Alternatively, these different ideas of success show that there is support for the variety of insights and viewpoints in mathematics education across the country. The different definitions/representations of success for the initiatives demonstrate numerous current issues based on various contexts within Canadian mathematics education. These contextual differences, either based on the research area or situated province, reflect the diverse experiences in mathematics teaching and learning. Either through educational research or practice, there is the freedom to express various perspectives and opinions seen in exploring and defining multiple modes of success. The next section will explore the aspects of student mathematics learning the initiatives had in common, and the possible successful features that led to extending learning beyond the mathematics classroom.

Overall Levels of Success: The Impact on Student Mathematics Learning

Apart from the differences in the focused changes in pedagogical approaches, the mathematics education initiatives have similar results when attaining success for mathematics learning in the classroom. All initiatives had improvements in student learning that were often attributed to challenging failed aspects of the traditional mathematics education approach/classroom. From the modern models/strategies used, these mathematics education initiatives have aimed to achieve and have reported positive outcomes for student engagement, participation, and motivation in mathematics learning.

From Building Thinking Classrooms, the indicators of producing a successful thinking classroom are seen with improvements in student involvement. It may also be appropriate to say that a thinking classroom consistently requires the aspects of student engagement, participation, and motivation, to be considered a thinking classroom. Liljedahl (2020) breaks down that engagement and thinking are correlated, in that, if we are thinking, we will be engaged, and vice versa. Therefore, although engagement may seem like a product of thinking classrooms, engagement is used as a pedagogical tool to build a thinking classroom. The format of Building Thinking Classrooms also encourages the aspect of participation and engagement through collaborative group organization and effort. The strategies of the project supporting rich tasks, formative assessment, and student autonomy display growth in their actions towards continued student motivation (Liljedahl et al., 2021). The aspects of student involvement in the initiative did not only show increased success but were also reported to have sustained long-lasting student engagement and motivation with student thinking.

In the structuring inquiry model from Math Minds, several factors are used to

support and signify student involvement based on the knowledge and understanding of student learning behaviours. Engagement can be seen as a method of feedback for teachers, checking for effective variation, visible learning, and responsive teaching. The RaPID element of travelling is a method for strong engagement and participation through making connections within and between lessons with ideas of sequencing (Metz et al., 2017). When directing and prompting variation successfully, engagement and motivation can continue to exist past completed tasks, as students may participate in bonus tasks and make extensions beyond the classroom (Preciado-Babb, Aljarrah, et al., 2016). While incorporating ideas of intrinsic motivation (Pink, 2011), working memory (Guskey, 2010), and the Variation Theory of Learning (Marton, 2015), the RaPID model fulfills engagement and participation, promoting them as necessary indicators to gauge student ability and successful teacher prompting/teaching.

From the SMYM project, patterns of engagement, participation, and motivation are consistently present as student behaviours. Often in Indigenous communities, these types of student behaviours are not evident in mathematics classrooms, as the traditional classroom can be disengaging and disregard concepts of wholeness in Indigenous ways of knowing and learning. Not exclusive to Indigenous communities, other communities may also struggle with disengagement in mathematics classrooms, which approaches like SMYM tackle through improving teaching and learning in an equitable manner (Wagner & Lunney Borden, 2011). As SMYM celebrates and encourages the cultural, familial, and community aspects in classrooms (with mathematical investigations and community-based projects), this directly addresses students' interests and needs. The schools involved with SMYM are found to show remarkable results from encouraging

participation, where students respond positively with authentic engagement and making meaningful connections to mathematics. The motivation of learners is displayed through student autonomy, spoken native language, and opportunities to create, which has even inspired peer mathematics tutoring sessions between students (Lunney Borden, 2010).

The delivery of each of the mathematics initiatives has encouraged growth in student learning, altering the behaviours and attitudes that students have towards mathematics. With more positive experiences in mathematics learning, students open themselves up to more opportunities to make connections to mathematics outside of the classroom. These initiatives support these positive responses in their pedagogical approaches within the classroom, sustaining them for long periods and encouraging the greater possibilities for lifelong learning in mathematics.

Table 3

The Success of Canadian Mathematics Education Initiatives

Describing Success	Initiative		
	Building Thinking Classrooms	Math Minds	Show Me Your Math (SMYM)
Individual impact/success	Workshop and Teacher Book Guide access (teacher, consultant, researcher report success)	Provides courses for educators online (National math performance in CTBS testing)	Over 1,000 children from 5 different communities supported (teacher, student, family report success)
Definition of individual success	Increased student thinking in math classes for longer periods of time	Improvements in the areas of math conceptual understanding and problem-solving	Build meaningful personal connections between math thinking & community cultural practices

Shared aspects for success in student learning (Engagement, motivation, participation)	- Engagement fosters thinking (vice versa)	- Student feedback and responsive teaching	- Celebrates culture, family, & community in classrooms
	- Collaborative group formation and effort	- Directing and prompting with effective variation	- Mathematical investigations and community-based projects
	- Autonomy, rich tasks, formative assessments	- Making extensions beyond the classroom	- Student autonomy, native language, peer tutoring sessions

In this chapter, I have introduced the context of Canadian mathematics education and three Canadian mathematics education initiatives: Building Thinking Classrooms, Math Minds, and Show Me Your Math (SMYM). I have identified the main features of the three initiatives, explored their commonalities and differences, and discussed their diverse and shared elements for defining and representing success. The next chapter will introduce three radical Global South alternative approaches and will follow a similar outline to the Canadian initiatives, as it will examine the similarities and differences between approaches and deliberate their possible features for success.

CHAPTER FOUR: REVIEW OF GLOBAL SOUTH ALTERNATIVES

In the previous chapter, I discussed the Canadian educational context and three Canadian mathematics education initiatives. In this chapter, I review three Global South alternative approaches that have contributed to large-scale educational change within their specific regions and beyond. In a similar format to the previous chapter, I will first identify the Global South approaches with a brief summary of each. Then I will draw comparisons among the alternative approaches, examine their areas of success, and offer possible reasons for their success.

Identifying the Successful Alternatives

The Global South is often referred to as the developing countries or the Third World, but extensively represents the historically colonized parts of the world (Rincón-Gallardo, 2019). There are three alternative approaches originating from the Global South—Escuela Nueva in Colombia, the Learning Community Project in Mexico, and BRAC Non-Formal Primary Education in Bangladesh—which have been successful in national performance for the core academic subjects (Farrell et al., 2017). When examining these three alternatives, it is important to note that there are significant contextual differences addressed in describing the Global South approaches, in comparison to Canada’s provincial-based education system in place.

The Colombian alternative schools from Escuela Nueva were created to support primary schooling in remote rural communities. The Escuela Nueva model has been able to mould educational theories of student-centred learning with affordable and sustainable goals, granting access to high-quality education for all students (“Colombia’s Road to Revolution,” 2014). This alternative schooling has a multigrade/multiage framework,

with a focus on small and diverse collaborative group work and peer tutoring (Colbert & Arboleda, 2016). The pedagogical approaches of Escuela Nueva promote the critical features of student-driven learning, variation in learning paces, creative collaboration, student autonomy, teachers as facilitators, and strong relationships between school and the community (Fundación Escuela Nueva, n.d.).

The Escuela Nueva model was first developed by Dr. Vicky Colbert, creating a workable model that has now been implemented through her non-governmental organization, Fundación Escuela Nueva, fulfilling large-scale impact (“Colombia’s Road to Revolution,” 2014). The Escuela Nueva schools have proven their success in outperforming their urban school counterparts, gaining traction to start over 41,000 rural schools, and contributing to the growth of adopting the framework in over 15 different countries (in Latin America, Africa, and Southeast Asia), educating more than 5 million students (Fundación Escuela Nueva, n.d.).

The Learning Community Project (LCP) from Mexico has funded public rural middle schools which have become established as local learning communities. The LCP was intended to initiate a new pedagogy for deep learning and a new form of education through frameworks based on tutorial relationships of dialogue and reciprocal learning among students and between students and adults. A primary strategy for the students in the LCP program is to develop skills for student self-regulated learning, following lines of inquiry at their own pace (Rincón-Gallardo, 2013). In terms of educational reforms, the scale of the impact of the LCP approach is recognizable in processes of widespread cultural change, effective pedagogy through multigrade/multiage organization, and reshaped social relationships in schools (Rincón-Gallardo, 2016).

The success of schools from the LCP is shown in the improvement of students' scores in math and language, which grow at a faster pace than in other privileged schools, reaching or even surpassing their academic performance. Initially, the poor levels of academic performance in Mexican schools were one of the main motives for implementing LCP, as indicated through results from the national testing system (ENLACE) and internal standardized tests (EXCALE). Since then, schools implementing LCP approaches have measured great improvement in Spanish and mathematics, as the mean percentage of Good and Excellent student scores increased from 7.4% to 15.7% within 2 years. These displays of student achievement are impressive, as the scores even surpass the scores of schools that do not implement the LCP program (Elmore, 2010; Meixi, 2019; Rincón-Gallardo, 2016). LCP schools are avid markers in educational change, displaying change in the levels of spread, depth, shifts in ownership, and sustainability for success as a movement (Rincón-Gallardo, 2016). In Mexico, over 300 schools have been funded by the LCP, gaining outreach and networking undertaken by teachers, local administrators, and project leaders. The project has transformed teaching and learning in 9,000 lowest-performing schools across the country (Rincón-Gallardo, 2019).

The non-formal primary education from the BRAC alternative schooling provided outreach to those unable to reach the scale necessary to meet the educational needs of rural and other marginalized communities. These alternative schools created an educational environment to honour cultural practice/wisdom within small communities while empowering local women in education (Numan & Islam, 2021). The approaches from BRAC focus on student needs and learning through features such as a customized curriculum that is contextually relevant, reorganizing class times for family accommodation, and building sincere student–teacher relationships in the classroom

(McLorg, 2019). In addition, compared to traditional/public schools, BRAC schools encourage cooperative learning in groups and are consistent in providing quality learning assessments and feedback to students (Numan & Islam, 2021).

The success of the association's work has gained support from a variety of international and donor agencies in Ethiopia, Sudan, Somalia, Uganda, Sierra Leone, and Afghanistan. Currently, BRAC education has spread to approximately 37,000 rural schools in Bangladesh, expanding to an enrollment of more than 1.5 million Bangladeshi children with even more students worldwide (Hanemann, 2017; Mahbub, 2008). With a focus on primary school learning, there are significant strides in BRAC schools toward student inclusivity, supporting and representing ethnically diverse children, children with disabilities, poor children, and young girls (Mahbub, 2008). As well, Numan and Islam (2021) found that BRAC students displayed passing rates of 100% in comparison to 96% for public-school students, as well as the minimum skills in all subjects in comparison to weak skills in mathematics and English and no analytical skills in other subjects.

It is important to note the contextual differences of the educational systems in place for each of the Global South alternative approaches. Colombia, Mexico, and Bangladesh all have national education systems, meaning that public schooling is controlled by the national governments in determining educational policies, curriculum, and implementation. The Escuela Nueva model was implemented as a national education policy by the Colombian Ministry of Education and the LCP was implemented by the Mexico Ministry of Education and continues to participate in plenty of cross-state involvement and community partnerships (Colbert & Arboleda, 2016; Rincón-Gallardo, 2019). BRAC, as a non-government organization (NGO), partners with national governments and adheres to the national curricula, but its implementation of educational

policies stands on a sole foundation with the ability to move across several jurisdictions (Numan & Islam, 2021). These non-state sector educational changes must be addressed when thinking about implementing curricula and educational policies, presenting major differences for large-scale implementation in Canadian education provincial systems.

Table 4

Summary of the Global South Alternative Approaches

Aspects	Approach		
	Escuela Nueva	Learning Community Project (LCP)	BRAC alternative schooling
Country of origin	Colombia	Mexico	Bangladesh
Goals	Support primary schooling in remote rural communities	Support student learning through reciprocal learning & relationships in local communities	Provide outreach to meet the educational needs of rural & marginalized communities
Pedagogical features	<ul style="list-style-type: none"> - Multigrade/multiage framework - Collaborative group work & peer tutoring - Student-driven & self-paced learning - Teachers as facilitator 	<ul style="list-style-type: none"> - Self-regulated learning - Following lines of inquiry at their own pace - Effective multigrade pedagogy - Reshaping social relationships in schools & community 	<ul style="list-style-type: none"> - Honour cultural practice/wisdom - Empowering the local women in education - Customized curriculum - Building sincere student-teacher relationships in the classroom
Widespread notable impact	<ul style="list-style-type: none"> - Started 41,000 rural schools - Spread to over 15 different countries 	<ul style="list-style-type: none"> - Started more than 300 funded schools in Mexico - Transformed teaching and 	<ul style="list-style-type: none"> - 37,000 rural schools in Bangladesh - Enrollment of more than 1.5 million

- | | | |
|-------------------------------------|---|---|
| - Over 5 million students worldwide | learning in 9,000 lowest-performing schools | Bangladeshi children
- Spread to more than 7 countries |
|-------------------------------------|---|---|
-

Comparison Between Approaches and Intersecting Areas of Success

For these Global South alternatives, there are similarities that arise in mindsets and concepts when observing their perspectives and practices. The main theoretical observations with the three alternatives are the focus on learning, orienting pedagogy to be more student-centred and active, and involvement of the local community in education. There are also many common threads to improving rural community areas at the national level for all three of these approaches. Despite the several areas of intersection, these approaches have differences in core beliefs regarding the methods to achieve success. These distinctive values are seen in their perspectives and original motives toward educational change.

From Escuela Nueva, the focus of effective teaching relies on the aspects of student-centred learning. Although the features of the student-centred approach are similar to the other Global South alternatives, the model explicitly uses these strategies to support all types of students. In providing student learning support, the model finds ways to encourage student independence and autonomy. The teacher steps back in this approach, taking on a facilitator role to simply observe and assist when necessary. Students are shown to work independently on tasks at their own pace, seen to work alongside peers of their own volition, and reciprocate learning amongst themselves with peer tutoring (Colbert & Arboleda, 2016). These features support the belief that students should have freedom in their learning, where they can make their own decisions, and that

the classroom and facilitators should work for them. Also, the model strives for educational changes to be feasible and long-lasting, in the financial, political, and societal aspects. The model of Escuela Nueva has created sustaining impact through this mentality by utilizing research, unions, and communities, to accomplish change in systemic ways and national policy (AERA Educational Change Special Interest Group [SIG], 2013).

The Learning Community Project explains its goals through its name, fulfilling the needs of students through the community. Whether this means developing education within rural communities, making connections between school and community, or creating a strong school community, there is a sense of bringing people together to support student learning. Community involvement is actualized within the curriculum, providing local and cultural knowledge for students about locally relevant topics such as farming or migration (Rincón-Gallardo & Elmore, 2012). The members of the community (including family) are also very involved with the learning process of students, participating in student demonstrations and student body government (Elmore, 2010). Although the multigrade, self-paced, and student-centred learning styles in LCP are similar to Escuela Nueva, these are deemed useful by the learning community and have a larger purpose in involving students within the community. The new pedagogical practices from the model are derived from a critical community to induce sustained and impactful educational change, as they embody shared interests (Rincón-Gallardo, 2019).

The goals of BRAC carefully align with the Bangladesh government's priorities and sustainable development, which focus on raising the levels of learning for disadvantaged students. These students are found in rural communities, with greater

targets of inclusion for girls and children with disabilities. In order to gain involvement in these rural towns, the local community is engaged by reviving native traditions and language in the classroom (Mahbub, 2008). The teachers at the schools are all women, empowering girls as role models, and maintaining friendly, warm relationships with every student. The BRAC programs try to represent disadvantaged groups within the classroom where at least half of the class is comprised of girls and 10% of children live with a disability (McLorg, 2019). The approaches to student learning with BRAC schools are very flexible to each student's accommodations and needs. This is apparent, as teachers will accommodate to keep moderate class sizes, create personalized curricula to slowly accustom students to the standard curriculum, and offer consistent assessment and feedback to students (Numan & Islam, 2021).

Defining and Representing Shared Success

By looking through the lens of these alternatives, we can learn from their successes. A form of success that is linked across the alternatives is improved academic performance. More specifically, students in schools using Escuela Nueva models have presented higher test scores than those in conventional rural schools by more than 11% in mathematics and 19% in Spanish (Colbert & Arboleda, 2016; Schiefelbein, 1992). Schools with the LCP program reach high levels (with good and excellent scores) of achievement, generally at faster rates and with better scores (mean percentage of 15.7) in national standardized testing in comparison to schools without the LCP program (mean percentage of 13.8; Meixi, 2019; Rincón-Gallardo, 2016). BRAC schools appear to report positive performance over public (government) schools in terms of basic education levels (e.g., reading and writing scores), quality, power, and enjoyment of learning (Haiplik,

2004). The students involved with the Global South approaches have displayed significant success/progress at school through their test scores by performing as well as or even better than the students in regular schools (typically in urban regions) and have achieved high completion rates for primary and middle school level grades (Farrell et al., 2017). These schools that implement the alternative models have also done so with limited funding and resources, and even though the actual costs are lower than traditional schools, students are still able to stay in school, finish primary level schooling, and develop self-confidence and self-esteem to carry on their education. These alternatives remain successful in their positive results for enrolment, retention, completion, and movement to the next levels of schooling and measured academic success (Fundación Escuela Nueva, n.d.; Mahbub, 2008; Rincón-Gallardo, 2019).

Another distinct area of shared success is the influential impact and sustainability of educational change for each approach. All three alternative approaches have implemented models and programs that have grown to a national, and even international level. At the nationwide level, the countries of Colombia, Mexico, and Bangladesh have enacted educational policies and programs to support the goals of the alternative approaches (Numan & Islam, 2021), with Colombia and Mexico providing government funding for Escuela Nueva and LCP (“Colombia’s Road to Revolution,” 2014; Rincón-Gallardo, 2013). Vicky Colbert has led the rapid expansion of these types of schools, integrating multiple levels of scaling to gain interest from the larger players in education (AERA Educational Change SIG, 2013). In its growth and aspirations, the LCP views teaching and learning as a social movement in its transformation. This view of large-scale educational reform can be represented in developing the aspects of a strong instructional

core, maintained commitment, and involvement in educational research and policy (Rincón-Gallardo, 2019). For BRAC, the level of growth in educational change can be attributed to the levels of alignment toward large-level educational goals. This can be matched with Bangladesh's national education goals, which include the desire to represent inclusivity of education and raised the quality of education in rural areas, along with attaining Sustainable Development Goals (Mahbub, 2008; McLorg, 2019).

Although these versions of success are subjective, it is important to note the significance of such successes. Depending on the goals of each approach/initiative, success can be oriented and interpreted differently based on the motives of those involved. The previously mentioned versions of success involve the reports of academic performance success and large scalable (levels of impact) success. These are both ways to measure the success and improvements of these Global South approaches, but there should be a focus also drawn to the unmeasurable amounts of success associated with student learning. The levels of success surmounted to student learning can range beyond performance, relating to positive changes in student behaviours/attitudes towards learning, student–teacher relations, student levels of connection, student ability to remember new understandings and content, and student ability to create new forms of knowledge. The next section will provide the reasons and importance of the successes of the Global South, informing more of the unmeasurable successes that come with the forms of success described above.

Importance and Reasons for Success

Since the shared commonalities seem to contribute/relate to each program's success, this section will further explore the intersecting areas of success of the

alternatives by providing the possible reasons and correlations behind the positive results of student learning and performance. The common aspects of student-centred learning, classroom environment, facilitator role, and community involvement will be examined in relation to explanations of success in improving student learning at the large-scale level. Through the observations of the similarities between the three approaches, we can explore possible reasons and improvements to critical teaching and learning strategies through possible shared areas of success.

Table 5*Comparing Success Between the Global South Alternatives*

Aspects	Program		
	Escuela Nueva	Learning Community Project (LCP)	BRAC alternative schooling
Focused areas of success	Effective, sustainable model for student-centred learning of all students	Fulfill the needs of students through the community	Raising learning levels for disadvantaged students (e.g., young girls, disabled children)
Shared representations of success	Improved academic performance, high levels of completion, continuation of enrollment	Improved academic performance, high levels of completion, continuation of enrollment	Improved academic performance, high levels of completion, continuation of enrollment
Educational change impact	Scaling levels in the technical, political, and financial aspects, gaining interest from the larger players in education with rapid expansion	Viewed as a social movement, developing a strong instructional core, maintaining commitment, and involving educational research and policy	Large-level educational goals (national education goals to represent inclusivity and raise the quality of education in rural areas)

Student-Centered Learning

There is a common thread of practices surrounding student-centred learning in all these alternatives. In general, student-centred learning involves approaches that emphasize student active participation (e.g., motivation), relationships/interaction (e.g., peers, teacher), real-life skills (e.g., cultural relevance), adapting to needs/interests, power-sharing (e.g., self-regulation), and student autonomy (Bremner, 2021). In contrast to the approaches to student-centred learning, the traditional models of teacher-centred learning are more likely to have problems with student discipline and mental health. This is possibly due to the fact that teacher-centred approaches tend to diminish or exclude

student's voice, self-control, motivation, and engagement leading to many undesirable physical and psychological responses such as distress, motivation, boredom, and anxiety (Cornelius-White, 2007; McPherson, 2021; Sakata et al., 2021).

With a focus on learning that is directed toward students, the three Global South approaches can encourage students to do work and in-class activities with their own self-paced, self-guided instruction (Farrell et al., 2017). Therefore, in the classroom, students are found working independently or in small groups, at learning stations, centres, or corners. These groups are often organized with the multigrade/multiage framework in mind, as students can be free to learn from their peers and should normalize working at different levels (Colbert & Arboleda, 2016; McLorg, 2019; Rincón-Gallardo, 2019). By instilling the ritual/practice of independence, students are seen to be able to develop motivation, self-confidence, and self-esteem in their learning capabilities, which creates the drive to carry on their education (Zumbrunn et al., 2011).

Classroom Environment

The classroom environment of these implemented alternative models generally consists of a completely different dynamic to the traditional classroom. There is an alternate order of reaching out for assistance or communication to authority, in which students will ask for support on a topic from the peers in their group or from a student who has already mastered the subject, before asking a teacher/facilitator (Fundación Escuela Nueva, n.d.). This new order of assistance is implemented within the classroom, where there is a practice/skillset of peer tutoring in class that develops a sense of pedagogy learning, tutorial relationships of dialogue, and reciprocal learning. In Escuela Nueva and LCP (McEwan, 2008; Rincón-Gallardo, 2019) this classroom atmosphere is

discussed as multigrade learning; but when analyzing all three models, this can be covered as multigrade/multiage learning as students will support one another with their learning that can be observed in groups of mixed abilities all at different learning levels. Conflicts surrounding multigrade schools can be found, as the schools generally are a response to low enrollment in rural areas. But as one part of a larger purposeful pedagogical strategy, the multigrade aspect in redesigned models displays greater performance and favourable reports from teachers, in comparison to traditional approaches (Hammler, 2017; Psacharopoulos et al., 1993).

As students can discuss their work and find resources around the classroom, the atmosphere in class will display busy, noisy (non-disruptive), free-flowing movement to/within learning stations of students' explored, occupied learning (Colbert & Arboleda, 2016; McLorg, 2019; Rincón-Gallardo, 2019). With more freedom and autonomy in their learning environment, students can explore interests within the curriculum with enjoyment and genuine interest. This type of classroom environment also considers students' individual learning journey, promoting positive development for student identity, self-esteem, student academic motivation and engagement, and improved academic performance (Kaput, 2018).

Facilitator Role

For these alternatives, the traditional teacher role is more commonly modified as the facilitator role. The facilitator is a figure that will provide the guidance and supporting role the class needs, instead of conducting and leading the classroom. While still remaining in a position of authority, the facilitator acts as a member of the class guiding students to their most significant potential and sharing power within the

classroom that empowers learners. In contrast to the typical teacher, facilitators allow greater room for choice and voice in activities, assessments, and levels of instruction (Farrell et al., 2017; McCarthy, 2015). The facilitators are generally found to be traversing through the classroom, checking the students' progress, solving problems, answering questions, and recording each student's progress and development (Fundación Escuela Nueva, n.d.).

The facilitators in these alternatives are found to be trained in the community, often as young women that are locally known, sometimes with university certifications but mostly working at several different schools remotely (moving from place to place). For the training of facilitators, commonly there is a practice of in-service peer mentoring that continues through their work at schools so that facilitators can help one another analyze problems and discuss their results. In the alternative models, this form of peer mentoring typically allows facilitators to meet every 1 to 4 weeks, avoiding leaving new teachers in the dark to figure out their job teaching or without assistance in the new teaching environment. As a result, the instructors gain encouragement from in-service peer mentoring sessions, forming a strong support system that would continue after their training (McLorg, 2019; Rincón-Gallardo, 2019). In these methods of training teachers/facilitators, gaining expertise, knowledge, and experience is a collaborative process. This process supports only growth and development, preparing facilitators to focus on what the student brings to the classroom, their knowledge and abilities, and their comfort and response to new learning (Rickards et al., 2020).

Community Involvement

These alternative schools have a strong alliance and relationship with the local communities. By allowing the connection for local involvement with the schools, there is a development (that is newfound, growing, directed, important/appreciated) in local communities' history, culture, and families (Colbert & Arboleda, 2016; Mahbub, 2008; Rincón-Gallardo, 2016). The schools that apply these models have developed a new form of community education that is incorporated into the curriculum. Through these modifications, local community practices and traditions are found to be taught/maintained within the school, and the community provides locally sourced teaching, and locally sourced learning materials and resources (Colbert & Arboleda, 2016; McLorg, 2019).

The increased participation of the community (e.g., in student school government) can include involvement in school activities, allowing students to understand and practice democratic behaviours and values. Through community involvement, students are also able to experience applicable issues, as they learn to examine local challenges that directly affect them and identify their cause and design unique solutions (Rincón-Gallardo, 2019). This strong foundational relationship between school and community highlights the significant factors of reciprocity and ethical relationality natural in making human connections. These relationships help to maintain personal/community integrity, teaching the acts of giving and giving back, meaningful contribution, and showing care as holistic communities (Wiseman et al., 2020).

Table 6*Deriving Reasons for Success: Explaining Common Features*

Student-centred learning	Classroom environment	Facilitator role	Community involvement
Self-paced, self-guided instruction	Busy, noisy (non-disruptive) atmosphere, free-flowing movement	Provides guidance and supporting role (replace directing and leading)	Community education incorporated in curriculum
Learning stations, centers, or corners	Assistance from peers before facilitator (teacher)	Consistently traverses through the classroom	Locally sourced teaching, learning materials and resources
Multigrade or Multiage	Peer tutoring & reciprocal learning	Training of in-service peer mentoring (continuing after working at schools)	Development of history, culture, and families in school-community connection

Acknowledging Importance in Success

From recognizing the common aspects that have contributed to the success of the Global South alternatives, the reasons for achieving such success become significant in several ways. The main reason to acknowledge these attributes is to understand the areas from which we can learn, in the areas of research and pedagogy. The implications for large-scale education reform, lead others to view what successful large reform practices may look like and possible methods to achieve such change. There can be many aspects of these alternative approaches that can be implemented pedagogically, and applicable to changes made within classrooms, for students, teachers, and communities. In research, there can be more awareness drawn to these versions of success from areas that often go unrecognized in the Global North, and the Eurocentric systems can be challenged with

such innovative methods. Along with these radical approaches for success from the Global South, context must be considered. It is crucial to understand the reason and explanations behind such success, as the approaches must not be borrowed and implemented without the knowledge of contextual and systemic differences. Therefore, in learning about the aspects that drive the success of the Global South alternatives, it is important to note the factors that are truly applicable for large-scale educational change and overall improvement in student learning.

In this chapter, I described three successful Global South pedagogical approaches: Escuela Nueva, Learning Community Project, and BRAC Non-Formal Primary Education. I continued to examine these alternative approaches, discussing their similar and different aspects, possible shared areas of success, and reasons for said success. In the next chapter, I will compare the three Canadian mathematics education initiatives with the three Global South alternatives. It will be the last chapter of results and findings, bringing to light the commonalities and areas of potential consideration between the approaches, and the potential for integrating the aspects of the Global South alternatives for Canadian mathematics education.

CHAPTER FIVE: DISCUSSION AND ANALYSIS

In Chapters 3 and 4, I examined each of the three Canadian mathematics initiatives and each of the three Global South alternative approaches. In both chapters, I introduced the pedagogical approaches, then discussed comparisons, intersecting areas of success, and possible reasons for their success. In Chapter 5, all six of the alternatives and initiatives will be compared and discussed in detail. Comparisons will be drawn between the Canadian initiatives and Global South alternatives, along with ideas for integrating the approaches.

Comparisons

To start Chapter 5, I wish to remind readers of the contextual differences between Canada and the countries of the Global South, which have implemented these initiatives and alternative approaches. The Global South alternative approaches that are being examined are from the countries Bangladesh, Colombia, and Mexico, which function in national education systems. In comparison to Canada, where the educational systems are provincially governed, the Global South alternatives have more opportunities to spread change across their provincial borders. As well, the mathematics education initiatives from Canada generally follow the Western & Northern Canadian Protocol (WNCP) Common Curriculum Framework (CCF) for mathematics but are recently developed programs/projects (referred to as initiatives) with no national policy, programs, or curricula to be considered large-scale change (Simmt, 2015). The contextual differences in educational systems and the duration for these approaches to form are important factors to consider when making comparisons between approaches, as they can affect certain generalizations and assumptions in findings. More specifically, the comparisons

should consider these differences with respect to the design, implementation, and educational impact when examining levels of change from approaches in the Global South or Canada.

Unless otherwise indicated, the Canadian initiatives refer to all three mathematics education programs, Building Thinking Classrooms, Math Minds, and Show Me Your Math (Davis et al., 2020; Liljedahl, 2020; Wagner & Lunney Borden, 2011). As well, when referring to Global South alternatives, this encompasses the three large-scale impact educational approaches of Escuela Nueva, Learning Community Project, and BRAC Non-Formal Primary Education (Colbert & Arboleda, 2016; Farrell et al., 2017; Numan & Islam, 2021; Rincón-Gallardo, 2019). When conducting the comparisons, I will first examine the similarities between the Global South alternatives and Canadian mathematics education initiatives. Although these similarities are at different levels and have disparities based on context, I will consider the commonalities in the areas of overall background, results, pedagogical standpoint, and pedagogical approach. After examining the similarities, the main differences and areas of potential consideration between the Global South alternatives and Canadian initiatives will be analyzed. These differences will show the areas where there is potential for reciprocal learning between both global areas. As discussed in the introduction, this analysis can also redirect the flow of information from the Global South to the Global North, as the Eurocentric views have been dominant in the current global education systems (Brissett, 2020).

Similarities in Alternatives and Initiatives

When observing the approaches from the Global South and the Canadian mathematics education initiatives, there are several similarities that can be seen at the

broad level. In terms of educational change, all six approaches have addressed issues in formal school education and have teams/groups dedicated to designing and implementing changes within education systems. Although the degrees of involvement differ, since the Global South approaches have been incorporated in education systems for far longer, with the involvement of strong organizations, programs, unions, and governments, the Canadian mathematics education initiatives have strength in their background of new researchers, new research teams, board, and school members involved in the design and implementation of their models.

In addition, there are articles and journals to support the creation of the alternatives and initiatives, with differences in the currency of said research and theoretical background. There are also well-known researchers in their respective fields (of either educational change or mathematics education) who have produced, contributed to, or shed light on all six approaches. Some of the mathematics education researchers, renowned in Canada and worldwide, include Dr. Peter Liljedahl (Building Thinking Classrooms), Dr. Brent Davis (Math Minds), and Dr. Lisa Lunney Borden (SMYM), and some of the world-renowned educational change researchers include Dr. Santiago Rincón-Gallardo, Dr. Vicky Colbert (LCP), and Dr. Joseph Farrell (BRAC, LCP, and Escuela Nueva). While challenging the traditional systems and approaches, all methods from the alternatives and initiatives focus on bringing change for students and their learning, whether these are made through student-centred approaches, community practice, or alternate teacher instruction.

At their levels of success, often the results of success are measured based on academic performance or reports of produced positive outcomes. The reports commonly

describe improvement in student attitude/behaviours towards learning, teacher outlook and instruction, development of strong relationships within the classroom, and overall environment of the classroom, school, and/or community. For all three of the Global South approaches, there are academic performance results to support claims of improvement, including national standardized testing, student reports, and comparative research studies (Farrell et al., 2017; Haiplik, 2004; Mahbub, 2008; Meixi, 2019). For the Canadian initiatives, all three have reports from teachers and students that acknowledge positive outcomes from implementing new changes, and Math Minds has national testing of CTBS to show increased levels of student understanding and problem-solving (Preciado-Babb et al., 2015). Although there are different displays of success from all approaches, the positive results from the initiatives and alternatives have claimed to improve student learning.

In the methods of supporting student learning, there are changes made to teacher instruction, classroom environment, and/or school culture, but in all aspects, there is the consideration of students in their diverse ways of learning. The Global South alternatives have strong correlations with student-centred learning in their models which include encouragement of student autonomy, self-paced learning, and individual-based assessments. The Canadian initiatives focus on various areas to improve student learning, including cultivating student thinking (Liljedahl et al., 2021), incorporating knowledge about working memory and variation in learning (Guskey, 2010; Marton, 2015), and introducing intergenerational culture into the classroom (Wiseman et al., 2020). In all approaches in Canada and the Global South, teacher programs are promoted either

through teacher training, professional development (PD), community support, or peer tutoring among teachers and teacher candidates.

From the detailed examinations of the Global South alternative approaches in the last chapter, there are several overarching similarities in the aspects of student-centred learning, classroom environment, facilitator/teacher role, and community involvement. These aspects can also be associated with recognizable themes within some of the Canadian mathematics education initiatives. Notably, the theme of community involvement is apparent in the SMYM program, similar to the Global South alternatives, the methods and practices have cultural significance and are often accompanied by contributions from local community members (Indigenous elders, members speaking native tongue, involved parents/guardians). Although the SMYM initiative prides itself on supporting the Indigenous Mi'kmaw Kina'matnewey community and isn't location-based like most of the rural communities from the Global South alternatives, there are strong ties to incorporating cultural and traditional aspects connecting to the curriculum, activities/projects, and school environment (Lunney Borden, 2010).

From the Building Thinking Classrooms initiative, the key features of group work and altered classroom environment show resemblances to the Global South alternatives as well. From the student-centred approaches in the alternatives, there are learning stations (corners/centres) that seem to align with the aspects of group work settings in Building Thinking Classrooms. Although Building Thinking Classrooms describe that groups should be randomized and the alternatives form groups through the multigrade/multiage learning framework, both of these approaches recognize the

potential of group structured learning. As aspects of group structured learning systems encourage collaboration, which is strongly present in 21st century skills and relevant to lifelong learning (Liljedahl et al., 2021; McLorg, 2019). The classroom environment that Building Thinking Classrooms instills also holds similarities to the alternative approaches from the Global South. Building Thinking Classrooms has found that changing certain elements of the traditional classroom has increased student thinking, including altering classroom movement and student formation as standing and open (Liljedahl, 2020). Similarly, free-flowing movements with busy working are encouraged within the classroom environment of the alternatives, associated with student exploration and autonomy in their learning.

In addition, there are overlaps between the approaches from both the Math Minds and Building Thinking Classrooms initiatives with the Global South alternatives. Both Math Minds and Building Thinking Classrooms incorporate appropriate prompting/hinting in instruction and class work; these show aspects of the facilitator role from the Global South alternative approaches. From Math Minds, strategies for prompting students are derived from the RaPID model and from the Building Thinking Classrooms framework, strategies for answering questions and hinting are included as part of the 14 practices (Liljedahl, 2020; Preciado-Babb et al., 2019). These tactics are involved with teacher instruction, orienting students towards the correct directions in their mathematics learning, which can relate to the modification into the facilitator role, guiding and supporting appropriately according to student needs (Fundación Escuela Nueva, n.d.; Rincón-Gallardo, 2013). In comparison to the Global South alternatives, the Math Minds and Building Thinking Classrooms follow more traditional teacher

roles, but there are shared instructional strategies used in their approaches to appropriately guide students.

Table 7*Similarities Between the Global South Alternatives and Canadian Initiatives*

Aspects	Global South alternatives	Building Thinking Classrooms	Math Minds	SMYM
Educational change	Large-scale, addresses issues in traditional systems	Smaller scale, addresses issues in traditional systems	Smaller scale, addresses issues in traditional systems	Smaller scale, addresses issues in traditional systems
Teams for design and implementation	Governments, NGOs, nationwide programs	Research teams and school boards or classes	Research teams and school boards or classes	Research teams and school boards or classes
Renowned researchers	Rincón-Gallardo; Colbert; Farrell	Liljedahl; Larson	Davis; Metz; Preciado-Babb	Lunney Borden; Wagner
Positive outcomes and results	National and standardized testing, with student, teacher, parent reports	Student, teacher, parent reports	National level testing & teacher reports	Student, teacher, parent reports
Support student learning	Student-centred approaches	Altering instruction, environment, class formation	Altering instruction and pedagogical approach	Culturally relevant pedagogy & practices
Teacher programs	Teacher training, teacher peer tutoring	PDs, teacher training	PDs, teacher training	Community support
Community involvement	Local community relationship with school	N/A	N/A	From elders and other members to learn native tongue & practices
Group work	Learning stations, corners, centers (multigrade, multiage)	Student formation group collaboration (randomized)	N/A	N/A
Classroom environment	Active, busy, noisy, free flowing	Standing, active, open	N/A	N/A
Teacher providing guidance	Facilitator role to guide and support students	Hinting, methods to answer student questions	Appropriate prompting in RaPID	N/A

Gaps and Areas of Improvement

From analyzing the connections drawn between the Global South alternative approaches and Canadian mathematics education initiatives, there have been commonalities in the areas and aspects of success and certain aspects of the pedagogical approaches. But there are multiple differences between the alternatives and initiatives, mainly in the overall perspectives and frameworks of the pedagogical approaches, which are worth noting. While assessing the divergent areas between the approaches in Canada and the Global South, there are opportunities to learn from certain unacknowledged aspects of each global area and offer potential consideration to fill in noticeable gaps.

The scale of educational impact and subject area are notable aspects that indicate the most wide-ranging differences between the Canadian initiatives and Global South alternatives. As stated previously, the level of educational change should be considered based on context, but subject areas should also be deliberated as the initiatives are solely mathematics focused and the alternatives from the Global South are not subject-focused (includes all subjects, and measure performance is from core subjects). In addition, the levels of learning are acknowledged differences, as the Global South approaches generally focus on the primary to middle school levels, while the Canadian initiatives support students from Grades K–12 in mathematics learning. I consider these differences when exploring the differences and gaps between the initiatives and alternatives.

Previously, I compared the goals and focused areas of success for each of the alternatives and initiatives in Chapters 3 and 4, but there are differences in general goal focuses between these approaches from Canada and the Global South. The three Canadian initiatives focus on improving mathematics in classrooms, increasing student

thinking, understanding, performance, and connections to culture and community. In this respect, the measurements of success are generally based on improvement in mathematics performance, through test-based scoring (e.g., CTBS) or reports (educators, students, family), whereas for the Global South alternatives, the general goals are oriented toward access to high-quality education for rural regions. Since the focus of the alternatives is about educational changes made to support marginalized regions, the measurements of success are primarily based on accessibility, efficiency, and comparative/performance testing.

In addition, the degree of educational change to the traditional classroom approach varies between the Global South alternatives and Canadian initiatives. The Global South alternatives conduct school-wide and community-wide changes, altering the traditional models to multiple modern models, including student-centred approaches, multigrade approaches, and local and community projects/resources. In comparison, the Canadian initiatives offer various levels of (mathematics) educational change from the traditional approaches which are generally at the classroom level. The movements in these mathematics educational changes appear to range from general classroom reform (Liljedahl, 2016) to alterations in teaching instruction and mindset (Metz et al., 2017) to overall community involvement in the math classroom (Lunney Borden, 2010). The Global South alternatives seem to offer more drastic and dramatic changes to the traditional pedagogical approaches than the Canadian initiatives, as they have inspirations from a multitude of models and the initiatives seem to alter fewer or less shocking aspects of traditional approaches. These types of changes may also be attributed to the

program and research traditions embedded within the educational approaches of Canada and the Global South.

In the aspects of research, the Canadian initiatives have strong research to support their approaches that is more relevant in the field of mathematics education (i.e., culturally responsive pedagogy, variation theory). But in comparison to the Global South alternative approaches, there are not nearly as many papers that have referenced or reported the success of the Canadian mathematics initiatives, which may relate to their recent development and performance within schools. The Global South alternatives have been recognized extensively in research (Farrell et al., 2017) but have not been taken into consideration for implementation in the Global North, displaying that the research may not be as up-to-date on trends in the field of educational change.

In the aspects of pedagogy and schooling, there are several differences between the three Canadian initiatives and the three Global South alternatives. This primarily includes the aspects of teacher role, student role, group/peer work, community involvement, grade level, and assessment. For the role of the teacher, the Global South alternatives have teachers take the facilitator role to guide and support students around the classroom, while the Canadian initiatives generally maintain teacher-centred instruction as the teacher still directs the class. In the role of the student, the learning is more independent and personalized in the alternative approaches, as students experience a self-regulated, self-paced customizable learning style of classwork and experience. Based on the Canadian initiatives, each offers a variety of different roles for students to take. Building Thinking Classrooms gives students the role to always be thinking (Liljedahl, 2020), while SMYM gives students initiative roles to take on

community/inquiry-based projects (Lunney Borden & Wagner, 2022), whereas Math Minds doesn't direct changes to the role of the student but instead considers their mentality and ways of thinking (Preciado-Babb et al., 2019).

The aspect of group work setting is viewed as a common factor between the Global South alternatives and Building Thinking Classrooms, but the Canadian initiative develops groups randomly and group work is to be well prepared and recorded for the teacher (Liljedahl et al., 2021), whereas the alternatives form groups based on multigrade/multiage levels and expect group work (or peer-tutoring) to come naturally and form connections as learning communities, with the choice for students to work individually or together. The other Canadian initiatives, SMYM and Math Minds, don't have many changes oriented toward group dynamics or group work. For the Global South alternatives, community and family involvement is apparent as an aspect of all approaches, but only SMYM shares this similarity, but Building Thinking Classrooms and Math Minds don't introduce any cultural significance or local involvement in their approaches.

For grade levels, the Canadian initiatives follow standard grades in classroom learning, but the alternatives often have a multigrade or multiage approach where students in a class can be at a variety of learning levels, grades, or ages (Farrell et al., 2017). Finally, the aspect of assessment is seen differently as the three Global South approaches have the facilitator conduct consistent assessment throughout the class to view student progress, whereas the Canadian initiatives stick to planned and formal assessment with Building Thinking Classrooms and SMYM considering formative or personalized versions for assessment (Liljedahl, 2016; Wiseman et al., 2020).

Table 8*Identified Differences or Gaps Between Approaches*

Aspects	Canadian math ed initiatives	Global South alternatives
Goal focus/ performance level	Success with improvements in math classrooms and altered practice, measured success based on math performance (e.g., test-based, reports)	Success is viewed based on increased access/quality of learning for rural areas (some cases measured in comparative testing)
Comparison to traditional schooling	Altered group environment, learning mindset/instruction, or community involvement	Multigrade/multiage, student-centred learning, cultural & local community connections
Research currency	Current research trends/concerns in math ed research (supported by current strong math ed researchers)	Respect in extensive research papers, but not as updated to address educational change issues (supported by strong educational reform researchers)
Teacher role	Teacher leads and directs the class (more traditional)	Teachers are facilitators to guide and support students
Student role	Students follow instruction, with prompts, more engagement, and relevant material (more traditional)	Self-regulated, self-paced, peer tutoring learning (more personalized and independent)
Group work (setting)	Only Building Thinking Classrooms, strongly suggests group formation and collaboration	Learning stations, corners, centers, organized for group work and peer tutoring
Community/ family involvement	Only SMYM connect student learning with community & family	Community & family involvement, locally sourced school resources and materials
Grade level	Standard	Multigrade/multiage
Assessment	Planned/formal assessment (sometimes personalized/formative)	Consistently done throughout the classroom

Potential to Integrate/Adopt Global South Approaches in Current Canadian Mathematics Education Context

After conducting comparisons between the Canadian initiatives and alternatives from the Global South, there is a better understanding of the strengths and areas of potential consideration in both global areas. It also provides a more distinct context for the possibilities of the alternatives from the Global South in offering new ideas of educational change to Canada. These new ideas and perspectives from the Global South can further be considered in the improvement of Canadian math education. Although the Global South continues to learn new initiatives from the countries in the Global North (including Canada), there is significance in Canadian systems to learn from the Global South, and hopefully, be open to exploring their successful approaches. This is not only for movements toward decolonization/anti-colonization, but also for generating a flow of learning from the Global South to the Global North, that is rarely seen with the constant import of knowledge and information from the Global North to the Global South.

While commenting on the areas of potential consideration for Canadian mathematics learning, the three Global South approaches provide perspective to induce flow toward the Global North and insights for implementation of newfound alternatives for pedagogy. Therefore, I believe there is potential to introduce some of the influential aspects of the three Global South alternatives into the Canadian mathematics education context. I will predominantly discuss the opportunities in which Canadian mathematics education can integrate and learn from the models in Escuela Nueva, LCP, and BRAC, keeping in mind the contextual relevancy of the three Canadian mathematics education initiatives.

For integrating outside approaches to mathematics education in Canada, the diversity and history of Canada are considered in conjunction with the structure of Canadian mathematics educational systems. Again, it is worth noting that the Global South approaches are not subject-specific, but the aspects mentioned are pedagogical approaches meant to be designed and implemented for any subject area. From the previous chapter, the common features of the Global South alternatives that could be associated with their success are the main aspects that could be considered in current Canadian mathematics pedagogy. These features are student-centred learning, classroom environment, facilitator role, and community involvement (seen in Table 6). The previous section outlines most of the aspects that display the disparities attributed to these common features of the Global South approaches. From Table 8, it can be noticed that the aspects of student role and grade level are related to the student-centred learning feature, the teacher role aspect is related to the facilitator role feature, the group work setting aspect is related to the classroom environment, and the community involvement aspect corresponds to the community involvement feature. As well, the aspect of comparison to traditional schooling encompasses the overall differences of the four common features.

More specifically, the common feature of the classroom environment can integrate student-centred approaches, including the multigrade/multiage formation and learning stations, to allow students to interact with a variety of skill levels (similar to real-life experience), and peer tutoring between classmates can also be incorporated to encourage collaboration and student confidence in learning (Zumbrunn et al., 2011). Additionally, the student and teacher roles may be integrated, as teachers can take a further step back and students (in self-paced, self-regulated learning), to provide more

opportunities for exploration of independent work and learning. The aspects of community involvement can be further incorporated into Canadian mathematics education systems (with more of an extension to SMYM) where multiple cultural groups and local community members can develop strong relationships with the school with community-based curricula, larger participation, and locally sourced learning materials within the mathematics classroom.

The common features of the approaches from the Global South seem to encapsulate striking differences from the Canadian initiatives, which set them apart from multiple norms of the traditional models of schooling. Even though each of the Canadian mathematics initiatives has aspects which deviate from traditional pedagogical approaches, the changes are not as extensive or dramatic as the Global South approaches. Whereas each of the Global South approaches' models and practices attribute to drastic impactful changes toward large reform, challenging the traditional ways of teaching and learning. The Canadian mathematics initiatives do have the potential to grow based on their focused areas for change, but when implementing large educational change, the common features of the Global South approaches can be considered to move away from formal schooling. The common features attributed to the three Global South approaches could be considered for pedagogical aspects to adopt or integrate, which may lead to such successful educational change within Canadian mathematics classrooms.

This chapter has compared the similarities and differences between the Global South alternative approaches and the Canadian mathematics education initiatives, and further explored the potential to integrate aspects of the Global South approaches into Canadian mathematics education. In the next chapter, the final chapter, I will close the

major research paper with recommendations, directions for future research, and concluding thoughts.

CHAPTER SIX: CONCLUSIONS

In the previous chapter, I compared three alternatives from Global South and three mathematics education initiatives from Canada. I discussed the main similarities and differences among the approaches, as well as the potential to integrate the Global South approaches into Canadian mathematics education. This final chapter will close this research project, providing recommendations, directions for research extensions, and conclusions.

Recommendations

From conducting a comprehensive literature review, I was able to observe excellent examples of programs and approaches in the fields of mathematics education and educational change. While considering the contextual differences between the Global South and Canada, I have begun to understand the methods of designing, developing, and implementing pedagogical approaches with specific goals for the improvement of student learning. From the Canadian initiatives, I learned about the research-based changes made to the areas of instruction, practices, and classroom environment, and how these were oriented to support goals in trending concerns within the field of mathematics education. The goals of the initiatives address issues in cultivating student thinking in the math classroom (Liljedahl, 2020), mathematics instructional strategies and approaches (Davis et al., 2020), and Indigenous community involvement in mathematics learning (Lunney Borden & Wagner, 2022). From the three Global South alternatives of Escuela Nueva, LCP, and BRAC, I reflected on methods of implementing large-scale changes made in the education systems nationwide and beyond, addressing the goals of gaining access to

high-quality education for hard-to-reach, hard-to-teach rural communities (Farrell et al., 2017).

From the previous chapter, the comparisons displayed gaps between the initiatives and alternatives based on the changes made to traditional schooling models and approaches. In comparison to the Global South alternatives, the Canadian initiatives seemed to keep most of the traditional ways of learning and teaching, while using frameworks to alter specific aspects, such as instruction, practices in the classroom, and participation of the community in activities and curricula. Whereas the Global South offered multiple frameworks for changes, including multigrade, student-centred, community-based learning approaches. Whether pedagogical approaches are aimed toward making changes at the smaller (classroom or instruction) level or at the systemic (school board or national system) level, readers should consider the variety and level of change we wish to move away from the traditional norms within educational systems.

I would encourage the readers to keep questioning the traditional methods, explore the diverse ways of thinking and knowing, and be open to unfamiliar ideas for beneficial insight. If we do not consistently question the traditional methods, there would be no motives for producing change (in research, pedagogy, and accessible knowledge) and creating movement toward success in student learning. Only from considering the Global South alternative approaches and exploring their successes, did I have opportunities to explore newfound connections between fields and explore the potential of unfamiliar ideas. While giving a platform for the educational discoveries Global South, I hope that readers may realize the potential to discuss the underrepresented frameworks

and models of the Global South and inspire new perspectives into aspects that could lead to success in mathematics education and beyond.

While trying to find the middle ground between educational change and mathematics education in the six approaches, I would recommend considering the contextual differences but continuing to push boundaries and linking differences for the improvement of student learning. I see the potential for integration of approaches between the Global South and Canada for mathematics education, and so I recommend those reading to observe the current aspects of the teacher role, student role, group work and environment, and community involvement in your math classes. These were the main gaps indicating differences between the initiatives and alternatives, that may provide guidance/inspiration to re-evaluate the current systems in place and consider in what ways is it plausible to make improvements. Personally, the possible integration of aspects from the Global South approaches in Canadian mathematics education has led my interest in the next steps of my journey as a researcher in the field of mathematics education.

Directions for Further Research

While continuing my research in the field of mathematics education, I hope to develop a model that can be utilized in mathematics classrooms in the Canadian context. This inspiration was discussed in the last section of Chapter 5, where I discuss the potential for adopting aspects of the Global South alternatives that may be considered in Canadian mathematics pedagogy. As an extension, I personally want to continue research on the potential of integrating these aspects, with the possibility of developing a model that represents the main features of Escuela Nueva, LCP, and BRAC programs. The model's main features would indicate areas in which Canadian mathematics education

may want to learn from the Global South alternatives, including focused change in the teacher role, student role, group work setting, and community involvement. From this project, the background is provided as I have already established the context of the approaches in the Global South and Canada. As well, I have comprised the key sources referencing results and main research literature to display the multitudes of success (Colbert & Arboleda, 2016; Davis et al., 2020; Farrell et al., 2017; Liljedahl, 2020; Numan & Islam, 2021; Rincón-Gallardo, 2019; Wagner & Lunney Borden, 2011) giving significance and rationale for developing such a model.

Through learning about the successes of these Global South alternatives and considering the implementation of a new model, there will certainly be limitations and challenges. From the Global South approaches' frameworks and applications, one thing to note is that there is not enough literature that provides detailed accounts of the day-to-day practice of these alternatives, and the locally sourced materials of some alternatives are currently not made available (students' workbooks, teachers' guides, etc.). Therefore, when applying certain aspects of the Global South models, it would pose a challenge to understand and implement changed practices in Canada. Also, due to the language barriers and cultural differences, the attempt to interpret these alternatives through our terminology and categorizations may have not fully captured the alternatives framework, and therefore there could be information loss about how these programs have performed so successfully.

When conducting research for the new model, I must also consider the practicality of implementation from the Canadian mathematics education initiatives. This future research may involve Canadian mathematics classrooms to implement the new model,

revamping the classroom environment, student–teacher dynamics, teacher instruction, and class resources. The process or plan for implementation would be to start testing with a few math classes, creating teaching plans with a facilitator group, and developing the necessary learning resources (such as workbooks and lesson plans). There is a possibility that in the attempt to make these types of big changes, I will refer to the implementation of these various alternatives that have spread to other countries internationally (Cronin, 2008; Hossain & Sengupta, 2009; Islam & Anwar, 2012; Jorrín Abellán et al., 2013; Le, 2018). As Canada displays the call for a new reform to reshape our schools and demonstrate stronger results (Fullan, 2021), there is greater potential for this new combined model, taking what has been learned from the success of these Global South alternatives and evolving Canadian mathematics learning to wield stronger performance and overall student learning.

As the Canadian initiatives have a strong developmental background in research and are exemplary for current mathematics education movements across the country, there is room to explore research on the currency and impact of these initiatives. In addition, there is potential to conduct research that recognizes the initiatives and how they represent change within Canadian mathematics education. While observing these goals from the Global South alternatives and Canadian initiatives, the views and measurements of success were notable in that, there was a mix of success based on individual feedback reports and comparative test scores (e.g., CTBS for Math Minds and national/standardized testing). I would be interested to explore further research into the significance of assessment and interpretations of success, investigating if certain types of success vary based on the subject area (mathematics or general core subjects) or global

context (Global North and Global South). While my main research focus is mathematics education, there can be other subject-focused fields that can incorporate features of the Global South alternatives. In exploring alternate routes for research, I may also consider other links between large-scale educational change and mathematics education. This may answer further questions that surround creating change in mathematics teaching and learning across Canada while considering educational colonialism and eurocentrism embedded in the Global North systems.

Conclusion

As a researcher, I have learned a great deal about the underlying systems in place that affect education, especially in the Global South. At first, while reading about the three Global South approaches, I simply saw the advantages that could be directly taken from the approaches and applied to mathematics classrooms in Canada. Although there may have been good intentions behind these initial thoughts, I was unaware of the Global South's historic, social, political, and economic disadvantages that affect education. While situated in the Global North and learning about educational colonialism in a different context (outside of Canada's history with Indigenous education), I was able to understand the one-way directed flow of knowledge and information from the Global North and Global South. In this major research project, I have improved my knowledge as a researcher surrounding the fields of educational change and mathematics education, while highlighting notable works and scholars for future reference. In addition, this was my first primary lead on a research project, where I improved my abilities in reviewing the literature, writing skills, and analysis skills. Beyond writing and implementing research extensions, I wish to continue to place myself in conversations that question the

ways we make changes in mathematics classrooms and how we are rooted within our current education systems. In generating these types of conversations in different circles, I will be able to learn from a multitude of perspectives and get out of my comfort zone for personal and academic growth.

While starting with an introduction of the Global South alternatives and Canadian mathematics initiatives in the first chapter, I was able to frame the rest of my study with confidence in my research background topic, purpose, and questions. In conducting a comprehensive literature review in Chapter 2, the necessary resources were collected and analyzed for identifying and comparing all six approaches. The core of this study was to explore the features and shared aspects associated with the success of the three Global South alternative approaches and the Canadian mathematics education initiatives. These features between the Canadian initiatives (Chapter 3) and the Global South alternatives (Chapter 4) were identified by analyzing commonalities between approaches and further discussed for possible areas of success. Additionally, when conducting the comparisons between the three Canadian initiatives and three Global South alternatives (Chapter 5), the gaps and areas of potential consideration help to discern the major components unaddressed between approaches. In Chapter 5, the comparisons unfolded the main aspects of the Global South alternatives that have the potential for integration into Canadian mathematics education. These aspects displayed differences in interpreting educational changes from traditional education approaches, mainly with pedagogical transformations to the teacher role, student role, classroom environment, and involvement of the community.

In the future, I wish to see schools in Canada experiment with new frameworks/programs based on newfound approaches, such as the Global South alternatives, which have displayed much success. This comparative study will be a step in the right direction, creating a foundation and link between mathematics education and large-scale educational change for future extensions in research and pedagogy. While incorporating drastically different contexts, this study starts another conversation between Global South and Canadian education, opening and changing the direction of flow for learning and knowledge. In future conversations and research, I hope that methods for educational change in student math learning may consider the integration of the Global South alternative approaches and the mathematics education initiatives.

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