

Factors Affecting the Teaching of Grade 9 Locally Developed Mathematics

by

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Abstract

This qualitative study explores the factors affecting the teaching of Grade 9 Locally Developed mathematics. This analysis focuses on what factors teachers perceived as having an effect on their teaching, as well as how they value these factors in regards to their ability to effectively teach this particular level of mathematics. I conducted this study by observing two regional Locally Developed Compulsory Credit (LDCC) mathematics classrooms on a weekly basis over the course of two academic semesters within a secondary school context in Ontario. I conducted regular check-ins with each classroom teacher and formally interviewed the two teachers at the end of the term.

I analysed these observations and interviews using the framework of axiology to explore what values teachers assigned to various aspects of teaching LDCC mathematics. My analysis indicates that these particular teachers valued non-curricular factors, such as a safe classroom environment and the creation of healthy student relationships, as being equally as important as curriculum factors, and perhaps even more so. Additionally, teachers expressed a strong need for additional resources to better teach LDCC students. These resources include: teaching resources, knowledgeable personnel support, and financial resources to supply students with a more enriching and supportive classroom experience. My analysis suggests that the values that these teachers held had notable effects on the teachers' respective practices, suggesting implications for Locally Developed mathematics courses being taught by other teachers in other contexts.

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Chapter 1: Introduction

Introduction

Context.

Modern society is evolving at an extremely rapid rate. The demand for its citizens to be fluent in not only mathematical procedures but also possess the ability to effectively think and reason is at an all-time high (National Council of Teachers of Mathematics [NCTM], 2000, 2014). Basic understanding of mathematical concepts and procedures as well as the ability to overcome obstacles with problem solving is an invaluable life skill (Hurlington, 2010; NCTM, 2000, 2014). Students who struggle with mathematics, or are in any way “at risk”, are in danger of not developing the skills necessary to function independently in today’s advanced and technological world (Kajander & Zuke, 2008; NCTM, 2000).

Students need multiple opportunities to explore mathematics and be challenged by it (Boaler & Humphreys, 2005; NCTM, 2000). When exposed to open-ended mathematics, as opposed to more traditional “drill” type activities, students develop a much more flexible understanding of mathematical ideas (Boaler & Humphreys; 2005, Boaler & Staples, 2008; Kajander & Zuke, 2008; NCTM, 2000). However, rich, open-ended mathematics activities may be difficult for teachers to create or implement effectively. There are numerous factors that may act as barriers to creating and executing these rich learning tasks. Student motivation, engagement, opposition, resources in the school and classrooms, teacher training, familiarity and comfort with the material, structural and societal issues, parental involvement, cultural values, availability of technology, as well as numerous other factors may be inhibiting educators’ ability to effectively teach mathematics (Bol & Berry, 2005; Campbell, Sullivan, Mornane, Prain, Deed, Drane, ... Smith, 2009; Clandfield, Curtis, Galabuzi, San Vicente, Livingstone & Smaller, 2014;

Hand, 2010; Jao, 2013 Kajander & Zuke, 2005; Marks, 2000; Stoilescu, Mcdougall & Egodawatte, 2015). These issues are especially problematic in mathematics classrooms with at-risk or low-functioning students, such as the students found in remedial, basic, or “bottom” levels of mathematic courses in secondary school.

Statement of the problem.

In the past, there has been research that examined the difficulties of teaching students performing under grade level in North American mathematics classrooms such as that described by Stoilescu, Mcdougall, and Egodawatte, 2015. Jao (2013) and Macaulay (2015) examined effective methods and strategies in lower levelled classrooms in Canada, whereas difficulties pertaining to students have also been considered by Hand (2010). for example. There also exists research on the process of streaming (the process by which students are separated into different levels of a subject, also known as “tracking”) itself, including Clandfield et al. (2014) and Hamlin and Cameron (2014). Which particular stream students have been placed in has been shown to have negative effects on student learning and self-efficacy (Clanfield et al., 2014). In Ontario, Grade 9 and 10 mathematics are split into three distinct streams, Academic, Applied, and Locally Developed. In Ontario, “Locally Developed” titled courses refer to courses created by a particular school board to, “meet educational and career preparation needs of students that cannot be met by the courses authorized by the provincial curriculum policy documents” (Ontario Ministry of Education, 2005, p. ii). This project will focus on two classrooms within the Locally Developed stream.

Teacher perspectives have also been included as an important perspective when discussing lower levelled mathematics instruction. For example, Jao (2013) explored teacher perceptions of student engagement in Grade 9 Applied Mathematics, Bol and Berry (2005)

discussed secondary teachers' perceptions of the achievement gap present in secondary schools, and Stoilescu et al. (2015) studied teachers' views on the challenges of teaching Grade 9 Applied mathematics in Toronto. However, what exactly motivates students to learn mathematics, and teachers' perceptions of how to effectively teach students placed in lower levelled mathematical streams, are far from being understood. Research such as Boaler and Humphreys (2005), Boaler and Staples (2008), NCTM (2000, 2014), Kajander, Zuke and Walton (2008), and Macaulay (2015) indicate that students' responses to traditional, lecture-and-practice mathematics are often less effective when compared to rich and open-ended mathematics tasks.

With little existing research aimed specifically at Locally Developed, I sought to address the question of what factors affect teachers' ability to effectively teach Locally Developed? With so much data existing on effective practices in other levels of mathematics such as Applied and Academic, it seemed natural to question what practices were or were not effective in Locally Developed mathematics. I chose to focus on teacher perspectives as I was interested in their values, decisions, and practices when teaching this particular stream of mathematics.

Past research.

Past research has touched on many areas relating to the teaching of mathematics to students who are performing under grade level and includes student behaviours, motivation, and engagement, as seen in the work of Kajander, Zuke and Walton (2008), Campbell et al., (2009), Hand (2010), Jao (2013) and Marks (2000). However, there appears to be little to no research focused specifically on the Locally Developed courses, with the Kajander, Flessa, Sedor and Lampo (2018) study being one of the few recent publications specifically exploring problems surrounding Locally Developed programming. The hierarchical structure of post-secondary mathematics classes in Ontario begins with Locally Developed on the bottom as it is the most

basic in terms of content. The stream “above” Locally Developed, namely the Applied stream, has been the focus of notable research including that of Jao (2013), Macaulay (2015), and Stoilescu et al., (2015). Research such as that done by Clandfield et al. (2014), Hamlin and Cameron (2014), and Tilleczek (2008) have studied the effects of the streaming process but not how it relates specifically to the Locally Developed stream in Ontario. Furthermore, little research exists that identifies and explores the perceptions and needs of the actual teachers themselves. Stoilescu et al. (2015) explore the challenges of teaching Applied level mathematics in Ontario, but again the Locally Developed stream is not considered. As described in Kajander et al. (2018), Locally Developed courses exist outside the realm of EQAO testing, thus creating interesting consequences for Locally Developed classrooms.

Purpose of the study.

This study was designed to identify and document teacher identified factors that affect their abilities to teach Locally Developed mathematics in Ontario. Furthermore, it is my hope that this study will open a dialogue surrounding the teaching of Locally Developed mathematics so that not only will students have improved experiences in mathematics classes, but that it may also establish recommendations on how school boards and decision makers can better support the teachers of these mathematically at-risk students. Every student has the right to have a positive experience in mathematics so that they may receive the skills and tools they need to better support themselves throughout their lives. There are two main questions under consideration in this study. These questions were derived to provide a framework to better understand the factors that affect the teaching of Locally Developed Mathematics. The questions are:

1. What factors do teachers perceive as affecting their ability to teach Locally Developed Mathematics?
2. How do teachers value these factors in regards to their teaching?

Significance of the study.

This research is significant for several reasons. This study sheds light on an otherwise poorly understood area of mathematics instruction in classrooms across Ontario. As there exists little research on Locally Developed courses, or Locally Developed is not considered in existing research, it is important to establish a foundation of literature and research regarding Locally Developed mathematics due to the high-risk nature of the majority of these students (Kajander et al., 2018). The outcomes of this study might help guide further research and discussions of how to more effectively teach Locally Developed classes, by explicitly identifying examples of some teacher perceived limitations and needs. Furthermore, this study aims to provide recommendations that may guide this future discussion, and improve instruction in Locally Developed classrooms overall. It is difficult to create policy and resources that can support the teachers in these classes without having a clear representation of the problems that the teachers of these classes perceive that they face. This study is a sub-project of a larger project being conducted by the Ministry of Education's Mathematics Knowledge network¹.

Limitations of the study.

Due to the use of a case study methodology, as will be described in Chapter 3, the data pertains to specific teachers, in one school, in a particular region. As such, the results may not extend or generalize to different people, settings, and areas (Creswell, 2014). The teacher

¹ The larger project being conducted is under the community of practice titled "Critical Transitions". One of the main goals of our team in this community of practice is to create and gather resources for teachers to access when teaching Locally Developed mathematics. In order to create effective resources, myself and the other members of the research team gather data from teachers and students in various Locally Developed classrooms to guide the creation of effective and engaging activities. The data in this study is a subset of the data gathered.

participants were chosen on a voluntary basis. All participants chosen are that of a convenience sample. The researcher sought to include other perspectives from other participants, such as students, but was unable to do so due to ethical boundaries. It is my goal to preserve participant meaning and achieve optimum trustworthiness and authenticity (Creswell, 2014). Classroom observations were used to inform the creation of interview questions to ensure that they were relevant and informative. Interview questions were reviewed by the fellow student researchers, the advisor, as well as participants. Nevertheless, the use of semi-structured interviews “provide indirect information filtered through the view of interviewees, provides information in a designated place rather than the natural field setting” and “the researcher’s presence may bias responses” (Creswell, 2014, p. 191). The inclusion of classroom observations mitigated some of these shortcomings, as themes from interviews are connected to relevant observations in the classroom. While I have nothing to gain from any outcomes of the study, I am obviously interested in the field of mathematics education. My motivation for researching Locally Developed mathematics stems from my teaching experiences in these courses. As such, there is risk of researcher bias. Bias was minimized by the use of peer debriefing, and also by the presentation of any negative or discrepant data where applicable (Creswell, 2014). Furthermore, “rich, thick description” is used to convey the findings in order to make the research as realistic as possible (Creswell, 2014, p. 202).

Chapter 2: Literature Review

To understand more about the nature of Locally Developed courses in Ontario, the history of the courses and existing curriculum and policy documents will be discussed. This review will also consider factors pertaining to mathematics instruction, the process of streaming, and student behaviour, in order to develop a broader perspective of factors that affect the teaching of Locally Developed mathematics in Ontario. In order to analyse the research, it is important to first discuss the theoretical lens that is being applied in the analysis.

Conceptual Framework

This study employed a theoretical perspective of axiology. This framework is used in conjunction with the researcher's perspective on mathematics reform, which aligns with that of NCTM (2000). Axiology, by definition, is a philosophical method of thought, or what Bahm (1993) refers to as a "Value Science". Hartman (1967) describes axiology as a method of logic and reasoning through which people assign value to things. Axiology is concerned with the idea of "goodness", or how good something is perceived to be (Bahm, 1993). "Goodness" can be qualified by numerous factors depending on the context. In this study, I am concerned with what Raveendran and Chunawala (2015) refer to as the "value judgements" teachers make. Value judgements refer to decision making when assigning value to things. I am specifically interested in the value judgements teachers make in regards to various aspects of their experiences over the semester such as teaching strategies and practices. Axiology is a suitable framework as it allows for the "study and exploration of human values, which enables us to identify the underlying beliefs and values that influence our perceptions and interpretations of our life experiences, our decisions and actions—to understand clearly why we do what we do" (McArdle, Hurrell, &

Muñoz Martinez, 2013, p. 84). Thus, an axiological lens can be used to explore a person's perceptions, beliefs, and experiences as well as how these inform their actions.

This perspective is relevant to my research for several reasons. The National Council for the Teaching Mathematics guides much of the discussion in regards to mathematics education and mathematics reform in North America (e.g., NCTM, 2000). Bossé (2006) argues that the mission statements of the NCTM “form a unified and cogent axiological position” (p. 5). It is the goal of professional organisations such as NCTM (2000, 2014), as well as many teachers, to ensure an excellent mathematics education for students. For example, both of the teachers in the current study expressed a strong overall desire to *improve* student experiences in Locally Developed mathematics. These ideals, like the goals of NCTM (2000, 2014) are inherently axiological and relate back to the idea of “goodness”. As I aimed to explore teacher perceptions of how their semesters were progressing, it was expected that teachers would feel that certain aspects and experiences were “good” while others were not. Raveendran and Chunawala (2015) explore to what extent values inform decisions in regards to knowledge. This aligns with the goals of the study, namely how teachers value factors affecting their teaching. As a corollary to discovering what teachers valued in their classrooms, it is natural to inquire as to how these values shaped further lessons, practices, and behaviours. Longino (1983) recognized the importance that epistemic values play in the context of science whereas this study focuses on the context of mathematics. Since axiology is a method of logical reasoning, it is thus closely linked to the topic of mathematics (Ernest, Skovsmose, van Bendegem, Bicudo, Miarka, Kvasz, & Moeller, 2016). Skovsmose writes that, “It is a concern of a critical mathematics education to address mathematics in its very many different forms of applications and practices. There are no qualities—like, for instance, objectivity and neutrality—that automatically can be associated to

mathematics” (2016, p. 9). It can be argued that it is how teachers disseminate mathematics curriculum that such qualities of objectivity or neutrality are achieved. That is, student experiences in mathematics are shaped by what teachers deem as important, i.e., the value judgements they are making in regards to specific topics in mathematics, or curriculum, compared to non-educational factors such as student well-being.

Values are often the term used to describe one’s fundamental personal beliefs. In the context of axiology, value refers to the personal valuation a person attributes to an idea, or object. Melville, Campbell, and Jones (2017) write that “A concept, or object, has value relative to the extent to which it fulfills its intension” (p. 3). Furthermore, mathematics as a subject is known to contain abstract concepts and ideas. As such, what values teachers attribute to course content and how teachers’ perceptions affect how they value things such as course content compared to other aspects of the classroom experience is particularly interesting. Chin and Lin (2001) write that the values teachers hold affect their “choice of pedagogical strategies and perception of the students’ needs” (p. 4). As I engaged teachers in reflection regarding the outcomes of their respective semesters, it is relevant to analyze how they valued certain aspects of the semester *as they perceived them*. Furthermore, these perceptions promote discussion in regards to school factors such as curriculum, as well as student factors such as attendance. My study aims to describe what factors teachers perceive as having an effect on their teaching. Using an axiological perspective will allow me to describe how teacher participants perceived that their courses transpired and to describe the possible reasoning behind these perceptions, and how these values possibly influenced subsequent teaching (McArdle, Hurrell, & Muñoz Martinez, 2013). Clearly, teacher perspectives differ from those of students, given that teachers use their knowledge of curriculum and educational practices to inform their perceptions.

Locally Developed courses are intended to be relevant to students in order to prepare them for their adult lives (Ontario Ministry of Education, 2005) and thus it is necessary to explore how teacher perceptions of these courses relate to how they assign value to factors of education and their teaching. The construct of axiology allows me to draw connections between teacher perceptions and the value judgements they made with various factors such as curriculum and teacher-student relationships. Additionally, the perspective of axiology allows for discussion in regards to the decisions teachers made when planning lessons in Locally Developed mathematics. Which topics, ideas, or practices teachers deemed important, especially when compared to others is of particular interest and will be illustrated in the analysis of the study results. An understanding of what teachers prioritize when teaching Locally Developed, and how their values influence their interactions with students can improve the dialogue surrounding Locally Developed mathematics.

History of Locally Developed Pathway

Locally Developed courses in Ontario possess a rather complex and ambiguous history. This is partially due to the different nomenclature used to refer to the courses. In 1999, when compulsory secondary school years were reduced from five years to four, the courses were known as “Essential” courses (Craven, 2003). The name “Essentials”, in theory, refers to the goal of the course, giving students only the mathematics essential to functioning in the workplace. As such, these courses were often referred to as “Workplace” level credits. Before 1999, the third course type in the previous curriculum were referred to as “Basic” math courses. The 1999 curriculum document was meant to “replace the sections in *The Common Curriculum: Policies and Outcomes, Grades 1-9, 1995* that relate to mathematics in Grade 9, and...

Mathematics, Part One: Grades 9 and 10, Basic Level; Grades 11 and 12, Basic Level; Intermediate and Senior Divisions, 1985” (Ontario Ministry of Education, 1999, p. 3).

Later on, the term Locally Developed was coined, as the courses were developed by individual school boards to address the specific needs of their students (Macaulay, 2015). However, this term is still not universally used. Craven (2005) still refers to the courses as “Essential” level for example. Since the adoption of the name “Locally Developed” in the mid 2000’s, the courses have remained relatively unchanged, and unrepresented. For example, the People for Education (2015) study titled “Streaming” that discusses the demographics of which students are enrolled in the different levels of mathematics courses, make no mention of Locally Developed courses under any name whatsoever, despite having data for the Locally Developed enrollment in past studies. In 2013, approximately 6.4% of Grade 9 students were enrolled in a Locally Developed mathematics course (People for Education, 2015; Macaulay, 2015). It is unclear whether there exists more recent data regarding the current enrollment in these classes.

Unfortunately, there exists very little information regarding Locally Developed mathematics courses. There are several possible reasons for this gap, including: courses being known under different names, the courses varying greatly from one school board to another, and most significantly, the fact that students in Grade 9 Locally Developed Mathematics courses are not required to write the Education Quality and Accountability Office (EQAO) standardized assessment that is mandatory for all other Grade 9 students in the province.

Locally Developed Curriculum

As the name would imply, Locally Developed courses vary from region to region. In order to instate a Locally Developed course, the curriculum, expectations, teaching strategies, and other factors must be proposed to the school board before being reviewed for approval

(Ontario Ministry of Education, 2004). Thus, curricula are determined in part by the board that has created them. The following will pertain to Locally Developed courses within Ontario schools.

According to the 2005 Curriculum document for Locally Developed Compulsory Credit (LDCC) Courses, “LDCC courses are intended to meet educational and career preparation needs of students that cannot be met by the courses authorized by the provincial curriculum policy documents” (Ontario Ministry of Education, 2005, p. i). As such, the LDCC curriculum is designed to improve students’ abilities in four primary areas: literacy skills, mathematical literacy skills, “essential” or otherwise known as “life” skills, and student confidence. Theoretically, students who successfully complete the Locally Developed course should be better equipped to function in their everyday lives, as well as possess the skills required to enter the work force (Ministry of Education, 2005). Students in LDCC courses should be given “opportunities to develop, enhance, and practise literacy, and mathematical processes, concepts, skills, and strategies,” as these are presented as being “critical in strengthening students’ learning in all subject areas and preparing them for later success” (Ministry of Education, 2005, p.1). However, these goals prove to be very problematic for teachers since students “may be up to four years behind grade level with significant gaps in knowledge, conceptual understandings, and skills” (Ministry of Education, 2005, p. 1). Two students in any given LDCC classroom can vary significantly in terms of their levels of literacy or mathematical understanding, thus teachers of these courses are faced with numerous challenges.

There are three primary strands in the Grade 9 Locally Developed course description, and three for Grade 10. The strands in the Grade 9 curriculum are: Developing and Consolidating Money Sense, Developing and Consolidating Concepts in Measurement, and Developing

Concepts in Proportional Reasoning (Ministry of Education, 2005). Similarly, in Grade 10, the strands are extensions of the ones seen in Grade 9. These strands were designed to be applicable and useful to students in their lives outside of mathematics classrooms and to give them skills they could use in future employment (Ministry of Education, 2005). Topics include applications such as calculating percentages for sales tax, fractions and proportions for baking, as well as measurement for building purposes. In theory, these strands give students an opportunity to see the context in what they are learning. The curriculum stresses the need for students to establish connections between the course content and the real world (Ministry of Education, 2005). As many of these students will not attend college or university, it appears that the intent is to maximize relevancy.

The curriculum document makes suggestions as to which teaching strategies should be used within LDCC courses. In order to make the material more engaging to students, using manipulatives and technology are heavily encouraged. Also suggested is the use of “before-learning, during-learning and after-learning tasks” (Ministry of Education, 2005, p. 2). Some teachers may interpret this as a “warm-up”, “main”, and “exit” activity as the document does not describe how these tasks should be carried out, nor the attention that should be paid to each. Students who struggle in mathematics often have shorter attention spans and can become discouraged and disengaged more easily than those who do not (Kajander & Zuke, 2005). Thus, it is important to vary activities and teaching strategies even within a given day in the classroom. Similarly, the curriculum suggests providing students various ways to communicate their thinking. Exploring mathematics in visual, oral, and written ways gives students ample opportunity to improve not only their literacy skills but also their mathematical literacy. According to the document, students in LDCC courses may be severely lacking in terms of

literacy skills, posing a significant problem for classroom teachers. Students may need significant support in the form of vocabulary building activities, organizers to convey their thinking, and even reading and writing practice. In addition to these literacy and mathematical literacy skills, teachers are tasked with instilling essential skills in their students. Skills including but not limited to: proper study and work habits, punctuality, respect for peers and property, obeying rules, time management, and self-regulation (Ministry of Education, 2005). It is evident that the high-needs nature of this particular demographic of students results in a large hurdle that teachers must try to scale.

Currently, there exists little research specifically focusing on Locally Developed curriculum and related teaching methods. Kajander, Flessa, Sedor, and Lampo (2018) analyzed the perceptions of teachers in regards to the evolution of the Locally Developed pathway. The findings identified some issues with the construction of Locally Developed curriculum and how these courses are being supported. Teacher participants identified significant issues with student attendance and expressed a desire for more professional development for teachers, specifically for those teaching Locally Developed classes.

Assessment

While not explicitly stated, the LDCC document provides some guidelines in regards to student assessment. According to the document, “The primary purpose of assessment and evaluation is to improve student learning” (Ministry of Education, 2005, p. 6). The 2010 Ontario Ministry document, *Growing Success* describes the vital role that assessment has on students and describes assessment as a tool that can be used “as learning” and “for learning” (Ontario Ministry of Education, 2010, p. 3) Also suggested is the use of assessment and evaluation to monitor student learning, gauging student strength and weaknesses to adjust instruction

accordingly (Ministry of Education, 2005). With students potentially differing greatly in terms of mathematical understanding, it is important for Locally Developed course teachers to be both experienced and flexible in terms of their assessment and evaluation strategies. The document possesses links to achievement charts for LDCC mathematics courses (however at the time of this paper's writing, the links are inactive). Students possessing any manner of exceptionalities are not uncommon in Locally Developed courses and as such, the document provides some commentary regarding modifications and accommodations, explaining their use in the context of Locally Developed courses. Mathematics can often be challenging for students without learning or behavioural exceptionalities. Thus, the issue of course content, combined with these exceptionalities, poses an even larger problem for teachers of Locally Developed mathematics.

While the course document is concise in length, there is a lot of information housed within it. It is quite clear from the document alone that the students that make up the population of LDCC courses may be considered fragile and extremely high-needs. Given all of these additional challenges and still being expected to improve literacy, mathematical literacy, life skills, behavioural regulation, mathematical content knowledge, as well as everything else, poses an enormous challenge for Locally Developed teachers and district school boards across Ontario.

Reform Based Practices Defined

What exactly is meant by the term 'math reform'? In a general sense, mathematics reform refers to a movement to bring mathematics education beyond traditional teaching strategies of 'teacher lectures, students practice'. Many may think that math reform, often referred to as 'new math' or 'reform math' is the avoidance of these procedural tasks or traditional methods altogether. While there may be some validity in these beliefs, they are far from what truly lies in the heart of reform-based mathematics. The NCTM is attributed with providing the foundation

for the math reform movement and describes the goal of the advance. The NCTM describes their “vision” for mathematics education as classrooms in which students have access to engaging mathematics curriculum and rich tasks to develop mathematical thinking and inquiry (NCTM, 2000). This ideal environment is supported by the curriculum, teaching materials, and resources as well as teachers themselves (NCTM, 2000). Students, in this vision, learn multiple strategies for given tasks, communicate their thinking in a variety of means and truly “explore” mathematics, as opposed to “learning” it (NCTM, 2000). Reform math is not meant to replace the learning of arithmetic and similar mathematical procedures, but rather complement them so that students may understand *why* they work (NCTM, 2000). The Ontario Ministry of Education’s 2005 report, *Early School Leavers: Understanding The Lived Reality of Student Disengagement From Secondary School*, writes in its recommendations that, “Develop[ing] local curriculum (fitting local job pathways, providing relevance and appropriateness for different cultural groups, meeting individual needs)” and using “Innovative, interactive and personalized instructional strategies” may reduce the risk of students leaving school before obtaining their high school diploma (Ferguson, Tilleczeck, Boydell, Rummens, Edney, Michaud, & Cote, 2005). This is in alignment with NCTM (2000), which stresses that when teaching mathematics, it is pivotal that the material be taught with understanding as well as context.

Furthermore, mathematics reform does not only refer to how a teacher structures the lesson. Curriculum, school hours, teacher attitude and behaviour, the classroom environment, and more factors are also critical to mathematics pedagogy and encompassed in reform-based practices, as seen in Boaler and Humphreys (2005), Boaler and Staples (2008), and Ferguson et al. (2005). In the former, the classroom teacher fostered mathematical reasoning, discussion, and community within her classroom while in the latter, the school organized the class timetable in

such a way that it was more conducive to the learning of mathematics, much in alignment with the “vision” outlined in the NCTM 2000 Standards document.

A controversial belief present in reform-based practice is the notion that each and every student is capable of learning mathematics, which may be contrary to the opinion of some teachers. For example, one student at risk as reported in Kajander, Zuke, and Walton (2008, p. 40) was given workbooks to complete independently and essentially cut off from class ‘for their own good’, despite struggling with reading and comprehension. All students are capable of learning mathematics given the proper support and foundation (Boaler & Humphreys, 2005; NCTM, 2000), a mindset that according to literature, is rarely found in the classroom of traditional teachers. Some teachers would rather stream students so as to ‘more easily’ teach each group (Boaler & Staples, 2008). The idea of streaming students for the sake of convenience for the teacher, as opposed to being for the benefit of the students, becomes extremely problematic when teaching high-needs students such as those found in Locally Developed courses.

Benefits of Reform Based Practices

It is not uncommon for people to choose careers or university programs intentionally to avoid mathematics. However, many do not realize the fact that mathematics is embedded throughout society, inseparable from living a functional life. The world is constantly changing, new technology and information are at one’s fingertips each and every day. The demand for people with sophisticated mathematics skills and the ability to think logically and scientifically has never been higher (NCTM, 2000; Rymanowicz, 2016). Furthermore, many fundamental life skills require a certain level of mathematics understanding: “Making purchase decisions, choosing insurance or health plans, and voting knowledgeably all call for quantitative sophistication” (NCTM, 2000, p. 4). In order for one to live a fulfilling and self-sufficient life,

mathematical skills are increasingly seen as being imperative. Thus, the need to evolve mathematics teaching, to suit those who will use it, is also critical. Paraphrasing relevant research, the NCTM writes “[it is] clear that many students are not learning the mathematics they need or are expected to learn” (NCTM, 2000, p. 5). Smith, Martin, Wan, Duenas, Shumack, and Beziat (2015) found that college students’ mathematical understanding in regards to application benefited greatly from exploring mathematics using reform-based methods.

The study conducted by researchers at Queens University, *Who Doesn’t Go to Post-Secondary Education? Final Report of Findings*, shows that students who enroll in Academic level mathematics in Grade 9, are much more likely to get their high school diploma and similarly, students who fail Grade 9 math in their first year of high school are less likely to graduate (King, Warren, King, Brook, and Kocher, 2009). Additionally, only 3.1% of Grade 9 students that take Applied level math, continue on to apply to a university program (King et al., 2009). In the case of students in a Locally Developed course in Grade 9 or 10, 94.3% of these students did not apply to any form of post-secondary education (Parekh, 2014). Furthermore, only 20% of students in Locally Developed courses graduate on time (Parekh, Flessa & Smaller, 2016). Based on existing literature, it suggests that current mathematics instruction is not optimal for every student and student experience with mathematics in high school, influences their educational future.

The Locally Developed curriculum document states that students within these courses respond better to math involving technology and manipulatives, furthering the need for reform-based teaching (Ministry of Education, 2005). Thus, there exists an apparent need for reformed mathematics instruction, particularly in these classes.

Educators and researchers alike may hold varying perspectives on the validity and practicality of reform-based teaching methods. This opposition is embodied even by the parents of students as was the case of a parent group in Alberta, actually protesting the use of inquiry-based mathematics (Canadian Education Association, 2016). The CEA attributes much of this resistance to falling test scores on the international PISA assessment, of which math reform is “apparently” the cause (Canadian Education Association, 2016), according to some critics. These critics neglect to consider several important facts, such as the fact that many children in traditional math classrooms have very negative attitudes towards mathematics (Kajander, Zuke & Walton, 2008; Boaler & Staples, 2008; King et al., 2009). Reform-based practices are not designed to sabotage students’ arithmetic skills, but to actually help them understand the processes behind such skills and enjoy the learning of mathematics (NCTM, 2000). Furthermore, traditional classrooms can often ostracize lower achieving students or those who are otherwise “at risk” (Kajander, Zuke & Walton, 2008). The students in Kajander, Zuke and Walton study encountered significant difficulties in school due to extenuating life circumstances. When confronted with unengaging material and low teacher expectations, both their motivation to do mathematics, as well as their confidence in their mathematics ability dropped dramatically (Kajander, Zuke & Walton, 2008). When students do not see how they fit into mathematics, they can become overwhelmed with a sense of disenfranchisement and reject mathematics altogether (Boaler & Humphreys, 2005). Traditional methods also result in students being much more passive learners. When teachers are constantly giving students a step-by-step procedure to follow, students become less able to think on their own. In her book, *Building Powerful Numeracy for Middle and High School Students* (2011), Harris writes that:

[W]e end up with some students who can solve textbook problems very nicely, but not problem solvers who can adapt their understanding to new contexts and situations. We also end up with other students who believe that they can't solve problems because for them, the memorized rules never worked. By allowing students to solve problems in their own way and then modeling, comparing, and discussing different strategies with the rest of the class, we honor the students' thinking and nudge students toward more efficient and sophisticated thinking (pp. 6-7).

Traditional methods alone deprive students of autonomy and can complicate their mathematical futures. For students who are unable to memorize basic facts and procedures (of which there are many), they have no entry point into mathematical discussions and activities. Harris (2011) describes the result of this:

Students seem to either reach for a calculator or just shrug and say, 'I don't know' when asked simple arithmetic questions. They seem ill prepared to learn higher math because they have not memorized basic facts. Many students make careless errors with nonsensical results, yet do not recognize how far off their answers are (p. xii).

Students require some exploration in mathematics in order to develop more flexible understandings of concepts. For example, Beatty and Bruce (2012) were pleasantly surprised to find that even the lowest performing students in their class performed well when provided with open-ended problems in patterning and algebra.

Much of the existing research surrounding reform-based mathematics teaching shows that students' attitudes towards mathematics as well as their motivation to do mathematics improve when the teacher implements reform-, or inquiry-based activities (Boaler & Humphreys, 2005;

Boaler & Staples, 2008; Humphreys & Parker, 2015) In order for this to happen, however, the teachers need significant support from every component of the educational system: students, parents/guardians, fellow teachers, administrators, and policy makers (Boaler & Humphreys, 2005; Boaler & Staples, 2008; Kajander, Zuke & Walton, 2008; NCTM, 2000). Many teachers subscribe to the benefits of reform-based mathematics practices but fail to effectively implement them, leading to frustration in the teacher as well as that experienced by students (Kajander, Zuke & Walton, 2008). The literature suggests that teachers looking to evolve their practice or those with potentially challenging classes, such as Locally Developed classes, require considerable support in their classrooms.

Successful Implementation

While showing examples of successful reform-based practice is far from a comprehensive proof of its value, it is important to consider research and literature surrounding these practices to develop a sense what works, and what does not, in mathematics education. Boaler and Humphreys (2005) and Boaler and Staples (2008) are two such examples that vastly differ in context, but both situations allow for excellent commentary in regards to reform-based math. Boaler and Humphrey's (2005) book *Connecting Mathematical Ideas*, follows the classroom of Humphreys. The book is structured in a manner that showcases several lessons Humphreys has created that are far from traditional lessons featuring teacher instruction followed by student practice. Through her attitude, behaviour, lesson structure, and questioning techniques, Humphreys fosters a healthy curiosity in her students and allows for students to truly think critically about mathematical concepts and procedures. Student input and participation make up a majority of lessons, whereas Humphreys spends the majority of classroom time facilitating student discussion and exploration. She models respect for each and every single one

of her students and truly values their input regardless of whether they can completely answer a question, or merely ask a question that progresses the discussion. Consequently, a manner of “mathematical community” arises in her students. The students pick up on the behaviours and attitudes modelled by their teacher and thus many barriers between high achieving students and low achieving students are overcome. Humphreys celebrates varied thinking instead of strictly enforcing a particular method on the class. At many points throughout the book, examples show how she sees a new solution in a student’s work or thinking, or conversely uses an “incorrect” answer to address a new area and propel the discussion forward. How Humphreys uses the input of her students to unpack their thinking and share it with the class is in direct agreement with an important notion addressed in the NCTM standards document: “Often, a student, who had one way of seeing a problem can profit from another student’s view, which may reveal a different aspect of the problem” (NCTM, 2000, p. 62). The problems chosen for Humphreys’ lessons allow for a plethora of different approaches and many times she would spend an entire class period on one problem, much to the criticism of her fellow teachers (Boaler & Humphreys, 2005). As a result of her practice, most, if not all of Humphreys’s students are engaged and regularly participate in classroom discussions and activities. Boaler and Humphreys (2005) do not provide any statistical commentary regarding how these practices affected student outcomes on formal assessments but the extensive commentary on students’ attitudes surrounding mathematics is extremely promising.

Using a mixed methods approach, Boaler and Staples (2008) provide commentary addressing both student attitudes with regards to mathematics as well as their achievement and understanding. Similar notions are found in Humphreys’s and Parker’s *Making Number Talks Matter* (2015). Humphreys and Parker provide an effective guide as to how teachers may

implement and facilitate “Number Talks” within their classroom. “Number Talks” are an open-ended discussion in response to a problem provided from the teacher, however the teacher provides very little instruction as to how to attempt the problem. Humphreys and Parker (2015) write:

Number Talks turn students’ roles in math class upside down. Now they are supposed to figure something out rather than be told the steps to follow. Now they are supposed to explain what *they* think rather than waiting for us to explain. They are also supposed to explain *why*, when in the past knowing *how* was enough. Now they are expected to test new ideas, with mistakes just another part of the process. Now they need to believe that their wrong answers can be opportunities rather than blemishes on their mathematical self-esteem. And the answer isn’t what matters most anymore (p. 13).

Allowing students to explore mathematics as opposed to being passive learners gives them the opportunity to develop a more flexible understanding of the concepts (Boaler & Humphreys, 2005; Humphreys & Parker, 2015; NCTM, 2000). Number talks, as well as other reform-based methods, place the emphasis on student understanding as opposed to what students produce. The benefits of Number Talks are reiterated in Beatty and Bruce (2012).

The “Railside” school described in Boaler and Staples (2008) is situated in a low-income neighbourhood and houses students from a multitude of cultural contexts and social backgrounds. Many of the students could be categorized under the definition of “at risk” as outlined in Kajander, Zuke, and Walton (2008), and are similar to those often enrolled in Locally Developed courses in Ontario. The instructional methods and overall approaches used in the Railside school are very progressive and “reform-oriented” compared to two other schools that are more traditional in nature (Boaler & Staples, 2008). Additionally, the classes at Railside are

homogeneous in composition at each level, much different from that of the other two schools and schools in general (Boaler & Staples, 2008). In this reform-based environment, teachers spent only 4% of class time lecturing and, “teachers posed longer, conceptual problems and combined student presentations with teacher questioning” (Boaler & Staples, 2008, p. 619). This is similar to that seen in Boaler and Humphreys (2005) and advocated in NCTM (2000). Teachers at the Railside school worked cooperatively planning lessons to best improve mathematics instruction overall (Boaler & Staples, 2008). As a result of Railside’s approach to teaching mathematics, student achievement mostly improved as years passed, and the achievement gaps within specific classes began to shrink (Boaler & Staples, 2008). The authors make a point of mentioning that many of their results are not typical, given the extreme circumstances found within the school, however, one could argue that their student success can be attributed to the high levels of support from every level of the school staff and parents, as envisioned in NCTM (2000). Similarly, significantly more students attending the Railside school reported enjoying mathematics more and their beliefs about mathematics improved dramatically (Boaler & Staples, 2008). The systems in place at Railside school were able to change how students perceive mathematics instruction and begin the shift towards that outlined in NCTM (2000): “It’s not just one way to do it. . . . It’s more interpretive. It’s not just one answer. There’s more than one way to get it. And then it’s like: ‘why does it work?’” (Boaler & Staples, 2008, p. 630). Again, while the case of the Railside school may be unlikely as it is “outside the norm”, it is not without value. The cases of Railside school as well as Humphreys’ class show that with proper support, reform-based practices can be efficiently implemented into classrooms, and that the benefits can be tremendous.

In addition to promoting inquiry-based learning, reform-based mathematics promotes critical thinking, community, support, and respect, and gives students the opportunity to truly understand the ‘behind the scenes’ aspect of mathematics. That is, instead of a rote memorization of procedures and rules, students can develop a coherent and flexible understanding of mathematical concepts (Boaler & Humphreys, 2005; Boaler & Staples, 2008; NCTM, 2000). In order for this to be accomplished, competent and motivated teachers are needed as well as continued support from all components of education, from staff, to parents/guardians, to policy makers. Reform techniques are needed more than ever as the demand for higher mathematical thinking increases (NCTM, 2000). There is evidence that for many students, traditional math simply is not working for them, and they do not see how they fit into mathematics as well as how mathematics in turn fits into their everyday lives (Hand, 2010; Kajander, Zuke, & Walton, 2008). Marchis (2011) found that a teacher’s attitude towards mathematics, as well as the relevance of mathematics in their everyday life, had a positive effect on their attitudes towards mathematics. As context and relevance are a primary focus of the LDCC curriculum, teachers must be open to various teaching practices in order to better serve their students.

Standards-Based Reforms

Education is defined by the policies and practices designed to support school staff and students. Various systems that are present within a particular school can have profound impacts on student achievement (Bol & Berry, 2005; Sandholtz, Ogawa & Schribner, 2004). Obvious factors such as curriculum, teaching styles, and class resources can dramatically affect student learning in addition to subtler factors such as student education standards, school organization, parent involvement, and student demographics (Bol & Berry, 2005; Clandfield et al., 2014; Hamlin & Cameron, 2015; Stoilescu et al., 2015). The relative importance of these factors, and

decisions related to them, can be extremely controversial between members of the educational community and those with stakes in educational outcomes. In particular, schools' use of educational standards and how students are 'streamed' can be especially sensitive topics for teachers and parents/guardians alike. The implementation and benefits of policies such as standards-based curricula and student streaming are controversial, not consistently accepted across educational realms, and experience significant resistance from parents (Bol & Berry, 2005; Clandfield et al., 2014; Macaulay, 2015; Sandholtz et al., 2004; Stoilescu et al., 2015). Streaming is particularly interesting in regards to Locally Developed courses as these courses act as a 'catch basin' for students with any manner of difficulties and exceptionalities.

In order for practices of education to evolve, new reforms must be developed, implemented, and evaluated. Despite some use by many educators and researchers alike, research suggests that the type of problem-based learning as described in the NCTM standards is still far from being commonplace in every school in Canada or the United States (Hand, 2010; Harris, 2011; Kajander & Zuke, 2005). Curriculum standards, such as those proposed by NCTM, require support from every level and component of the school system such as education board members, school administration, teachers, and parents/guardians (NCTM, 2000).

Sandholtz, Ogawa and Scribner's 2004 study, *Standards Gaps: Unintended Consequences of Local Standards-Based Reform*, illustrates the consequences of misguided and ill-supported standards reforms in the context of American schools. The authors sought to examine the results of the state and district standards on teacher-centered projects and through interviews with teachers and administrators from over twenty schools. The authors learned of extreme unrest within teaching communities in regards to district and state standards: "Many state standards are ambiguous, and most would argue with their breadth and their imbalanced

emphasis on the highest levels of critical thinking at most grades” (Sandholtz et al., 2004. p. 6). Additionally, they discovered that some elementary school districts adopted standards much lower than that of the state and separated the standards by academic levels. This modification that the district undertook resulted in what the authors refer to as a “standards gap” (Sandholtz et al., 2004.). Similarly, secondary schools deviated from established standards and adjusted standards to students depending on academic ability: “We emphasize minimum and essential standards in ‘general’ math classes. Higher level skills receive more emphasis in CPM [college preparatory math] and algebra classes” (Sandholtz et al., 2004, p. 11). The adjustment of curriculum exacerbated the disparity in ability between various groups of students.

The pressure for the participating American teachers to adhere to standards established by their school administration was so immense that teachers made significant sacrifices to their teacher instruction. Several teachers reported having insufficient time to incorporate higher order thinking into their lessons and activities and relied heavily on “drill-and-kill” type tasks (Sandholtz et al., 2004.), which is in direct opposition to much research indicating how students actually learn (NCTM, 2000). Consequently, teachers more or less “taught to the test”. That is, the state-regulated test evaluated mathematics and language exclusively and so many teachers, roughly a third of study participants, removed subjects such as art, science, and history from their instruction time and spent 70%-100% of teaching time on mathematics and language (Sandholtz et al., 2004.). In Ontario, secondary schools spend considerable time and resources preparing for the provincial EQAO mathematics assessment. What does this mean for Locally Developed students, who are not required to write any form of provincial assessment? Is their progress and development tracked and valued as closely? Are less resources devoted to improving their mathematical ability? Curriculum standards are meant to improve and guide teacher instruction.

As was the case with the American schools in the study by Sandholtz et al. (2004), the EQAO assessment can serve to degrade students or otherwise deprive them of rich learning opportunities if not implemented properly.

In Canada, there exists a large education gap between Aboriginal and Non-Aboriginal students (Nguyen, 2011). A large portion of Canada's Aboriginal population find themselves within a low socio-economic status and students that come from such homes are often placed in lower level mathematics classrooms (Bol & Berry, 2005; Clandfield et al., 2014; Sandholtz et al., 2004). Sandholtz et al. also describes how the school implements the process of 'tracking' students, also known as streaming. To begin discussing tracking or streaming it is important to first define it and describe in what contexts students are "streamed" and then describe its effects.

Streaming Defined

Sandholtz et al. use the term "tracking" to refer to two similar processes: academic tracking and ability grouping (Sandholtz et al., 2004.). Academic tracking, or streaming, is the process of dividing students into different "sections" for a particular subject area, whereas ability grouping typically refers to grouping students within a single classroom in terms of ability (Sandholtz et al., 2004.). In secondary school in Ontario, these sections or pathways are most often: university preparation classes, college preparation classes, and workplace preparation classes (Bol & Berry, 2005; Clandfield et al., 2014; Hamlin & Cameron, 2015; Sandholtz et al., 2004; Stoilescu et al., 2015; Tilleczek, 2008). Streaming, however, can refer to specialty academic programs as well. For example, the Toronto District School Board offers 18 alternative school programs for students including: schools focusing on music education, schools with specialty athletic programs, religious and ethnic programs, International Baccalaureate (IB) programs, and perhaps the most well-known, language specialty programs such as French

immersion (Clandfield et al., 2014). Students may also be streamed within a particular classroom, whether consciously or unconsciously, based on race, language, behaviour, personality, and more (Bol & Berry, 2005; Clandfield et al., 2014; Stoilescu et al., 2015).

The process of streaming has a well-documented and complicated history, having taken many forms over the years and being the subject of much scrutiny (Clandfield et al., 2014):

[S]tate schools in Ontario have streamed students since they were originally established in the 19th century. . . . Secondary school streaming was open and blatant in the years following the introduction of the Robarts Plan in 1960. However, in recent years it has become more difficult to discern these streams, given the increasingly sophisticated ways in which programs and courses are now labelled and often masked. (p. 77)

The authors continue to describe that while the terminology associated with streaming has changed over the years, the process has essentially remained the same, and that the transition to a “pathway” or “destination” based structure is, for all intents and purposes, the same as decades prior (Clandfield et al., 2014). For example, in Ontario: “The policy was intended to end streaming in Ontario high schools and create a system that kept ‘options open’ for all students” (Hamlin & Cameron, 2015, p. 3). However, there exists very little research showing the existence of movement between mathematics course streams.

Often, students are placed in these groupings based on their perceived ability, or achievement in previous years’ courses with the intent of creating groups of students that are comparable so that they may benefit from being around students of similar understanding while simultaneously being easier to teach, often to the dismay of parents (Bol & Berry, 2005; Clandfield et al., 2014; Sandholtz, et al., 2004; Stoilescu, et al., 2015). Other times, students and their families are often tasked with selecting a stream or pathway at a critical juncture in the

child's life, when adolescent students transition to secondary education, thus complicating the process further. Tilleczek (2008) writes: "The transition from elementary to secondary school entails changes in school cultures, increased academic demands, the introduction of rotary systems, and shifts in peer groups that can be difficult to negotiate" (p. 1). Thus, going through the process of being "streamed" and how students perceive this process, can further confound a student's move to secondary education. The streaming process can have many impacts on student learning.

Consequences of Streaming

In theory, streaming students should allow for easier instruction as classes consist of more homogenous groups. However, streaming can have a significant number of intended as well as unintended consequences on students and student learning. This is in part due to which demographics of students are placed in any given stream. Research indicates that culture and socioeconomic status have large impacts on student achievement. Kajander, Zuke and Walton (2008) is an example of such research. Thus, there are often racial and status trends in regards to streamed classes. Higher track classes tend to consist more of non-minority, non-immigrant students from middle to high income homes (Clanfield et al., 2014). Furthermore, many of these students in "lower" track classes are already considered "at-risk": "by default, most at-risk students are streamed into the "lower" and less academic streams, making them especially vulnerable to under-achieving in mathematics" (Macaulay, 2018, p. 2). Research such as that conducted by Nguyen (2011) and by Boaler and Staples (2008) shows that these trends are common in both Canadian and American schools, with some variation depending on region and context.

The associated connotations of these children's backgrounds as well as the connotations associated with "lower" track classrooms have a notable negative impact on teachers' perceptions of their students (Bol & Berry, 2005). Thus, teachers in both Canadian and American contexts often lower their expectations for students and reduce tasks to "drill-and-kill type tasks" (Bol & Berry, 2005; Clanfield et al., 2014; Macaulay, unpublished; Sandholtz, et al., 2004). The reduction of expectations, leading to shallow tasks deprives students of developing higher level thinking and truly exploring mathematics as recommended in NCTM (2000). The difference in student streaming has resulted in considerably different approaches to teaching between levels: "Academic courses were intended to focus on "abstract applications of essential concepts" and applied courses were described as stressing "practical, concrete application of concepts"" (Hamlin & Cameron, 2015, p. 3). In Sandholtz et al. (2004) the teachers structured their standards around what they thought the students would be able to achieve, which one could argue was a contributing factor to their sizable standards gap that has been so problematic in the United States. Hamlin & Cameron (2015) write, in the context of social science courses:

The implication is that academic students are much more ready for critical citizenship than applied students. In citizenship, I don't know why you would have different content. There seems to be an assumption that applied students wouldn't be able to handle the bigger issues. In my own experience as a teacher, students in applied are, in many cases, much more ready to engage in critical questions than academic students are (p. 4).

Macaulay writes that each and every student should be held to high expectations and challenged within a reasonable setting to truly foster their development, particularly in mathematics (Macaulay, in press). Most streaming practices eliminate this possibility. It appears that even the mere concept of having students at different levels changes the ways in which teachers and

administrators perceive students and their abilities, perpetuating the stigma that the “lower” track courses are for “lesser” students. The modifications in expectations between levels has served to perpetuate an existing achievement gap in students as opposed to eradicating it (Sandholtz, et al., 2004; Clanfield et al., 2014). “Higher” level students are being adequately supported and propelled into further, deep understanding of course concepts whereas students in “lower” track classrooms are taught the basics and offered little challenge or enrichment. The achievement gap is reflected in graduation rates. In certain areas, approximately 40% of students enrolled in Applied level Grade 9 courses graduated after five years compared to upwards of 80% of students enrolled in Academic courses in Grade 9 (King et al., 2009). Graduation rates for those in Essential or Locally Developed courses are even more abysmal (Hamlin & Cameron, 2015; Clanfield et al., 2014, Bol & Berry, 2005). Bol and Berry (2005) write that some efforts to reduce the achievement gap using ability grouping have been shown to be effective, however, more needs to be done.

Students are aware of the low expectations placed on them and can begin to think of themselves as ‘stupid’, ‘incapable’ or otherwise inferior to those in other levels of courses: “Having been grouped in this way, students can easily come to internalize their status, with the resulting poor self-image doing little to promote interest, motivation or success. It is certainly not surprising that ‘behaviour problems’ result from such grouping practices, as frustration over lack of success increases” (Clanfield et al., 2014, p. 89). Thus, the causality that many teachers believe, that these students are in lower level courses is because their behaviour could in fact be cyclical. Students who perceive themselves to be inferior in mathematics often see little or no point in participating in math class: “grade 9 applied students think that they are not good at mathematics and they do not want to try” (Stoilescu et al., p. 91).

In some cases, students do not finalize their choice for what stream they progress through as it is typically chosen by the teachers, and or the school, or otherwise strongly recommended to the student and their parents/guardians. When students do have the choice, it is often when entering high school, where it is unclear whether or not students understand the options available and the gravity of their choice. The literature indicates that students and parents/guardians feel very overwhelmed and significantly uninformed of the options as well as the consequences when the student is placed in a particular level course (Tilleczek, 2008; Hamlin & Cameron, 2015). Again, this directly contradicts such documents as NCTM (2000) which advocates for the continued inclusion of parents in discussions that affect their child's education. Students see Academic courses as the only means with which they may attend university and become successful and so they often enroll in academic courses despite being unprepared for them (Stoilescu et al., 2015; Hamlin & Cameron, 2015). Another problematic aspect of streaming is the lack of upwards mobility. Most commonly, students drop down to a lower level class from a higher one. Very rarely is it seen that students are 'promoted' from a lower stream to a higher one: "once a student is placed in a program in Grade 9, there is still very little movement over the course of his/her secondary school career — and what movement does exist is overwhelmingly "'down' in nature" (Clanfield et al., 2014, p. 95). Furthermore, there exists little to no supports for students who lack the necessary skills when leaving elementary school. Students are rarely held back from Grade 8 for insufficient math skills and so regardless which stream they are placed in, some may begin at a large disadvantage (Stoilescu et al., 2015). For students in the precarious situation of having underdeveloped math skills when transitioning to high school, very few alternatives exist (Clanfield et al., 2014). However, Hamlin and Cameron (2015) describe an initiative implemented at the Granite Ridge Education Center, a K-12 school in

Ontario that involved the creation of a class that integrated Academic and Applied Grade 9 streams into a single class. The course is showing promising results on student achievement and performance on standardized EQAO testing (Hamlin & Cameron, 2015). Nevertheless, programs such as the one found at Granite Ridge are few and far between or may be more common in specific areas. Internationally, Poland provides an example of ending streaming based on previous achievement and or performance with positive results such as increased performance on international PISA tests (Hamlin & Cameron, 2015). Many of the attributed benefits of streaming are arguable or inconsistent. Furthermore, the process of streaming introduces an entirely new range of problems relating to student ability, self-esteem, and achievement.

In order to guide the future of education, standards and policies should evolve to meet the growing needs of the students. The benefits of streaming are still unclear and so great care ought to be taken when placing students in mathematics classrooms. Works such as Boaler and Humphreys (2005) and Boaler and Staples (2008) show that students often respond better to open-ended and critical thinking tasks as opposed to procedural tasks that focus on rote memorization. Alleged benefits are inconsistent whereas the negative impacts are sizable (Hamlin & Cameron, 2015; Bol & Berry, 2005; Stoilescu et al., 2015; Clandfield et al., 2014). Current streaming protocols may serve to exacerbate existing achievement gaps between higher and lower achieving students, contrary to the original intention of streaming as well as standards outlined in NCTM (2000). If anything, it should be the students who are placed in “lower” level classes that are provided with rich and engaging learning opportunities as they are in need of them the most. It may be the case that, existing streaming processes put “at-risk” students in even further jeopardy. Lowering expectations for “at-risk” students, may eliminate any chance for

them to be engaged and successful in mathematics (Kajander, Zuke & Walton, 2008; Hamlin & Cameron, 2015; Macaulay, 2015). The question then becomes how can we challenge at-risk students without making mathematics inaccessible to them?

Student Motivation

A common struggle among teachers is how to best motivate students within the classroom. Many students are extremely unmotivated, particularly adolescents and particularly in mathematics (Whitley et al., 2007). Research has postulated many potential causes of motivation problems in students (Kajander, Zuke & Walton 200); Hand 2010). Regardless of its origin, whether the lack of motivation comes from previous negative experiences in mathematics class, self-efficacy issues, or the classroom environment and culture, it remains a constant obstacle in the face of mathematics learning. Nevertheless, it is beneficial for educators to consider what research says in regards to motivation so that possible alleviants can be put in place in order to improve student learning.

Whitley et al. (2007) provide a unique perspective in regards to how motivation is affected by student transitions from one school to another. The main focus of the Whitley et al. (2007) study is student achievement, however the authors establish an intuitive and substantive connection between motivation and achievement and so the commentary provided is beneficial to consider. One observation made by the authors is the strain that students experience on their student-teacher relationships when they transition to a new school. In younger years, students remain with a single teacher for the majority of the day and so inevitably form a significant bond with said teacher. In middle and high school however, students may only be with a given teacher for one period a day, and so it is much more difficult to establish a healthy and supportive teacher-student relationship (Whitley et al., 2007). The stage-environment fit theory presented by

the authors in their discussion of existing literature suggests that the new environment students encounter, as well as the change in teaching and teacher expectations, can have a dramatic negative effect on student motivation and subsequently achievement (Galton, 2009; Whitley et al., 2007). Again, it is important to bear the social aspects of student transitions in mind when discussing student motivation.

When students arrive at a new school, it can be extremely intimidating. They are attempting to immerse and acclimate themselves to a completely new environment with new rules, norms, and expectations. Additionally, students are attempting to establish and maintain friendships and relationships, all while their mental, physical, and emotional physiology is under constant change (Whitley et al., 2007; Galton, 2009). In Canada and the United States, many students have emigrated from other countries, travelled from distant cities, have arrived from remote communities to receive an education. These students while acclimating to a new school environment, now must negotiate an entirely new set of cultural norms. Popadiuk (2010) writes that Asian international students:

were constantly negotiating multiple transition realities, many of which domestic students were not experiencing, including significant changes in academic systems and expectations; major changes in friendships and family support; new expectations around living conditions and level of autonomy; and a change in diet and physical environment that often impacted the person's physical health. At the same time, their sense of identity in this new context was often undergoing considerable flux, which put students at higher risk for falling in with the wrong crowd, failing to perform academically, or experiencing mental health concerns. (p. 1543)

It stands to reason that these students will experience these changes at varied rates, and perceive these changes in themselves and their surroundings differently. As previously mentioned, current research is inconclusive as to the degree in which a student's background affects their motivation in class. The teachers interviewed by Bol and Berry (2005) believed it was *precisely* these students' backgrounds that caused their minimal motivation in the classroom, arguing that some student families place little value on student education and thus the students were indifferent to their own learning. Conversely, the findings in Campbell et al. (2009) indicate that the main motivation for many students is to please their parents. Like many cognitive processes, motivation is far too complex to be caused solely by student background, student behaviour, school environment, the teacher's beliefs, course content, and the like, but may be caused by the complex exchange between these factors, as well as how the students navigate them. Established research has not provided an all-encompassing answer to the problem of student motivation, precisely because of the many factors that contribute to motivation. Understanding student opposition yields further insight into how student-teacher interactions can shape student behaviour.

Student Opposition

Student opposition stands as a clear barrier to student learning on a variety of levels. Not only do the students in direct opposition miss out on the benefits of being in the classroom, but bystander students may be adversely affected by the ensuing conflict (Hand, 2010). Additionally, students may feel pressured to reject authority figures upon witnessing their peers doing so, as students, particularly adolescents, often experience social pressures and feel the need to conform (Campbell et al., 2009; Hand, 2010; Jao, 2013; Whitley et al., 2007). Student opposition can be present in various degrees and take many forms, from conscious disengagement and off-task

behavior, to direct rejection of authority figures (Hand, 2010). Regardless of its form, it is important to understand potential causes of opposition so that proper intervention techniques can be developed and implemented.

Many believe that student opposition is a direct representation of student behaviour, or student disposition (Bol & Berry, 2005). That is to say, many hold beliefs that Student A is simply a “problem child” for whatever reason, and is thus more likely to act out. Hand’s (2010) study, *The Co-Construction of Opposition in a Low-Track Mathematics Classroom*, examines how opposition can be constructed as a result of teacher-student interactions. In regards to the belief that student misbehaviour is a trait inherent in the student, Hand (2010) writes that these assumptions, “may mask the process of classroom structures coming into opposition with each other, as classroom participants struggle to make sense of what it means to learn (or not learn) together” (p. 98). Hand describes that in the context of mathematics classrooms, the construction of a classroom that is “free from culture”, creates distinctions between mathematics and social realms, potentially skewing perceptions of mathematics that may result in students seeing the mathematics in their daily lives (Hand, 2010). Mathematics classrooms are cultural spaces, affected by societal and cultural norms, thus, Hand argues, normative structures such as privilege and oppression are inseparable from the mathematics classroom. Existing literature is inconclusive with regard to the effects of race and ethnicity in the mathematics classroom (Marks 2000). However, teaching is an act embedded within culture and so may explicitly or implicitly affect student behaviour.

Hand’s findings showed that in that particular “low-track” classroom, students became progressively more confrontational over the course of the term and the instances of antagonism became increasingly explicit. Hand attributes this largely to the classroom environment that the

teacher established over time. As the students progressed through the course, the opportunities that the teacher provided to “do mathematics” became increasingly shallow, and the teacher (likely unintentionally) placed the students in positions that made them seem incapable with little to no prospect to demonstrate their learning (Hand, 2010). For example, when discussing an algebra problem, the teacher gave explicit, step-by-step, and arguably convoluted instructions, and conveyed explicitly that if he “thought they could do it” he would send them on their way (Hand, 2010, p. 113). The students’ roles then became passive as they just had to follow the leader so to speak. The teacher used techniques such as these to mitigate behaviour issues in the classroom and ironically instilled negative beliefs into his students, consequently resulting in worse classroom management problems in the future. When students have reduced ability to participate, or become aware of reduced implicit or explicit expectations, they are likely to reject the task and even the figure assigning the task (Hand, 2010; Sandholtz, et al., 2004; Clanfield et al., 2014). The classroom in Hand (2010) could be considered primarily consisting of students “at-risk”, as many were minority students from low economic and educational backgrounds. As such, some interesting comparisons can be made to that of Kajander, Zuke and Walton (2008) who found that some of the students under focus were in extreme and explicit opposition against mathematics class. Students were often off-task, attendance was inconsistent, and engagement and/ or participation were virtually nonexistent. The students in Kajander, Zuke and Walton (2008) were also the subject of reduced expectations, placed within poor social settings, and given limited and shallow opportunities to demonstrate their learning like those in Hand (2010). As a result, the teachers encountered significant behavioural issues throughout their respective mathematics classes over the course of the researchers’ observational time. It is clear that many of the norms and practices that a teacher establishes within their classroom, can have a direct

result on students' behaviour and the respect they hold for their teacher and the class. In parallel, the teachers also became increasingly traditional over the course of the study (Kajander, Zuke & Walton, 2008). Cases such as those in Hand (2010) and in Kajander, Zuke and Walton (2008) serve to highlight just one of the many motivations for the creation of documents such as the NTCM (2000) *Standards* document, that advocates the importance of rich, open-ended tasks, as well as the beliefs that teachers impose on their students, such as expectations and attitudes towards mathematics. Student opposition is closely related to student engagement, which will be discussed in the following section.

Student Engagement

Student engagement is perhaps the most influential aspect of student behaviour that serves as a barrier to student participation. Furguson et al. (2005) cited disengagement as the attribute most likely to result in a student abandoning secondary school before obtaining their diploma. Even students who are motivated and conform to classroom norms may become disengaged for a variety of reasons (Marks, 2000). Many educational reform movements serve to increase student engagement in the classroom. If students are engaged, typically they are motivated and behavioural problems are reduced (Boaler & Humphreys, 2005; Boaler & Staples, 2008; Jao, 2013). Thus, educators have nothing to lose, and everything to gain by undergoing professional development and reflective practices to try and improve student engagement in their classrooms. Teachers in “low-track” mathematics classrooms, such as Applied and Locally Developed streams in Ontario, may encounter particularly substantial student engagement issues (Marks, 2000; Campbell et al., 2009; Jao, 2013). It is important to understand how particular factors, both social and academic, contribute to student engagement.

There exists an array of conflicting research describing how certain subjects such as mathematics relate to student engagement. Marks (2000) studied how student engagement in each age group (elementary school, middle school, and high school) related to a variety of factors. Marks (2000) confirms the inconclusiveness of this problem as the researchers found that engagement fluctuated notably between subjects and grade levels. In this particular study, the researcher found that students in mathematics classes were more engaged than that of their counterparts in social studies, noting that students in mathematics classes were more likely to regard their classroom as supportive (Marks, 2000). Marks also provides commentary on how certain social factors contribute to student engagement. In this study, Marks (2000) found that gender and social class significantly affected student engagement with girls on average being more engaged than boys, and those of a higher social class being more engaged than students of a lower social class. Interestingly, the researcher found no impact of race and ethnicity on student engagement. The finding that race does not affect student engagement contradicts the argument of Hand (2010) that classrooms are cultural spaces and so societal structures such as privilege and oppression were present within any classroom. According to research, previous schooling can also play a meaningful role in students' active participation within the classroom, primarily among elementary school students. Similarly, previous success in school appeared to have a notable impact on engagement among high school students (Marks, 2000; Campbell et al., 2009). Certain factors appeared to influence student engagement across all three levels of schooling. Those influences include: parental involvement, provision of classroom supports, and providing authentic work (Marks, 2000). Once elements such as these have been identified to potentially contribute to student engagement, what can educators do to act on this knowledge and begin to improve engagement within their students? While teachers may not be able to account

for every factor simultaneously, actions can be taken to foster engagement in their classrooms. Jao (2013) showcases three teachers in Canadian schools that have not only identified certain factors they believe to affect student engagement, but have implemented strategies and resources in an attempt to reach students on an entirely new level.

Jao's 2013 doctoral work, titled *Perceptions, Pedagogies, and Practices: Teacher Perspectives of Student Engagement in Grade 9 Applied Mathematics Classrooms*, seeks to address the problem of disengagement, among a particularly vulnerable group of students. Additionally, Jao (2013) serves to illustrate practices and pedagogy that, in the case of these Canadian classrooms, has shown to be effective. Jao acknowledges the existence of both social and academic engagement and demonstrates how different factors in each category of engagement can be addressed differently. With the rampant changes in adolescent students' cognition, bodies, and lives, each of the three teachers in Jao (2013) very strongly advocates for the creation of strong teacher-student relationships despite being in the context of a secondary school, where Whitley et al. (2007) describe these relationships as diminished. Jao writes about one teacher, "Nadia creates strong teacher-student relationships to support her students socially, yet finds that her relationships are of benefit to her students academically as they value her personal support and encouragement that they can be academically successful" (Jao, 2013, p. 201). Thus, a strong relationship between teacher and student can not only be beneficial to their mental and emotional state, but improve their academics as well. Similarly, each of the three teachers, in efforts to improve engagement and participation, established a strong, respectful, classroom community in which every student was valued and their contributions welcome (Jao, 2013). Jao describes these communities as effective in allowing even shy, reserved students the level of comfort to engage in classroom discussions. The teachers in Jao (2013) argue that

without this sense of community, students may not feel comfortable to participate and may act out, like that of the classes in Hand (2010). Conversely, one of the teachers described that after establishing a sense of community in the classroom, reticent students were more likely to participate as students witnessed the engagement and enjoyment that their peers were experiencing (Jao, 2013). By the same token, a strong sense of community, and the beliefs that these teachers embodied that valued everyone's opinions and contributions, had a positive effect on student self-efficacy, resulting in students developing healthy levels of confidence in their own mathematical abilities (Jao, 2013). Self-efficacy and esteem issues are a predominant issue with adolescences due to their physiological development as well as constant pressures from their peers. Students in non-academic streams are often labelled as being "inferior" compared to their Academic counterparts. Often, students can internalize these labels leading to even poorer self-efficacy beliefs (Clanfield et al., 2014). Thus, it is important that teachers position themselves in a way that they can foster students' self-efficacy beliefs and make them feel valued (Marks, 2000; Campbell et al., 2009; Jao, 2013). Another positive example of how teachers can foster self-efficacy can be seen in Boaler and Humphreys (2005) in which Humphreys creates a "mathematical community" in her classroom throughout the year, illustrating that even students that do not get the "right answer" can still make significant contributions to classroom discussions. The teachers in Jao (2013) as well as those in Boaler and Humphreys (2005) gave students the proper emotional and social supports so that students may better succeed.

Similar to the discussion provided by Marks (2000), the teachers in Jao (2013) firmly stress the need for relevant mathematical tasks and lessons. They argue that this relevance can be obtained in a variety of ways, all of which are especially important for "at-risk" students, such as

the ones in Jao (2013) and Hand (2010). One recommendation the teachers had in order to incorporate relevance into the classroom, is the integration of technology, much in alignment with NCTM (2000). Jao (2013) writes, “Benjamin says his students are never seen without their cellular phone and iPods or other electronic devices, thus it would be unnatural for them to be deprived of technology for that one hour and fifteen minutes” (p. 98). In addition to being more engaging overall, adolescents nowadays are extremely versed in technology and so not only are students able to complete the task, they can do so efficiently and construct their own solid understanding of the concepts (Jao, 2013). The author notes that technology cannot be a substitute for every type of activity, and bring with it certain complications. Nevertheless, with students’ reduced attention spans, using technology in a particular lesson can be just the thing to encourage even the more taciturn student into participating (Jao, 2013). Similarly, Jao (2013) and their participants advocate for the use of resources such as the Targeted Implementation and Planning Supports for Revised Mathematics (TIPS4RM). The TIPS4RM website is a collection of resources designed for teachers in alignment with mathematics curriculum. This set of resources was created for the use of educators with the aim to improve student engagement and understanding of mathematical concepts. Resources such as the TIPS4RM, as well as tasks that encompass students’ personal interests, encourage students to participate as well as giving them a solid context with which to apply their learning (Jao, 2013). Technology and other authentic tasks gives students the opportunities to construct their own mathematical meanings thus improving student participation as well as student understanding and comprehension.

Teachers can learn more about how to motivate and engage students from the examples that Jao (2013) offers. Similarly, Boaler and Humphreys (2005) provides further examples as to how students may be exposed to various strategies and techniques that can be used to motivate

and engage students in their classrooms. When educators can clearly identify causes of problems such as poor motivation, opposition, and poor engagement they may come together with fellow teachers, parents, and other colleagues and address the issue more effectively, together.

The need for effective and relevant mathematics teaching, particularly at the Applied and Locally Developed levels, has never been higher. Simply being in an Applied level course reduces the likelihood that the student will graduate (King et al., 2009). Furthermore, students need to master mathematical concepts and thinking in order to be effective members of society, especially in a world where technology and social norms are rapidly evolving (NCTM, 2000). As a result, educators should consider what actions they can take to help ensure their students achieve this level of mathematical competency. A growing body of research demonstrates that students need rich, open-ended, problem-based tasks in order to learn (Boaler & Humphreys, 2005; Boaler & Staples, 2008; Hand, 2010; Jao, 2013, Macaulay, 2015; Marks, 2000; NCTM, 2000). Examples such as those in Boaler and Humphreys (2005), Boaler and Staples (2008), and Jao (2013) show that the use of reform-based methods and practices can dramatically improve student behaviour and in turn, student learning. Practices such as incorporating student interests and technology, holding students to high and reasonable expectations, fostering student self-efficacy, and establishing a learning community in which all students may thrive, are simply becoming the new standards that teachers must meet. Hurlington (2010) adds that such practices also make students more resilient learners allowing them to overcome challenges instead of being discouraged by them.

Students need to be challenged and to truly discover mathematics for themselves, so that they may construct their own mathematical meanings. Students in low-track mathematics classes or otherwise vulnerable groups require even further support in order to thrive. The connotations

associated with the label of an “Applied class” or “Locally Developed class” can result in poor student esteem creating low motivation, low engagement, and increase instances of opposition in the classroom. Nevertheless, it is clear that teachers can take action to combat these factors, as long as they are willing to open their mind, and to adapt their teaching practices to suit the students in front of them.

Chapter 3: Methodology and Method

Purpose

The purpose of the research was to examine teachers' perceptions of factors affecting the teaching of Locally Developed mathematics. Teachers' opinions and attitudes in regards to elements positively and negatively impacting their teaching were examined. As stated in the curriculum document for Grade 9 and 10 Locally Developed courses, many students enrolled in these courses may be several grade levels behind in their mathematical ability and/or their literacy skills (Ontario Ministry of Education, 2005). As such, Locally Developed classrooms contain many high-needs students such as those with extreme behavioural/emotional problems, or students with learning disabilities and so the question driving the study was what do teachers perceive is required so that schools, boards and policy makers can better support teachers of these classrooms in order to improve outcomes for both teachers and students.

Student data was obtained as part of the larger project for the Ministry of Education's Mathematics Knowledge Network. The two students from whom ethics were acquired may be referred to in the context of conversations with teachers or during teacher interviews. All other student data such as attendance numbers, student grades, comments regarding engagement and motivation were also obtained from the perspective of the teacher through the informal meetings as well as the formal interviews at the end of the semester. The primary focus of this study is teacher perceptions about teaching Locally Developed Mathematics.

Methodology

This study used qualitative research methods in the form of interviews and observations to capture a realistic representation of teacher perceived barriers to teaching Locally Developed mathematics. This research used a case study methodology to examine two Grade 9 Locally

Developed mathematics classrooms in Northwestern Ontario. Case study methodologies are defined as, “the study of a case (or cases) within a real-life, contemporary context or setting” (Creswell & Poth, 2018, p. 132). Cases must be in a bound system of time and space (Creswell & Poth, 2018). The case study methodology, which may study “one or more individuals” (Creswell, 2014, p. 241) is beneficial to illustrate the realities of LDCC mathematics teachers in the chosen context. Case study research analyses a particular context in depth without attempting to generalize to other contexts (Creswell, 2014). Stake (1995) writes that the selection of cases should, “lead us to understandings, assertions, perhaps even modifying of generalizations” (Stake, 1995, p. 4). Developing an understanding of this particular case may help guide future discussions surrounding Locally Developed mathematics.

A case study methodology was selected primarily due to the nature of the research questions. Yin (1994) writes that, “case study is preferred in examining contemporary events, but when the relevant behaviours cannot be manipulated” (p.8). As I sought to explore events teachers were experiencing in Locally Developed classrooms and how they perceived these events, without modifying or altering these perceptions in any way, a case study methodology seemed preferable compared to other methodologies such as a history or experiment. Furthermore, since an experiment “deliberately divorces a phenomenon from its context” (Yin, 1994, p. 13), such a methodology would be counterproductive to the research questions. In this study, context is particularly important. It is not just the teaching of mathematics that is under study, but Locally Developed mathematics in particular. The act of teaching is a complex social process. A strength of case study methodology is that it “offers a means of investigating complex social units consisting of multiple variables of potential importance in understanding the phenomenon” (Merriam, 1992, p. 41). In this instance, there are many complex factors at play

including those related to teachers, students, administration and more, thus making a case study methodology suitable.

This study takes characteristics of what Yin refers to as an “exploratory” case study (1994, p.5) as it seeks to describe “what” factors teachers perceive as affecting their ability to effectively teach Locally Developed mathematics. However, I also seek to answer how these teachers value these factors and describe how they arrive at these value judgements. In this way, my study also takes on characteristics of an “explanatory” case study (Yin, 1994). While I was not trying to predict the outcomes of this study, the results may “develop pertinent hypotheses and propositions for further inquiry” (Yin, 1994, p. 5). That is, the results of this study may guide future research and discussion around Locally Developed mathematics.

I chose to use a case study methodology with direct classroom observations for several reasons. First, it aided in the creation of interview questions, as it was easier to discuss what things teachers valued in the classroom after having witnessed the classroom in action firsthand. Secondly, with direct observation I was able to describe “meaning” and adjust observation to hone and support that meaning (Stake, 1995). That is, trends and patterns became apparent, by making connections between participants, as well as connections between observations and interview data. Collecting data from several sources allows for a better representation of the entire case (Yin, 1994; Stake, 1995). Stake (1995) describes the importance of letting data tell the “story” and that “the story often starts to take shape during the observation” (p. 62). The inclusion and use of observations allowed for a more realistic portrayal of teaching in Locally Developed classrooms. Similarly, the use of interviews is beneficial as “each interviewee is expected to have had unique experiences, special stories to tell” (Stake, 1995, p. 65). In the case of the participants of this study, each had differing levels of experience teaching Locally

Developed mathematics and their experiences during the semester also differed. As such, it was beneficial to describe each of their “stories” and supplement this with both observation and interview data.

It can however be argued that case study methodology not always ideal as it may be susceptible to bias (Yin, 1994). As someone with an interest in mathematics education and with experience teaching in a Locally Developed classroom, I feel this concern is not baseless. However, I received no benefits from any particular outcome(s) from this study. Furthermore, I included contrasting or contradicting evidence where possible and endeavored to do so fairly.

Teachers were interviewed formally at the end of the semester, but were engaged in informal discussions during classroom visits. Any noteworthy information from discussions was recorded in the research journal. All data from the semi-structured interviews was audio-taped and transcribed. Analysis was *holistic*, looking at the whole case (Creswell & Poth, 2018), to gain as much understanding as possible about teaching in Locally Developed classrooms. Furthermore, I attempted to “preserve the *multiple realities*, the different and even contradictory views of what is happening” (Stake, 1995, p. 12). Data collected from each teacher and class were coded and grouped for a thematic analysis and compared and contrasted with that from the other teacher and class. The teachers were asked questions following the interviews to expand on ideas addressed within the interview if particular lines of inquiry needed to be followed. All data collection and reporting was completed in accordance with the guiding ethics permissions and participants were provided with a final copy of the findings if they requested this document.

Method

A qualitative case study was conducted in two Locally Developed classrooms (Creswell, 2014), one in the fall term, and one in the spring term. Both the fall and spring classes were in

the same public secondary school located in Ontario. These courses were taught by different teachers. I observed classes on a weekly basis for the duration of each semester, making frequent observations in regards to: class lessons, routines, teacher behaviour, student attendance, and teacher conduct, all of which were documented in my field notes. I regularly spoke to the two teachers themselves and engaged them in reflective discussions towards their practice. The goal of the classroom observations throughout the semester was to obtain a holistic view of their teaching approach, and note any changes or evolutions in teaching methods, teacher attitudes and/or behaviours, as well as student behaviours and/or attitudes where ethically available.

Teachers were interviewed using semi-structured interviews (See Appendix A for Interview Questions). The use of interviews, and particularly semi-structured interviews, was to ensure the preservation of participant meaning (Creswell 2014). It was important that the thoughts, attitudes, and feelings of participants were documented in their purest state. Interviews were audio-taped and transcribed prior to analysis. From the interview data, I extrapolated predominant themes regarding factors of effectively teaching Locally Developed mathematics, according to the teachers. The relevant themes emergent in interviews were connected to my own classroom observations. Data obtained was solely qualitative. The focus of the study was not to quantify teacher and student achievement and or satisfaction, but to begin exploring how Locally Developed mathematics education might be improved for both teachers and students. Due to the lack of existing research, this study was largely exploratory. I did not want to exclude any particular lines of inquiry as it is important that the dialogue surrounding Locally Developed education be broad in scope.

Research Sample

The study was conducted using a convenience sample. A convenience sample is one in which a subject group is chosen for its availability (MacMillan, 2000). Creswell and Poth (2018) note that convenience samples save time, resources and effort, “at the expense of information and credibility” (Creswell & Poth, 2018, p. 159). However due to ethical and time restrictions, as well as the limited number of Locally Developed Mathematics teachers in the chosen school, a convenience sample was ideal for this study. This resulted in two teacher participants. Each class consisted of 12-18 students. Student demographics were not recorded but are discussed anonymously through interview inquiry. Teacher participants were chosen from the mathematics department based on availability. Two teachers with varying levels of experience teaching Locally Developed courses were interviewed. Teachers were assigned random pseudonyms which will be used later.

Procedure

Before the observation period, I approached the teachers and explained the study and asked if they wished to participate. Once the teachers agreed, they were given ethical permission forms to complete. After I received them back with signatures, I consulted with each of them for an appropriate time to start observations. In the first semester, the observation period began at the end of September, several weeks into the term. In the second semester, I began observing the first week of the term in early February. I observed the classrooms a minimum of once per week, usually on Wednesdays. If the teacher expressed interest in my presence and or when my schedule permitted, I would also come to observe on Thursdays or Fridays. I conducted regular check-ins with the teacher and students both during and after class in an informal manner. I would ask teachers questions in order to engage them in self-reflection. If I noticed anything out of the ordinary such as students leaving the room for extended periods, or if I had any questions

regarding something the teacher did or said, I would approach the teacher after the class and get their input on the matter. Other questions sought to gauge how the teachers were feeling about the course, the content, how a lesson went, their plans for future classes, their perspectives regarding particular students, and more. I made these observations in my journal. Notes that I recorded in my journal as well as the things that I observed helped shape the research questions as well as inform data analysis. For example, factors such as attendance became immediately apparent after several days of observation. The teachers were interviewed once at the end of the semester, regarding their thoughts and feelings towards teaching Locally Developed mathematics. Questions ranged from how they perceive their teaching ability and student behaviour to perceived factors affecting their teaching (Appendix A). All noteworthy observations and conversations were noted in my field notes. I often noted how lessons started, how teachers responded to disruptive behaviours, teaching strategies used during lessons, teacher demeanor, and how they interacted with students. These observations continued throughout the semester and helped guide the inquiry in the semi-structured interviews at the end of the semester.

Qualitative data collection and analysis

The data analysis takes on some attributes of a narrative study by relaying anecdotes provided by teachers. This is due to the emotions and experiences that teachers experienced during the observation period. Each teacher has had various experiences with Locally Developed mathematics and I sought to preserve and relay these experiences and the sense of progression or maturation in participants, as accurately as possible. The data relating to students is in the form of teacher perceptions to student factors. Student data is provided by teachers themselves during the informal conversations and formal interviews.

Data collection took the form of an “emergent design” as classroom observations helped formulate the interview questions (Creswell, 2014). For example, I noticed that many students were absent from class on a regular basis, so I made sure to include a question addressing that in the end of semester interview. End of semester interviews were audio-taped and recorded on my electronic device. After I conducted all of the interviews, I listened to them in full to ensure that they were recorded legibly. After a preliminary playback, I manually transcribed both interviews while highlighting key pieces of information or particularly interesting comments. Such comments were highlighted in the initial transcripts and I made corresponding notes for later analysis and discussion. After the transcripts were completed, I listened to each interview again to ensure the accuracy of the transcripts and making necessary edits and formatting changes. Once the transcripts were edited, I listened to each interview yet again, this time reading along with the corresponding transcript, pausing to highlight key words or ideas. These key ideas formulated the different themes that encompassed the data. Using these disjoint themes as “baskets”, I reviewed the interview transcripts, and “placed” different comments into the basket that best represented the nature of the comment. These themes were refined and became the different overarching themes present in the discussion. After the themes were honed and the data allocated to the corresponding theme, I referred to my notes and searched for sub-themes that could be established within each of the overarching themes encompassing the data. This manual coding process is outlined in Creswell (2014). Due to the exploratory nature of the study, I allowed the themes to emerge from the data as opposed to using a qualitative codebook that may or may not be applicable to the data (Creswell, 2014).

Participant anonymity was preserved and participants, upon request, were to be provided with a copy of the findings. Interview data was stored securely on my password-protected

electronic devices. This project which began in 2017 is a 5-year project. I have been granted ethics permission to work on the project by the Lakehead University Review Ethics Board, as well as the Lakehead Public School board. This research project is a subset of a larger project coordinated by the Ontario Ministry of Education's Mathematics Knowledge Network. As part of this larger project for the Ministry of Education, student data is being collected, and resources will be created. All permission forms created in accordance with the Lakehead University Review Ethics Board and Lakehead Public School board are included (see Appendix B).

Chapter 4: Results- Classroom Case Studies

The following case studies were conducted in two classrooms, one in the fall term and one in the winter term of the same academic year. These classes were taught by two different teachers and had entirely disjointed student rosters. I felt it was important to present this data in a manner that, at times, takes the form of a narrative. My anecdotes and experiences are included to create a realistic portrayal of the classrooms. Emergent themes will be discussed in a later portion of the report. These themes were also constructed from teacher interview data. Interview data will be discussed in a later section. Ethics were obtained as part of the larger ministry project to collect data from two students in the classroom. As a result, observations involving other students are available only as told through the perspective of the teachers.

Classroom A

Teacher Observations- Mrs. Willis.

Mrs. Willis is a teacher with experience teaching at many schools in the area. She was always observed to be very friendly to me, her colleagues, the students in her class and students around the school. She is a parent to two children of her own and she often spoke about her family to the researchers and the students. Mrs. Willis consistently exhibited a warm and welcoming presence in the classroom. Mrs. Willis was chosen to teach this particular course due to another teacher having to take an unexpected leave as a result of a non-school related incident. As a result, Mrs. Willis was occupying a long-term occasional (LTO) position at this school for periods 1 and 2, and spent periods 3 and 4 at another school within the city.

The classroom was arranged in a traditional manner with desks placed in rows facing the front of the classroom. The teacher's desk was also at the front however it was rarely used. The classroom was outfitted with a SMART Board in addition to standard blackboards. Mrs. Willis

often made use of the SMART Board incorporating the board's applications into her lessons or using the board's capabilities to broadcast videos to the class to begin discussions. Students had mathematical resources such as manipulatives available when needed. Additionally, Mrs. Willis had access to a number of Android tablets if need be, provided that she booked them several days in advance. While convenient, the devices were unreliable and malfunctioned regularly. On some occasions, students had to try several devices before they found one that functioned properly and at a reasonable speed.

Mrs. Willis was observed to be very kind and nurturing throughout the research period. She greeted her students warmly every day and took a genuine interest in their lives outside the classroom. As students trickled into the classroom in the morning, she would inquire about their hobbies, extracurricular activities, friends and family. Even when a student arrived late, or responded with hostility, she would kindly welcome them to the classroom. Students were often disorganized or needed multiple reminders to get on task. Nevertheless, Mrs. Willis was not observed to have lost her patience. On some occasions, she took a stern tone with students but only when it seemed necessary. Mrs. Willis could regularly diffuse conflicts or keep students on task with her calm demeanor without the need for any disciplinary behaviour.

There was a student support person (SSP) present within Mrs. Willis's classroom by the name of Mrs. Thomas who was interviewed as part of the larger Mathematics Knowledge Network project throughout the semester. Mrs. Thomas was placed in the Locally Developed classroom due to the high-needs nature of the student population (Informal Meetings, Various Dates). Mrs. Thomas does not have a mathematics education background and primarily helped manage classroom behaviour among the students. Much of the mathematics content was

accessible enough that Mrs. Thomas was able to assist students with their activities. However this assistance depended on the particular task as well as the particular student that needed it.

Mrs. Willis possessed limited experience teaching Locally Developed mathematics, having taught it only once before (Interview Transcript), nevertheless she appeared confident and comfortable in her current role. Many of her days began with numeracy drills in which students would be allotted a certain amount of time to complete an array of questions, often relating to the mathematical operations. For example, one day students might complete a list of multiplication questions. Other days, they completed subtraction questions. Mrs. Willis's reasoning for this was that many of the students struggled with the basic operations and numeracy, so she felt it was beneficial to practice these skills regularly (Informal Meeting, October 2017). The drills would then be taken up as a class and students would be responsible for self-evaluation and self-correction. Once the drills were taken up, the work would be submitted and the students' names would be entered into a weekly draw where the students could win a small prize. Mrs. Willis had a number of other routines within the classroom including providing the students with some manner of food or drink on a daily basis, all of which were all paid for out of pocket. These snacks included crackers, fresh fruit, yoghurt, small doughnuts, milk, juice boxes, hot chocolate and more. Mrs. Willis began providing these snacks partway through the semester because early on in the semester she realized many of her students would arrive at her period 2 class, which began at 11:00 a.m., having not had anything to eat or drink. According to Mrs. Willis, many students came from low-income or otherwise unstable home lives and so eating breakfast simply was not always an option.

Mrs. Willis was observed to employ a variety of instructional strategies throughout the semester. Often when introducing a new concept, such as percentages or tax, she would begin

with a traditional style lesson in which she would describe the concept, demonstrate some examples, and give the students an independent activity in which they could practice the concepts. Other days, the lesson would be more interactive, getting students moving around the room, working in pairs, or using technology. One such activity occurred when students were practicing calculating percentages and using HST when shopping for things in their personal lives. In this particular activity, students were given one of the Android tablets to go to Wal-Mart's website and pick products from specific departments she had listed on the board. The students were given a budget to adhere to but were told that each department was going to be given a random discount to be determined later. Once students had chosen their items, she used a digital spinner on the SMART Board to determine each department's discount. After the discount for each individual department was determined, students were tasked with finding the new total of their goods, and then calculating and applying HST for a grand total. Students were very enthusiastic and engaged when the discounts were being determined (Informal meeting, October 2017). Many of the boys in the class had chosen a large amount of electronics and video games, which ended up receiving one of the smallest discounts. Students bought heavily into the activity which spanned two classes. Tasks varied heavily from day to day and Mrs. Willis often adapted her activities to suit the students that were in class on that day. Other tasks involved students doing "hands-on" activities. For example, when discussing measurement, Mrs. Willis designed a task that involved students working in groups, getting up and moving around the room to measure various components of the classroom. Once the measurements were obtained, they were to draw a scale diagram of the classroom. This activity appeared to be well received by the students as they willingly participated, and seemed to derive some enjoyment out of it.

When engaging in classroom discussions or taking up activities, Mrs. Willis often struggled to get certain students involved. If a student was in a bad mood, or just shy, Mrs. Willis often had to change her strategies with how to incorporate these students, sometimes getting the student to write down their answer or comment, and hold it up (Informal Meetings, Various Dates). When necessary, Mrs. Willis would engage students in one on one discussions to gauge their understanding or discern why they were not participating in the class discussion. Students were rarely given “notes” to copy down and Mrs. Willis never assigned students homework. All work that was to be completed, was to stay inside the classroom. The reason for this, she said, was that students rarely returned materials or work that was brought home and when they did, it was not clear who had completed the work (Informal Meeting, November 2017).

Mrs. Willis’s strategy for dealing with the wide array of disruptive behaviours was particularly interesting. Some students possessed diagnosed behavioural issues (Informal Meeting, October 2017) and at times were especially disruptive. When these students were particularly disruptive, one or two calm interventions would be used before Mrs. Willis would pull up a chair close to the student and work individually with them. On several occasions, the behaviour became extremely distracting and the student could not be calmed by the usual intervention techniques that Mrs. Willis used. When such an event occurred, the student would be taken by Mrs. Thomas to a quiet work space where she would work on the task with them and try to help the student relax. On one occasion, a particularly anxious and aggressive student had to be sent home for the day due to their overt negative and disruptive behaviour (Informal Meeting, November 2017).

Throughout the observation period, despite many issues which will be discussed later, Mrs. Willis was observed to be positive, optimistic and caring to the students in her class. This

was apparent in her interactions with students before and during class. I noticed that many students took advantage of the things Mrs. Willis offered. The snacks brought to class were always quickly consumed and Mrs. Willis felt the snacks had an observable impact on the students who partook in them. Many students returned the interest that Mrs. Willis showed, asking her about her interests and her family. As the semester progressed, the relationships that formed between Mrs. Willis and her students was particularly remarkable. Several times during the semester Mrs. Willis was absent and a supply teacher filled in. Despite the fact that nearly all of these students had this supply teacher as their regular teacher in period 4 (Informal Meeting, November 2017), the change in student behaviour and attitude was dramatic. Students were noticeably more confrontational and aggressive towards this supply teacher.

At the end of the semester, the students undertook a culminating activity done in conjunction with another class in the school, one of two culminating activities that Mrs. Willis gave to her students. The students spent time planning for several days of food baking and preparation in the school food laboratory. Several days leading up to the activity were spent doing health and safety, food and kitchen safety, as well as food preparation techniques. This involved watching videos of the particular topic and a class discussion of the potential hazards and problems. The task was connected to the course curriculum through the topic of fractions, proportions and proportional reasoning in regards to following a recipe. Students were placed in groups and assigned different jobs for each of the food items being prepared. Each group was comprised of students from both classes. As a result, teamwork and communication were crucial to the success of the activity. The cooking activity went very well overall and Mrs. Willis was very happy with how her students behaved and performed during the task (Informal Meeting, January 2018). It is worth noting that much like the welcomed snacks that Mrs. Willis provided,

all of the resources purchased for the cooking project were purchased out of pocket by Mrs. Willis and the teacher of the other class (Interview Transcript).

Student Observation.

Ethics permissions were only obtained for two students. Student observations will refer to only these students who will be referred to by pseudonyms and no identifying characteristics or quotations will be listed for any of the remaining students. Any other information described here were things gleaned in informal conversations with Mrs. Willis as well as discussed in Mrs. Willis's end of semester interview.

Nearly every student placed in Mrs. Willis's Locally Developed classroom could be described as at-risk. Many students were performing significantly under grade level in terms of numeracy and literacy (Informal Meetings, Various Dates). Some students came from remote communities or otherwise volatile home lives. It was not uncommon for students to arrive to class anxious or feeling threatened due to things transpiring in their families (Informal Meetings, Various Dates). Mrs. Willis informed the researchers that several students had to withdraw from the course and move out of town as a result of mental health or family issues (Interview Transcript). Students often arrived at class hungry as mentioned previously, but also students were regularly tired and fatigued. More than once a student was observed to be dozing during class time (Interview Transcript). Mrs. Willis also suspected that some students struggled with substance abuse issues (Informal Meeting, November 2017). One day during the observation period, administration was circulating the vicinity of the classroom attempting to ascertain the origin of a marijuana odor. Furthermore, some students were involved in other manners of legal trouble. One student missed part of the final culminating project due to having to make an appearance in court for assaulting another teenager in the city. Mrs. Willis spoke in her interview

about how this student, despite missing significant time throughout the semester, made an effort to find time with her so that he could finish the culminating task. Ultimately, he was able to finish, and was successful in obtaining the course credit.

Engagement.

Student engagement varied heavily from day to day. Some students willingly participated in classroom discussions and activities regularly, whereas others rarely participated in any form of activity. Nevertheless, the majority of the students were lively and energetic, and could often be seen chatting with one another during independent work and during group activities. Some students were quite shy and rarely spoke, however this was a small subsection of the class. The level of energy some students possessed was surprising to me as Mr. Anderson, the other teacher participant later confirmed, it differed with past experiences in the Locally Developed classroom.

Motivation.

Similar to the engagement of the students, whose motivation and resilience often fluctuated throughout the term (Interview Transcript). Select students required no intervention, attempting tasks and problems as soon as they were provided to them. Others, however, whether due to lack of understanding, or lack of motivation, required multiple suggestions from Mrs. Willis before even reading the activity (Informal Meetings, Various Dates). As many students struggled with their literacy skills (Interview Transcript), one can speculate that this lack of motivation could be due to not understanding the instructions. However, these students also struggled with non-written activities. One of the students for which ethics was obtained, Zachary (a pseudonym), was quite capable, but was often just lethargic (Kajander et al., 2018). Often when students in Mrs. Willis's class were faced with some form of adversity, they disengaged entirely (Interview Transcript).

Opposition.

Student opposition was rarely observed during the semester. The researchers did not observe many explicit conflicts between the students or between Mrs. Willis and the students however there were still some prevalent issues. Cellphones were ubiquitous in the classroom and students were continuously on their cellphones during class time. On one occasion a student was in a video call with a student in a different classroom during a lesson. The school has a “bring your own device” policy meaning that students are permitted to have their cellphones on them, but that they be used at the instruction of the teacher. After conversations with multiple teachers around the school it seemed as though teachers were hesitant to confiscate devices as they then become liable should anything happen to them (Informal Meetings, Various Dates). As such, there were only a few instances in which Mrs. Willis confiscated a student’s device. One of these occasions was when a student was texting a parent about a domestic conflict. The student became extremely agitated after the device was confiscated (Informal Meeting, November 2017). Cellphones remained a constant issue throughout the term often distracting the student using the phone and the surrounding students. Some students regularly played music or videos from their phones at a high volume during activities despite repeated requests from Mrs. Willis to turn the volume off.

I noticed a change in student behaviour as the semester progressed. Zachary was a prime example of this. In the beginning, he was quiet, unmotivated, disengaged and rarely associated with his classmates even when working in groups. Mrs. Willis noticed these problems and moved Zachary’s seat from the back of the room, to the front. She did this to discourage some of the off-task behaviour. As a result of the new seat, Zachary was befriended by his new seatmate. I noticed an immediate improvement in Zachary’s work habits and overall disposition once this

friendship had been established (Interview Transcript). Off task behaviours such as playing games on his cellphone were also reduced. Other students also seemed to improve once they were comfortable with Mrs. Willis, the researchers and each other (Informal Meetings, Various Dates).

Mrs. Willis commented to us that it took time for students to open up to her. She commented that building up that level of trust was slow and that it took time for students to feel safe. According to her, this was true for many students (Informal Meetings, Various Dates). After the I had attended the class several times, I was approached for help, or asked about my personal life and interests. It appeared as though the students viewed me differently than that of a “teacher” and so some became quite candid with me, speaking about things they did not share with Mrs. Willis. As a whole, the class was very rambunctious and energetic, with many students having opened up significantly from the beginning of the semester.

Attendance.

One of the more predominant issues observed was student attendance. Like many other aspects of the class, attendance fluctuated significantly from one day to another. On average, there were 9 to 10 students present of the 13 on the roster. However, there were some days where only a few students were present. Many students had chronic absences with one student missing 45 classes out of the 90-day semester (Interview Transcript). Other students had absences in the 20’s or 30’s. Conversely, several students missed less than 10 classes.

When students were present, many were often significantly late to class. In the 75-minute period, it was common for students to arrive upwards of 20 or 30 minutes into the period. Most students were 5-10 minutes late on a consistent basis. Mrs. Willis never scolded students for arriving late, regardless of the time which they arrived. She appeared genuinely happy to see

them and warmly welcomed them to class while filling them in on what the class was doing at the time. It is unclear which factors contributed to these trends in attendance. It seemed to change depending on the student and the day. Mrs. Willis commented that there were days when her students would be present for her class, and be marked absent in the rest of their other classes (Interview Transcript). She also mentioned that some students walked to school or relied on public transit as they lived far away from the school, and so they would consistently miss their first period class due to the commute (Informal Meeting, November 2017). Mrs. Willis did not know why these students were not taking a school bus and instead were relying on public transit. Select students would often try to sneak out of class early or leave class for extended periods of time. As the semester progressed, this happened less, but did not stop completely.

Classroom B

Teacher Observations- Mr. Anderson.

Mr. Anderson (a pseudonym) is a veteran teacher with significant experience teaching all levels of mathematics; from Grade 9 Locally Developed all the way up to Grade 12 Calculus. In years past, he had acted as the head of the department and, during the observation period, he missed several classes acting as “teacher in charge” for the school (where a teacher fills in for a principal or vice principal while they are absent) (Interview Transcript). Thus, Mr. Anderson had notable experience teaching mathematics as well as some experience with the administration aspect of education. I observed Mr. Anderson to be calm at all times and friendly to all people within the school. He was very soft spoken but appeared very confident with the material and the students.

Similar to Mrs. Willis’s classroom, Mr. Anderson’s classroom was arranged in a traditional manner with desks being arranged in rows facing the front of the classroom. Mr.

Anderson mentioned that this was not his choice, and that he would much prefer tables so that students could work in groups more easily (Informal Meeting, February 2018). This classroom too, was outfitted with a SMART Board in addition to regular blackboards. Mr. Anderson was extremely well-versed how to use the SMART Board as well as other forms of technology. Mr. Anderson had set up a website for the course where he posted lessons and resources for students to access. He did not create all of these resources, but gathered them for students to use. For example, one of the lessons contained a video of someone explaining the concept and assigned corresponding practice examples within the video. Mr. Anderson had access to the same Samsung tablets as the previous semester's class, which he incorporated into his lessons regularly. Again, these devices were often unreliable as they were quite slow to load webpages.

Mr. Anderson was observed to be calm and friendly towards his students on a consistent basis. He made jokes during lessons and was often playful. He often tried to engage students in discussions both relating to and outside mathematics but sometimes struggled. This was not for lack of trying on the part of Mr. Anderson. In general, Mr. Anderson's students appeared to be much more difficult to engage compared to the students in the previous semester's class. Mr. Anderson felt that this group of students was quite difficult to engage on some days (Interview Transcript).

This second semester classroom also had a Student Support Person (SSP) present throughout the course. For the first several weeks, it was a different SSP from the previous semester's class. This SSP focused primarily on motivating students with extreme positivity and friendliness as opposed to "assisting" students with completing activities. This person also had no background in mathematics education. Part way through the semester, however, the decision

was made to rearrange the SSP assignments and Mrs. Thomas became the SSP for Mr. Anderson's classroom.

Due to the fact that Mr. Anderson was a very experienced teacher with a wide array of resources he had collected over his years of teaching, his lessons were quite varied from one day to another. Some lessons would begin with Mr. Anderson describing a concept on the SMART board before assigning some sort of practice activity. Others, like mentioned above, involved the students accessing the course website to undergo some independent learning. Mr. Anderson's rationale for this was that with students coming from different backgrounds, inconsistent attendance and working at different paces, working through topics on the website allowed students to work at their current level as opposed to the level of the majority (Informal Meetings, Various Dates). Some students worked well in this independent learning model, however others used the devices provided to watch videos or browse the internet. Additionally, working from the website with Mr. Anderson checking in on them appeared very impersonal. The students who worked well from the website completed the tasks assigned in a timely manner, but it was not clear how effective it was.

Similar to Mrs. Willis's class, getting students to volunteer ideas or participate vocally was often challenging for Mr. Anderson (Informal Meetings, Various Dates). In order to get students to participate in a way that did not involve students speaking, Mr. Anderson had a stack of small dry erase boards for students to use. Mr. Anderson would pose a problem or question to the class, and ask them to put an answer on the whiteboards. Sometimes the students held them up for him to inspect, other times he would circulate around the room and check their work. These whiteboards seemed more effective in eliciting input from the more withdrawn students however sometimes still led to some off-task behaviours such as doodling. Mr. Anderson also

incorporated games into his lessons where possible. When reviewing content from a unit on fractions, decimals and percentages, the students played a “Jeopardy” style game where they worked in teams to answer questions from various categories to earn the corresponding point value. I sat in on the groups and helped facilitate discussion. I noticed students relied on me to talk about the answers that they had come up with. Another example of such a lesson was students playing homemade “battleship” with one another after learning coordinate grids and plotting points. There was an observable improvement in student engagement during these activities compared to the more traditional “lesson and practice” style activities (Interview Transcript). On days when Mr. Anderson was acting as “teacher in charge” or otherwise absent, supply teachers were often provided with an array of worksheets to give to students. Days in which there was a supply teacher the classroom was particularly quiet.

As the semester progressed, Mr. Anderson continued to employ various strategies in his lessons with slight favouring to conducting a teacher directed lesson and providing practice exercises. He regularly sat and worked one on one with students to gauge understanding and work through content. However, with the number of students in the classroom, it was not possible to work individually with every student in a single class period (Informal Meetings, Various Dates). Mr. Anderson was observed to be patient and positive throughout the observation period. He was not observed to become frustrated or discouraged at any point. Mr. Anderson often engaged in self-reflection after classes, thinking about ways in which he could improve students’ experiences in the course, and how he might reach more difficult students. He also made comments to us that the current method for recording and reporting grades was ineffective for Locally Developed students. His reasoning being that at-risk students such as these often made progress in ways that was hard to “assign” a grade to (Informal Meeting,

February 2018). In his teaching, he seemed to balance focusing on skills, concepts, and thinking. Some days were spent practicing skills, whereas at other times, Mr. Anderson tried to engage students in the reasoning behind concepts and why it was useful. For example, one day he had students looking at flights to plan a trip.

Near the end of the semester, Mr. Anderson and school administration, and the Mathematics Knowledge Network research team organized for a local historical park staff member to come do an activity with the class. The school board also had someone acting in a position to facilitate Indigenous content and learning and he too helped in the organization of the task. Members from the park were offering a workshop to teach birch bark basket making. The researchers informed Mr. Anderson about the possibility and he enthusiastically agreed. The cost for the workshop was split between school administration and the funding source. The workshop lasted several days as the process can be very involved and students only had 75 minutes per day. The volunteers went through every step of the procedure, modelling the instructions before giving students an opportunity to attempt it. Students were very eager to get involved and appeared very engaged throughout the activity (Informal Meeting, June 2018). Students from neighbouring classrooms also came to participate with the permission of their homeroom teacher and Mr. Anderson. The workshop allowed for up to 20 students and Mr. Anderson's class had roughly 13 so it was possible for other students to become involved. Mr. Anderson said the task was connected to the mathematics curriculum through the idea of volume but he did not share with me how this was done. Mr. Anderson was very excited about the activity throughout. It was surprising to the researchers the extent to which Mr. Anderson bought into the activity as it is far from a typical activity for a mathematics lesson. Overall, Mr. Anderson felt the task was very

successful and beneficial for students and expressed interest in doing similar activities in the future (Interview Transcript).

Student Observations.

I observed students to be extremely withdrawn and quiet compared to that of Mrs. Willis's class the previous semester (Interview Transcript) The playful and fun atmosphere found in Mrs. Willis's class was non-existent in this one. Mr. Anderson felt that the level of engagement he experienced this term was similar to other Locally Developed courses he had taught.

All students struggled heavily with their numeracy and literacy. Mr. Anderson mentioned a student that struggled spelling his own name (Informal Meeting, March 2017). Students often appeared fatigued, bored or frustrated with several of them making negative comments towards the course or subject matter (Informal Meetings, Various Dates). Some students in the classroom possessed explicit exceptionalities including behavioural problems, learning disabilities, or forms of cognitive impairment (Interview Transcript). Mr. Anderson often had to make accommodations to activities as the act of writing to complete a worksheet, was too difficult for some (Informal Meetings, Various Dates).

Similar to Mrs. Willis's class, engagement fluctuated heavily from day to day (Interview Transcript). As a whole, this class appeared more difficult to engage than the students from the previous class. Mr. Anderson commented that some days, engagement was especially challenging (Interview Transcript). On days where activities were in the forms of games such as the battleship or jeopardy activities, students appeared much more engaged, actively participating throughout (Interview Transcript). Similarly, when activities involved a "hands on" component, such as the basket making activity, engagement was noticeably improved. During

the basket making activity, attendance also improved significantly. Mr. Anderson believed that when students knew a fun activity was coming in advance, attendance on the day of said activity was typically better (Interview Transcript). Conversely, when a lesson was more traditional in format, such as a group discussion followed by a practice worksheet, engagement wavered. During classroom discussions, students rarely volunteered vocal answers and often only participated if the conversation was facilitated by the white boards (Informal Meeting, Various Dates). When working on seatwork independently, off task behaviour was common (Interview Transcript). Again, Mr. Anderson felt that this trend was common in Locally Developed classrooms (Informal Meetings, Various Dates).

Mr. Anderson felt that the students in his class appeared largely unmotivated (Interview Transcript). Even when students participated in an activity, some would seem discouraged by the effort involved and stop frequently. Similarly, it did not appear to Mr. Anderson that the students cared how well they were doing in the course (Interview Transcript). In general, the students appeared indifferent to the things going on around them. Even stronger students seemed to struggle with motivating themselves to complete work in a timely manner and to do well in the course (Informal Meetings, Various Dates). Mr. Anderson mentioned some personal issues that students were dealing with outside of the classroom and that likely had an effect on their resiliency in the classroom (Interview Transcript). Like that of Mrs. Willis's class, some students had unstable home lives or personal issues that could negatively affect their life in the classroom.

Off-task behaviour was common in Mr. Anderson's classroom with the most common form being the use of electronics. Many days, students were incapable of staying off their devices for longer than 10 minutes (Informal Meetings, Various Dates). Mr. Anderson regularly told students to put their electronics away unless it was being used directly in the current task. As

seen in Mrs. Willis's class, personal electronics and cellphones remained a constant and unrelenting struggle for Mr. Anderson throughout the semester. Some students had iPads, others had laptop computers, and nearly all of them possessed cellphones. All of these devices were a regular distraction from the learning environment. Students would also wander in and out of the room or use the hall pass for extended periods of time (Interview Transcript). It would be reasonable to assume that like the students in Mrs. Willis's class, many of these students were coming to class hungry or thirsty, just as they seemed to be coming to school exhausted (Interview Transcript).

As expected, attendance was a significant obstacle in Mr. Anderson's classroom. With approximately 13 students on the roster (some would come and go throughout the semester) class usually started with 3 or 4 students present. Like Mrs. Willis's class, many students arrived late and so a class that began with 3 or 4 students, often ended with 10 or 11. Select students would regularly arrive up to 40 minutes late to the 75-minute period. Similar to Mrs. Willis's approach, Mr. Anderson did not lecture or chide students for arriving late. Once a student arrived, he would resume with his lesson or inform the student what activity the class was currently working on. Mr. Anderson reported that some students had absences in the range of 30 days out of the 90-day semester, noting that this was common in his experience teaching Locally Developed mathematics (Interview Transcript). Other students had less than 10 absences. There were some students that were removed from the class roster partway through the semester as they moved back to the remote communities they were originally from (Interview Transcript). With students absent regularly and even more students late, it appeared difficult for Mr. Anderson to teach a lesson that would be accessible to every student present. If a student missed the day prior, they often had to catch up and thus fall even further behind. Mr. Anderson allotted time towards the

end of the semester that gave students an opportunity to complete and submit the things that they missed. Some students had a significant amount of zeroes for assignments by the end of the semester. During the birch bark basket activity, attendance improved significantly and remained consistent for the duration of the workshop (Interview Transcript).

Summary

Mr. Anderson and Mrs. Willis are both experienced mathematics teachers. Both teachers were observed to be kind, patient and flexible and according to the teachers, they were dedicated to their students. Mrs. Willis in particular showed extreme care for her students and seemed to feel responsible for helping them in ways that sometimes went beyond mathematics curriculum (providing food and drink for example). Both teachers were observed to possess adaptability and resilience in their teaching strategies, using various methods to construct their lessons and activities. Mr. Anderson and Mrs. Willis incorporated technology, games, puzzles, manipulatives and hands on activities into their lessons where possible which often had an observable improvement on student engagement.

The student population present in each classroom shared many similarities. Both groups struggled in terms of literacy and numeracy skills (Interview Transcripts). Students from each class struggled when faced with adverse situations and needed significant support throughout the semester (Interview Transcripts). Each group had students with severe attendance issues with students from both classes missing upwards of 30 classes in their respective semesters. Cellphones posed a constant problem in each of the two classrooms and interfered with classroom activities regularly. Students in each class often seemed fatigued and unmotivated during class time (Interview Transcripts; Informal Meetings, Various Dates). This lack of

motivation fluctuated depending on the student, and the activity. The atmosphere in Mr. Anderson's classroom was much quieter compared to the previous semester's class.

Teacher Case Studies

In this section, themes in the teacher data will be outlined and discussed as well as relevant subthemes that emerged throughout the study. Both teachers were very receptive to participating in the study and engaged in reflection towards their practice regularly throughout the semester. Furthermore, both teachers seemed to genuinely care about their students. Mrs. Willis and Mr. Anderson both appeared to want their students to succeed in mathematics as well as enjoy their time in the classroom. Mr. Anderson was consistently positive and easygoing with his students. Mrs. Willis too was very positive in her attitude towards the students. Mrs. Willis also took on a very nurturing role with her students, often acting in a capacity to support students emotionally, or physically by providing them nutrition they seemed to be lacking.

The following section will discuss teacher interview data in detail and connect it to my classroom observations. Each of the interview questions was designed to engage the teacher in reflection towards the semester in retrospect. This reflection was not limited strictly to their teaching methods, but their perception of various factors that could be affecting their teaching. The overarching themes are ones that emerged from the teacher interview data while subthemes emerged from a combination of teacher interview data as well as classroom observations.

Access to Resources and Knowledgeable Classroom Support.

Teaching mathematics can often require a variety of tools and supplies for various lessons. Things such as: rulers, calculators, graph paper, technology, and manipulatives can often improve a lesson or otherwise make it much more engaging (Jao, 2013; NCTM, 2000). As such, it was not overly surprising that both teachers expressed a significant need for additional

resources in their classroom. However, their needs go beyond needing more paper and calculators in the classroom. When asked which specific resources would improve their ability to teach Locally Developed mathematics, Mrs. Willis commented that the research study presence alone was of significant value to her, saying, “For sure, having more people in the room helping the kids because I physically can’t get around to meet everyone’s needs. Especially when you want to do things like activities... having those extra people to work with them is huge”. When discussing this need for extra people working in the classroom, Mrs. Willis felt that it was not realistic to have more than herself and an SSP in the classroom. She suggested that volunteers with mathematics experience, such as students from the local university, be brought into the classroom to help support these students saying, “they do literacy support pulling kids, why not have numeracy support from there as well?”. Indeed, the local university does have a practice of its students coming into classrooms to support student literacy in elementary and high school classes. At present, no such program exists for numeracy.

Mr. Anderson also commented on the benefits of having additional people in the room to work with the students. He too suggested having, “students from doing placements at the university in math programs to come and help out”. It is interesting that when speculating about additional support, both Mr. Anderson and Mrs. Willis thought to have university volunteers. When further questioned as to what kind of “bodies” he would like in the room he said, “More bodies would be nice but the bodies have to be like—can’t be just warm bodies. Have [to] have a little bit of math sense”. This is particularly interesting as both Mrs. Willis and Mr. Anderson had Mrs. Thomas, an SSP, present in their classroom for the semester. Mr. Anderson commented on this saying, “When you have an SSP come in and say ‘I don’t know anything about math’... it’s hard right... all they’re going to do is behaviour management right? And it’s—you need

people with the math background to come in and help even though you have a small number”. In our conversations with Mrs. Willis and Mr. Anderson throughout the semester, both said that despite having themselves, Mrs. Thomas, and the two or three researchers present, they felt it was still insufficient to properly support each and every student in the classroom.

Need for Funding.

In addition to personnel support, each teacher participant also expressed an explicit need for financial support in the Locally Developed classrooms. When discussing financial support, Mrs. Willis referenced bringing in the food for her class and how beneficial that was: “There’s lots of things I’d love to go and do, having more I guess of a budget to support these kids too... you saw, I brought food in all the time. They were starving. It brought some of them [to class]”. Similarly, she mentioned how much the students enjoyed the cooking activity but said, “You can’t be cooking every day with them because we don’t have unlimited amounts of money. It would be fabulous to go out on field trips with them but having those resources available... we don’t have. Things are limited”. Likewise, Mr. Anderson reflected on the birch bark basket activity which was only possible due to his administrator contributing and the research funds available from the Mathematics Knowledge Network project. Mr. Anderson was quite passionate when expressing a need for more resources in Locally Developed mathematics. When concluding the interview and asked an open-ended question about what he felt it was important to say about Locally Developed mathematics, he again brought up financial support:

Do you know what would be nice... is getting more funding specifically for Locally Developed. Having more budget to do things because it’s very expensive just to bring in some material. In order to have those hands-on activities, you need resources, so more funding needs to be put into the Locally Developed. That’s what I think. I think it’d be a

huge success if you could put more funding into it so that you could do more activities, maybe you can [then] go on field trips

Repeatedly throughout the semester and the interview, Mr. Anderson expressed an interest in a specific budget being created and allocated to the Locally Developed stream. When asked the open-ended question, Mrs. Willis also expressed a need for resources. However, her idea was more of systemic resources combined with financial resources:

...to get a program developed that—depending on the task it is, but maybe having [a] consistent person, or having time to work with other teachers to develop resources that will engage them, having the financial support so that you can go out and do different activities with the kids, just trying to build that community I think would be really helpful.

In regards to educational resources, Mr. Anderson was very vocal and particular in what he thought would be helpful. His idea being that teachers of Locally Developed mathematics could have access to a bank of resources, created or approved by the Ministry of Education: "...if you're teaching, it's like, 'Okay here are a bunch of things—of projects you can do with a class' you know? 'Here's like five projects'... all laid out, everything all ready—assessment". Mr. Anderson had a bank of resources that he himself had amassed over years of teaching the course, however he felt more "project based" resources would be very beneficial. Even if it were just a list of resources on the ministry website that teachers could access, he felt it would be advantageous.

Space and Materials.

There were things not explicitly mentioned by the teachers in their interviews but were observed or mentioned in our informal discussions throughout the semester. For example, on several occasions Mr. Anderson expressed a desire to get large tables in his classroom instead of rows of desks. He believed this would assist in getting students to work in groups and engage with one another more, which he identified as something he struggled with during the semester. This struggle aligned with our observations as even in group activities, the classroom was often silent. Both teachers made use of the Samsung tablets in their lessons at least once during the semester. While convenient, these devices malfunctioned regularly and appeared in need of updating or replacement. The school also had access to a cart of iPads, but these devices seemed to be particularly coveted and neither class had access to them during our observation. Furthermore, everyday resources such as paper, pencils, erasers, pens, markers, calculators, rulers and such were in short supply and many of the classroom's tools were damaged. Mrs. Willis had to retrieve pencils she lent to students so as to have them for future classes. It seemed that both classes would benefit from additional supplies.

Teacher Capacity.

Mrs. Willis and Mr. Anderson are both experienced teachers each with varying levels of experience teaching in the Locally Developed stream. Mr. Anderson had been teaching high school level mathematics for over 20 years with more experience teaching at the elementary level prior to that. He has taught Locally Developed numerous times and said that if it is within his power, he likes to teach one Locally Developed class a year. The semester which we observed, he was originally slated to teach Grade 9 Academic, but traded the course with a colleague so that he could teach the Locally Developed class instead. However, despite having many years of teaching experience, Mrs. Willis had only taught Locally Developed once prior to

this semester. Nevertheless, Mrs. Willis said that she was “open” to teaching Locally Developed, and felt no anxiety when she discovered she was going to teach Locally Developed for the term. Both teachers were observed to be professional, calm and were always observed to be comfortable with the material. The depth of their teaching experience was obvious when it came to their behaviour management in the classroom as both teachers could regularly diffuse student conflict with minimal escalation.

Beliefs about Teaching.

Each of the teacher participants were extremely open minded in regards to their teaching strategy. This was apparent in the activities they used in their classrooms, such as the cooking activities that Mrs. Willis did, and the basket making that Mr. Anderson arranged for his class. Both were very unconventional activities for a high school mathematics classroom, however, neither teacher had reservations about doing such an activity, nor did they doubt its relevance to their course. Mrs. Willis and Mr. Anderson both expressed an interest in taking their students on field trips. Mrs. Willis was describing an ideal problem-based task and said, “It could even be starting about, you’re building a shed and looking into—researching how much wood costs, and then paint. Who knows, you could even take a fieldtrip to home depot to figure out all that. Then even make a model of it after”. Mrs. Willis was very receptive to trying new things with her students and did so often. When asked how she incorporates some of the non-mathematical curriculum expectations into her courses she said, “...the way I approach any group classroom, I try to encompass that, you know, building—making those connections, building community. I’ve brought classes to the shelter house, I’ve tried different things”. She continued to say, “I think it’s an open slate for every student. You can have [an] Academic kid who has poor work habits, it depends on what’s put in front of you and you kind of tackle that full force to meet their

needs”. Mrs. Willis’s open-minded attitude was consistent with what I observed in her teaching throughout the semester.

After discussing which teachers typically get assigned to teach Locally Developed courses, which will be discussed later, Mr. Anderson gave his ideas about what teachers should be teaching Locally Developed: “I think the person that is more willing to try things, more willing to try different things should teach that... what kind of teaching strategy, I guess the teacher has before assigning that class to them and how are they with assessment and evaluation?”. When asked to expand on what kind of teacher capacity is ideal for Locally Developed classrooms he said,

A very caring teacher, understanding, flexible... almost like a social worker... willing to go beyond what is required I guess, willing to try things, willing to bring guest speakers in or... assessment [and] evaluation—up to date with that. You know? Using a bunch of different strategies when it comes to the teaching

It is interesting that Mr. Anderson compared the act of teaching Locally Developed to that of a social worker, as many students present in both classes were undergoing a wide array of issues outside the classroom. When asked about what role teacher experience played in this teaching capacity, Mr. Anderson said, “Yeah experience, but sometimes with experience also comes stubbornness”, cautioning that sometimes teachers may rely on “what worked for them” as is sometimes seen in teaching. In addition to being caring and flexible Mr. Anderson also commented on the endurance required to teach Locally Developed students saying, “You need a lot of energy to teach these kids. To, you know, always be on, to have all these activities, to plan for all these activities. It takes a lot of time”. Flexibility, patience and resilience were observed in

both teachers throughout the semester in various ways. From their approach to late and absent students, to their teaching methodology and demeanor when working with even the most difficult students, both Mrs. Willis and Mr. Anderson demonstrated the characteristics they valued in teachers of Locally Developed courses.

Relationships.

One thing that I noted during the observation period was the impact that relationships had on students in these Locally Developed classrooms. For example, once Zachary had befriended someone in the class, his attitudes and behaviours improved remarkably. Mrs. Willis noticed this saying, “Changing his location was the first step. But he was not happy where he was sitting initially, but when he befriended somebody and built that relationship? It shows what’s important, those relationships made all the difference”. The relationships between teachers and students seemed equally important. Mrs. Willis seemed to make a conscious effort to establish relationships with her students and was quite nurturing with them. When asked how important those relationships were, Mrs. Willis said,

Very important, I think that’s half of it. If the kids know that you truly care about them and you want their best interest, then the kids will be more willing to do things for you. They’ll feel comfortable with you... [a student] came in today just to relax, say hi and hang out. I think that’s important. You don’t realize what impact you’re having on them at the time and sometimes you’re like ‘I don’t feel like I’m doing anything’. But sometimes after the fact... when you have conversations with them after and they come up to you or—because it’s hard to really reflect while you’re in the moment if you’ve made a difference

Mrs. Willis was aware of the impact she could have on her students and often supported them in whatever way she could. She made a conscious effort to be calm and supportive to her students regardless of the circumstances, noting that a safe and supportive environment may be something students are lacking in their lives: “Sometimes it was just being a welcoming environment, that had a part of it I think. Just me being ‘whenever you come, I’m glad to see you. Even if something happened yesterday that’s okay. We’ll move on’”. In regards to relationships, Mr. Anderson said, “If you’re not connected with those kids, I don’t think they’re going to last very long in your class”. When asked how important these relationships were compared to curriculum, Mr. Anderson said, “I think it’s equal... it’s equal because if you don’t have that, then the curriculum—it’s going to be hard to do that curriculum”. In my observations and conversations with students, students were clearly more motivated to participate and overall more engaged when they respected their teacher.

It is important to note that both teachers, with various levels of experience teaching Locally Developed classes, both highly value building relationships with students. Mrs. Willis went as far to say that sometimes getting a student in the classroom was an accomplishment, even if the student did not or could not work that day. Mrs. Willis commented that,

...realizing that in the end, the math is important but sometimes if it’s just getting them into the building, into the room and making them feel like it’s a good place. That’s why ‘Try one question and that’s it for today, I’m not going to fight you on it because I understand. Go get something to drink, go get something to eat. If you want to talk, I’m here’

Mrs. Willis exhibited much sympathy for her students as she was often aware of the external factors affecting their learning. This is not to say that she completely forwent curriculum, but it seemed that she often had to strike a delicate balance with her more troubled students. When thinking about the most at-risk students in her classroom, she reiterated the importance of maintaining that her classroom was a safe space:

‘Okay you need that time, you’re safe here. You feel comfortable enough to fall asleep, maybe that’s okay. You need that time right now.’ Or, ‘You just need something to eat and you know what? You’re talking with someone, maybe getting counselling’ which is helping them. If they’re coming here I think that’s great. It may not be curriculum but it’s helping them as a person

Mrs. Willis seemed to truly value the emotional and physical well-being of her students. Mr. Anderson too cared for his students however he seemed to demonstrate that in different ways, maintaining a calm and jovial presence, and making a dedicated effort to support their learning.

Each teacher had some additional comments regarding the curriculum. Both expressed the need to adapt the curriculum based on the students present. Mrs. Willis said, “[to] meet their specific needs, we can veer from the curriculum a bit to meet those needs of the student” where Mr. Anderson said, “we have to take them wherever they’re at”. Each teacher believed it was more beneficial to teach students at their current level, rather than the level they “should” be at, or the level of the rest of the class. Mr. Anderson also cautioned that the relevance of the curriculum greatly depended on the teacher saying, “...depends on how the teacher wants to approach it right? Depends on who’s teaching it, they can make it relevant or they can just go find a workbook and use a workbook”. He expanded on the idea of a workbook saying that, “A

lot of the new staff—the new teachers, they’ll be stuck with that. They’ll use a workbook and they’ll go like chapter by chapter, page by page and that’s all they’ll use because they don’t know. They don’t have the experience to be more flexible”. This comment is interesting because Mr. Anderson mentioned experience was important, but could also lead to “stubbornness”. Conversely, teachers with little to no experience may rely on inadequate teaching strategies out of comfort. Again, he addressed the need for teacher flexibility when teaching Locally Developed students.

Course Curriculum.

When discussing the course curriculum, both teachers felt that for the most part, the Locally Developed curriculum in its current form could be relevant to students’ lives. Mrs. Willis said that the curriculum expectations were “manageable for the students which is important. A lot of them are life skills, especially the money sense unit and even simple area. Most of it I think is applicable if that’s as far as they’re going in their math”. Mrs. Willis had a caveat however, saying, “The way it’s put out I think has to change. Not just teaching units, more like projects and things like that”. Mr. Anderson had no problems with the way that the curriculum expectations were laid out. He liked the way that Grade 10 was a direct continuation from Grade 9, but said that curriculum relevance depended on the teacher delivering it. He felt that teachers had the power to make it relevant, or they could rely on a “workbook” making the content disjoint from reality.

Student Factors.

Clearly, teaching any class is heavily affected by the students in said class. Regardless of the teaching style, teacher attitude and experience, an otherwise engaging lesson could be unsuccessful depending on the students. Which students were present, how they were feeling,

things they were experiencing, all seemed to play an extremely significant role in both Mrs. Willis and Mr. Anderson's classrooms. Enrolment fluctuated throughout the semester for each course which affected the pace in which Mrs. Willis and Mr. Anderson delivered curriculum (Informal Meetings, Various Dates). Both Mrs. Willis and Mr. Anderson expressed an interest in teaching to where students are, rather than where they ought to be, or where others were. Thus, students were often at the forefront of reflection for both classroom teachers. Through my observations and discussions with teachers, students and other people around the school, I identified some clear trends that seemed to dramatically affect Mrs. Willis and Mr. Anderson's teaching of Locally Developed Mathematics.

It became clear to us through my observations and conversations with teachers, that many students were experiencing significant difficulties in their home lives. As mentioned previously, the students in Mrs. Willis's class were arriving to her second period class starving and thirsty. As a result, Mrs. Willis provided various refreshments and snacks on a regular basis (all of which were paid for out of pocket). Many students came from tumultuous home situations which could explain why students were not eating in the morning. Mrs. Willis described a variety of issues she was aware of in her students' lives:

Having another student having problems within the home with the father and some abuse, [local family care agency] being involved and having a parent removed from the home was another scenario. One of the girls felt like she had no friends, was bullied lots, was getting into physical altercations and then she um—was a little bit just struggling to find her place, to fit in. Drugs, some of the students were doing drugs, which was pulling them away. I think a lot of it was the homes. The homes were not... maybe it was a large family. Maybe there was 14 of them living in the same roof... Cultural differences,

different cultures. There was also some domestic violence within the home to both the parents as well as the children. It ranges from some of them not having—they don't have any clean clothes to wear or food on their table, it stems in so many directions...

We often observed students in the same clothes several days in a row. Students were regularly fatigued, some exhausted to the point of falling asleep in a noisy classroom. As an extreme, one student was in the process of legal proceedings. This student had an especially troublesome personal life, severely jeopardizing their success in the classroom. Mrs. Willis gave us a brief description of the situation: “[They] got into an altercation with another student and beat them up... I guess broke his face so he needs facial reconstruction, so [they are] in the process of being charged. [They were] in foster care and now [they] are in a boarding home”. But in the classroom this student was always respectful and polite. Mrs. Willis also mentioned other students that were from remote communities and were living with older siblings that were not adequate guardians.

Mr. Anderson too encountered students from hectic home environments saying, “[Some] don't live with their parents... [some were] running away from home, not living at home, living with an uncle or aunt... A lot of these kids smoke and you don't know what else they're doing”. Mr. Anderson also described a Grade 9 student in his classroom that had a child of their own: “...one of my students had a baby... and bring it to school from time to time because [they] couldn't watch the—the babysitter wasn't... [their] mom was the babysitter? So [they'd] bring the kid to school and there'll be support at the school to help”. When asked if these problems were unusual, Mr. Anderson replied that they were not unusual and that Locally Developed students usually came with a lot of “baggage”. He said it was not the first time he had

experienced a student in Grade 9 with a child of their own nor was it the first time he had encountered students with various degrees of instability in their home lives.

Attendance.

Unsurprisingly, these adverse conditions seemed to have a negative impact on student attendance throughout the semester. Both Mrs. Willis and Mr. Anderson identified attendance as a primary obstacle to effectively teaching Locally Developed mathematics. Mr. Anderson recalled one student,

She just didn't show up and when she did show up... but she just out of the blue, just stands up and walks out of the room, like a number of times. It was hard to get her to the school, get her engaged. You try to discipline her and just gets worse you know, for her attendance. That one student, you know, she... she has a lot of things going on outside of the school and I think school is not her priority

When asked what the largest challenges were when teaching Locally Developed mathematics, Mrs. Willis responded,

Attendance is huge. Then the fact that students come in with all different needs, not mathematics related. Trying to meet the needs of the student and work with them to learn a bit of math, I find, you know sometimes they have so many problems that math is the least important thing in their lives. I find that's really hard. Then to engage them no matter what type of task you do, that engagement level isn't there. For some, they're engaged no matter what you're doing. But to try to get them really into what you're doing, I find that's really difficult. And keeping them motivated

It is important to note that again, despite having vastly different levels of experience teaching Locally Developed mathematics, both Mr. Anderson and Mrs. Willis identify similar issues affecting their abilities to effectively reach their students. Mrs. Willis and Mr. Anderson each reported having students in their class miss upwards of 30 days in the 90-day semester.

Similarly, each teacher experienced students who were chronically late as well as students that ended up leaving their class for personal or family reasons.

In regards to student engagement, each teacher felt that engagement was another area in which they struggled. Mr. Anderson felt that students were regularly too fatigued to work. When asked what types of activities students responded best to, both teachers felt that hands on and interactive activities were key. Mrs. Willis said, “If food is included, which I brought many times, the engagement piece is a lot higher. But hands on for sure. If they’re doing hands on activities they’re much more engaged than just sitting at their desks... they’re much more engaged than if they’re just sitting there”. Similarly, Mr. Anderson said, “I would say hands on, something that would be hands on, and sometimes they’d like anything that was interactive, moving, and something they can relate to”. During activities such as the food preparation activity, any kind of games, or the basket making activity, teachers reported particularly improved attendance and engagement from the majority of students.

When reflecting on student behaviours throughout the term, neither teacher felt that student opposition was particularly common or serious enough to have a large impact on their teaching. Mr. Anderson cautioned that, “...sometimes these kids [you’ve] got to be careful because [of] what’s going on in their personal life... You might interpret that they’re—that they don’t like you ... but [you’ve got to] remember they’re bringing in baggage and sometimes you have to be very understanding. Sometimes they need space right?”. He continued by saying that

he didn't feel there were "too many kids that opposed me or were being defiant". Mr. Anderson felt that he had a good rapport with his students. He explained that opposition primarily took the form of off task behaviour as opposed to explicit conflict.

When reflecting on student opposition, one student in particular was brought to mind. Mr. Anderson said, "[H]e seemed to—seemed to enjoy being at school but he was more concerned about his iPad, not working. But he had some learning difficulties too, he was having troubles. He has troubles communicating the written form so... he just liked to talk about his answers, talk about his work". Mr. Anderson felt that the student had good attendance and often paid attention to lessons and activities. When activities involved speaking or any form of competition, he was often quite vocal. However, with any written activities he seemed to struggle significantly and gave up quickly, turning to his iPad.

Engagement.

The teachers reported informally that attendance and engagement improved significantly when the class was doing some sort of hands on activity like the cooking in Mrs. Willis's class, or the basket making in Mr. Anderson's. However, both activities required a significant investment of time and money to organize, and so it is not feasible to do this manner of activity regularly without funding. Similarly, it was clear that one teacher and one SSP were not enough to fully support the entire class of students during the activities. I was often approached by the teacher or by the students for assistance, especially an intensive activity such as cooking in the foods lab. When reflecting on the food lab activity, Mrs. Willis commented, "Thank goodness you guys were there because it was basically one per station and I still felt like we were flying around". Due to the vulnerability and high needs of the students, it is not surprising that both teachers expressed a clear need for more personnel support in the classrooms. Many of the

students in either classroom seemed to greatly benefit from one on one support whether it was to support student literacy in understanding the task, understanding the mathematical content, or provide a means of emotional support.

Mrs. Willis too identified personal electronics as a significant barrier to her teaching. Cellphones in particular, posed a major challenge throughout the semester. When asked about cellphone use Mrs. Willis replied,

...they would pull it out and then I found they weren't engaged in what they were listening to...Then if someone texts them and the next thing you know, the student is upset because their friend is not being nice or something's been on Snapchat about them. Then there's a whole other aspect of the emotional roller coaster and they've disengaged totally in the math. If they didn't have their phone, it wouldn't have been a problem in the first place

From messaging, to games, to phone and video calls, there were numerous ways in which cellphones were distracting students. Mr. Anderson was particularly frustrated when we spoke about cellphones saying, "something's going to have to happen with the cell phones in education because it's ridiculous". Mrs. Willis and Mr. Anderson each used calm intervention, requesting students to put their cellphones away when it was distracting them or others from the task at hand. On several occasions, Mrs. Willis confiscated cellphones when students refused to keep them away. Neither strategy seemed to have a lasting impact as students in both classes would often pull phones out when the teacher turned away, or the problem would remerge the following day.

Student Confidence.

Neither teacher specifically commented on student resilience but both noticed how easily discouraged and vulnerable the students in their classes could be. Mr. Anderson felt that students were extremely shy, afraid to make mistakes. Mrs. Willis described how student confidence may contribute to engagement and participation within the classroom:

I think they needed someone to be with them and just give them [the] comfort zone just to keep on helping them with the confidence. Confidence was part of the problem for a lot of them. They all had different strengths and different weaknesses coming in that made it difficult to keep them going. [One student] was a really, really hard one to figure out because you would talk to [them] and [they] wouldn't even respond to you sometimes. I remember sitting in front of [them] trying to help [them] and if [they] didn't want to do it that day, [they] just [weren't] going to do it. You could try to encourage and try different spaces, whatever it may be, but it was very limited

Students in each class that seemed easily discouraged and struggled to persevere when faced with challenges in the task, or in the classroom. One could argue that due to the external factors, many students were facing in their personal lives, factors such as attendance, engagement, motivation, and resilience were that much more difficult to maintain. At the very least, each teacher believed there is a connection between what a student encounters outside the classroom, and their performance inside it.

Structural Factors.

Through my conversations with Mr. Anderson and Mrs. Willis, I attempted to gauge their perceptions as to whether there were any structural factors that were affecting their ability to effectively teach Locally Developed mathematics. Both teacher participants seemed hesitant to

definitively say there were such factors at work. However, both Mrs. Willis and Mr. Anderson identified several practices within the field of education, or things that have happened as a result of current practices, that were in fact affecting their classrooms.

Mr. Anderson often elected to teach Locally Developed when it was within his power. When asked which kind of teachers typically are chosen to teach Locally Developed, he said, “Probably the newer teachers with less experience are usually the ones that get it” he continued to say, “...usually they’re [transient] teachers, the teachers that just teach all over the place. You know? ‘You’re going here’ because they have such low seniority and all, so they’re in multiple schools”. This was particularly interesting because this is the exact situation that Mrs. Willis found herself in. Due to school board restructuring, she was selected to teach two Locally Developed classes at this school, and spent her afternoon at another school in the city. Mrs. Willis had many years of teaching, but limited experience with Locally Developed mathematics. When asked the same question, Mrs. Willis said that it depended on the situation, that many school boards and mathematics departments have different practices: “Sometimes it’s one of those classes where some—like if you are in a certain program, the Academic, EQAO classes, it’s important to have a good teacher in there. So sometimes maybe it’s other teachers who have a hard time making connections with the kids”. When asked about the alleged trend of newer teachers being assigned to teach Locally Developed she said, “Sometimes I think the newer teachers will get the Applied and the Locally Developed as an introduction to starting your teaching career for sure” but noted that it was not the case for her and that these, “high risk kids are the ones that we have to be looking after”. Thus, while it may depend on the school and the board, both Mr. Anderson and Mrs. Willis felt it was not uncommon for new teachers to be

allocated to teach Locally Developed mathematics despite these classes being some of the more difficult ones to effectively teach.

Professional Development.

As Locally Developed students do not write the EQAO testing, I was interested to hear about the level of support that teachers of Locally Developed classes receive. Due to the lack of standardized testing for Locally Developed students, did these courses receive less direct funding or professional development? In regards to professional development (PD), Mrs. Willis said, “We have huge PD on all of that. It’s focusing on the 9 Applied, by all means. And the Academic, yes, for sure. There is nothing—I don’t think there’s anything for Locally Developed. Which is obviously a problem especially with the pass rate and the type of kids. These are the ones we’re flagging as the most [at] risk”. Mr. Anderson also did not feel that there was professional development that specifically targeted Locally Developed. He felt that he was supported through his administration, who gave him the flexibility and security to employ different strategies in the classroom, and provided his class with and SSP. However, he felt it would be more beneficial to provide him with someone,

...knowledgeable about mathematics, that can have a discussion with the kids in a different way. You know, like you there compared to the SSP is different when you’re having the discussion. One is kind of like helping them on the worksheet, how to do this, this, this, this. You’re having—you can have, can pose questions right? I prefer to have someone that has a math background

As mentioned earlier, Mr. Anderson felt that SSP’s, as they had no training in mathematics education, primarily functioned as behaviour management.

When asked if they felt supported by students' families, both Mr. Anderson and Mrs. Willis had mixed feelings. Mrs. Willis said, "I feel that Locally Developed because the types of students and their families, those are the families that may not—like if there's a problem, they're not in fighting for their child. Sometimes I feel like they're pushed to the wayside and it's not focused on as much, although those are our highest risk kids". Mr. Anderson commented that, "Sometimes the parents are overwhelmed on what to do and to get their child to school so you call home and [they] say 'I dropped my child off already. They're skipping'". He continued to say that, "Sometimes yeah they talk to their kids, but I think there's sometimes it's more issues out there, then you know... they need—they might need more support". Depending on the student, they may not even be living with their relatives, as many were not. Thus, getting support from guardians to address problems of attendance or such becomes that much more difficult.

Education Gap.

With both teachers reporting significant issues with student literacy, I wanted to inquire about how drastic the gaps between students were. Both teachers explicitly identified the presence of an education gap in their students and each had comments regarding its origin. Mrs. Willis said, "It's a very wide gap. There's lots of holes in their understanding for sure. There are kids who come to us and they have maybe done Grade 6, and they've not been in school for 3 years and now they're in Grade 9 and I'm working with them. They have huge gaps in their understanding". She continued by commenting on the gap in literacy skills specifically:

There are some kids who don't know how to read. There are some kids who are great.

They could probably be in an Academic or Applied class for literacy. It's such a wide gap as well. I think it's the same with literacy and numeracy, if they've missed a couple years of schooling along the way and they've been bouncing from elementary to elementary...

by the time they get looking and testing them on where they are with literacy and numeracy it's almost too late because they're moving on to the next school. They can't get that support along the way

Whether a student remains in a classroom is completely outside the control of the teachers and could often be a result of societal factors (housing, economy, family matters, geography, etc.). Therefore, it seems particularly difficult for teachers to attempt to mitigate these issues. Mr. Anderson commented that the gap in his classroom ranged, "I would say from Grade 5/6 all the way up to Grade 8 when they entered into Grade 9" and commented that this gap was very typical in Locally Developed classrooms. The gaps present in these students' educations and the nomadic home situations have an unfortunate consequence in regards to classroom demographic. With no suitable classroom or stream to place these students, many are put into Locally Developed by default. Mrs. Willis describes the situation as she has experienced it:

...maybe it's other circumstances like attendance or maybe even that they can't focus, that they're placed in these courses. Just almost like a holding ground... so you have kids who really need to be there because that's where their ability is, and then you have kids that shouldn't be there because of behaviours or attendance, and then you have kids who are probably too low for it, they should be in different programming... but there's not even—there's not much available for them because they have very poor numeracy skills

Mrs. Willis referred to the Locally Developed stream several times as a "holding ground" or "catch basin" as it seemed that any student that was not suited for Applied or Academic, automatically was placed in Locally Developed, saying, "Lots of times when they're placed now into high school, they're not necessarily put in the right stream. Lots of the time we didn't

realize, ‘Okay you’re working at Grade 4 but now you’re placed in 9 Applied because that’s the next step’”. She recalled one student, upon looking at her Ontario Student Record (OSR), she discovered the student had been in approximately 14 different elementary schools in a 2-3 year span saying, “the consistency of that support isn’t there because by the time you try to help them, they’re gone”. Thus, it poses a difficult problem for teachers as to how these students should be placed, and if they are placed in Locally Developed courses with these holes in their schooling, how can Locally Developed teachers begin to repair these holes. As a result of these gaps, Mr. Anderson felt that maybe it would be beneficial to have two sections of Locally Developed, grouping the higher students together to teach them, and in a separate group have the students with significant gaps in their education and work on fundamental skills and other things help close the gaps in their literacy and numeracy.

When asked if there was anything that could be done earlier to mitigate these issues, Mrs. Willis and Mr. Anderson each offered some suggestions. Neither teacher felt that holding students back was necessary, saying that the practice of “socially promoting” as Mrs. Willis referred to it, was beneficial to students’ emotional and social well-being. Mrs. Willis suggested,

Even [if] they have the Spec. Ed. People at the schools or whatever right? Even having a teacher who works with kids trying to bridge the gap, having a program where you’re trying to get them over to the next level so those kids who are weak—maybe they’re pulled from something, I don’t know what it would be, but even having—I know they’re starting to have summer classes, for literacy specifically. But why not have a numeracy one?

It is interesting to note the existence of several programs within the board to support student literacy, but numeracy supports appear to be nonexistent, or at least teachers are unaware of such

supports. Mr. Anderson suggested that more appropriate elementary teachers may have a positive impact on the existing gaps saying, “Have math teachers, qualified math teachers teach in junior and intermediate levels. Then you see a big difference. Have rotary with math. Do rotary with math for Grades 5, 6, 7 and 8”. Mr. Anderson also felt that there was very little discussion or information provided when students transition from an elementary school to high school:

But as a classroom teacher, there is very little communication about specific students coming up. We used to have more in our PLG’s but now we don’t... When I was teaching Grade 8 it was really neat because a high school teacher would come in and interview the Grade 8 teachers and get all the data. I think it might happen now but maybe it’s not communicated

When asked why this communication did not exist, Mr. Anderson said that he felt that, “elementary schools don’t get anything out of it. That’s the feedback I got from them when I used to do the PLG’s. They’re not getting anything out of it” as if elementary teachers needed an incentive in order for these meetings to take place. Similarly, Mr. Anderson felt students needed more practice working in groups at earlier ages: “You can’t come in to Grade 9 and now they’re working in groups and don’t even want to work in groups. It’s like it’s foreign and they’ve never sat in a group to work and answer questions together”. It seemed clear that each teacher felt more could be done prior to students arriving in high school to address the varied issues that present themselves in Locally Developed classrooms. When asked for a final comment, Mr. Anderson suggested more attention be put towards Locally Developed:

If you want to see better success in Locally Developed then maybe you have to strike up a team, a group of people—a committee, to start looking into and getting the data and finding out what needs to be done... We don’t fund one specific Grade except for the 9

Applied and 10 Applied, because of the results for EQAO. I don't know about the funding... I would love to see more money going—would love to see money, a budget for Locally Developed

While not explicitly identifying them as such, Mrs. Willis and Mr. Anderson each had clear ideas of structural factors affecting their teaching, factors such as student placement practices, allocation of funding and support as well as systemic issues such as the educational gap many students possess appear to pose challenges to teaching Locally Developed mathematics. While the teacher participants easily can identify issues facing their teaching, providing potential solutions appears much more challenging.

Summary.

Despite coming from different backgrounds and possessing varying levels of experience teaching Locally Developed Mathematics, both teacher participants had very similar comments regarding their experiences in their classrooms. Both Mrs. Willis and Mr. Anderson encountered issues with student attendance, engagement, and motivation. Often, this seemed to be the result of external factors that students faced. Each teacher stressed the need for patience, understanding, and flexibility when dealing with these students as establishing a healthy relationship with them was very important to the students' success in the classroom. Mrs. Willis in particular, made a clear effort to support her students in ways beyond the curriculum. Mr. Anderson and Mrs. Willis demonstrated their beliefs in their delivery of curriculum, using varied strategies, incorporating interactive and hands-on elements wherever appropriate. Despite this, each teacher felt that more support is required, and more needs to be done to help students succeed in Locally Developed mathematics. The closely linked factors of student attendance and gaps in student education pose very large obstacles for teachers of Locally Developed

mathematics to attempt to overcome in the span of a 90-day semester. While there exist slight differences in teacher style and behaviour, the experiences Mr. Anderson and Mrs. Willis described during the semester were largely the same, raising the question as to whether or not these trends could be present in other schools.

Throughout each observation semester, both Mrs. Willis and Mr. Anderson, respectively, claimed to be very invested in the success of their students. Each teacher spent time throughout the semester reflecting as to how they may better serve the students in their care. Mrs. Willis for example, made decisions such as how to arrange students and how to adjust her delivery of the curriculum to better suit the students. Often during our conversations, Mrs. Willis would attempt to come up with ideas as to how she could get her students attending school and into her classroom. Mrs. Willis seemed very informed on the various situations that students were experiencing outside her classroom. She also seemed to check in with students' other teachers to see which behaviours were unique to her classroom, and which were consistent in the other periods. Unfortunately, Mrs. Willis was split between two schools, and so being available after class for her students was not possible. However, she did make time for students where possible, such as when she had some students come in during the exam break to catch up on work that was outstanding.

Mr. Anderson too reflected on how to keep students in the classroom. He regularly followed protocol with absences by contacting parents and guardians, or getting student guidance counsellors involved to determine the root of the absence problems. Again, Mr. Anderson seemed to be aware of various extenuating circumstances in students' lives. Mr. Anderson often considered alternative ways in which he could assess his students' learning. With many absent or late on a regular basis, and with a majority possessing some gap in their learning, he had to be

very flexible and understanding in regards to his assessment and evaluation. He mentioned taking issue with the manner in which marks were reported as allowed for less flexibility. He claimed that students may make progress in other areas such as literacy, numeracy, and communication skills, but there was no way to report this progress in the current marking scheme for the courses.

Chapter 5: Discussion of Case Studies

This discussion will expand upon the factors identified by teachers as affecting the teaching of Locally Developed mathematics from a teacher perspective. These themes were those that emerged from the transcript data. In the previous section, the themes were established and they were connected to interview and observation data. This section will expand upon the themes and establish connection to associated literature. While the sub-themes emerged from the data of the teacher perspectives, they also align with the conceptual framework of axiology in how they relate to the respective overarching theme. That is, the sub-themes also illustrate what the teachers valued in their classrooms, which relates to the framework and also relates to the discussion of the main theme.

According to the data obtained, teacher perspectives in the data suggested that the major foci discussed by the participants fell into four major themes, which will be discussed using the framework of axiology. These themes are: access to resources and knowledgeable classroom support, teacher capacity, student factors, and structural factors. In the discussion to follow, subthemes as well as other literature related to these themes and subthemes will be interrogated.

Access to Resources and Knowledgeable Classroom Support

Research such as NCTM (2000), Boaler and Staples (2008), and Harris (2011) show that students, even those identified as “at-risk”, respond better to open-ended, inquiry-based mathematics activities as opposed to the traditional method of teachers lecturing and students practicing. In line with this research, both Mr. Anderson and Mrs. Willis felt that Locally Developed students should be involved with more “hands on” and “project based” activities. Mr. Anderson and Mrs. Willis felt that this method of delivering curriculum fulfilled its intention more effectively, providing a higher value experience, when using the description of value in

Melville, Campbell and Jones (2017). However, each teacher expressed a clear need for someone, whether an organization or person, to create such tools for teachers to use.

Need for Funding.

Each teacher came up with their own interpretations of new needed classroom activities but described how tiring it can be to constantly be developing new activities. Similarly, each teacher had ideas for different activities that may be successful in Locally Developed mathematics but felt thwarted by either a lack of financial resources or physical resources, or otherwise felt their development was not feasible with current school support. Teachers felt that new and engaging resources were difficult to create and or implement. For example, Mrs. Willis described how beneficial it was for students to engage in the foods lab activity but said “you can’t be cooking every day” as there was no financial support and there would be inadequate staffing to supervise students regularly in large scale activities like that of the cooking. Mr. Anderson too placed explicit value on monetary resources as being important to his teaching.

Mr. Anderson had many ideas for his own classroom but again was inhibited by the school’s existing resources or funding. An example of this would be his idea to seat students at tables as opposed to desks. Mr. Anderson identified group work as a significant struggle in his classroom and felt that seating students together at tables may help this, but was unable to get tables for his classroom due to lack of funding. Mr. Anderson was fortunate enough to work in conjunction with a very supportive administration, which in turn made the basket making activity a reality. However, it is unclear as to whether or not this activity could be supported in the future or if it would have been supported with a difference in administration.

Each of the teacher participants we observed had a student support person (SSP) present in their classroom to assist them. Mrs. Willis and Mr. Anderson both felt that one SSP was

inadequate to truly support the students in the classroom. As seen in Kajander, Zuke, and Walton (2008), it can be very difficult for teachers to appropriately reach each of their at-risk students, especially when there exists a significant gap in the students' understanding of mathematics, or in the case of Mr. Anderson and Mrs. Willis's classrooms, in mathematical understanding, numeracy and literacy. Despite being very unrealistic, Mrs. Willis felt that a one to one ratio of student and adult was required to help students. She described students being so fragile that if someone were not available to help them, at that precise moment, they may disengage from the activity altogether. Mr. Anderson felt that SSP support was only able to serve as behavioural management, as the lack of SSP training in mathematics severely inhibited their ability to assist student learning or posing questions to scaffold activities. While appreciative of the support, Mr. Anderson felt that personnel support provided less meaning when it was not present in addition to mathematical understanding. It could be argued, that while Mr. Anderson held classroom support as an important value (Melville, Campbell & Jones, 2017), the support he received was valued as poor as it was not adequately fulfilling the purpose it was intended to serve.

Space and Materials.

NCTM (2000) suggests numerous recommendations to help teachers of mathematics provide their students with engaging and enriching experiences in mathematics. One such recommendation is incorporating technology and various tools to bolster student understanding. Furthermore, simple tools such as photos, videos, and manipulatives can serve as focal points for engaging and enriching mathematical discussion (Boaler & Humphreys, 2005; Humphreys & Parker, 2015). Mrs. Willis and Mr. Anderson each appeared to value the use of technology, and incorporated technology into their teaching on a regular basis. Due to financial restraints, much of the technology, such as the Samsung tablets, were outdated and cumbersome to use. Similarly,

the light bulbs for the SMART Boards in the classroom were very expensive, and so teachers were required to wait until the absolute end of the previous bulb's life span before acquiring another. This often meant that the board was incredibly hard to see, especially from farther away or with any of the classroom lights on. Both Mr. Anderson and Mrs. Willis used technology such as the SMART Board on a regular basis. While not explicitly stated, their reliance on such technology conveys a significant value being placed on adequate technological resources. Similarly, Mr. Anderson desired tables for his classroom to encourage group work amongst his students but lacked the opportunity to procure them.

Teacher Capacity

Beliefs about Teaching.

Mr. Anderson and Mrs. Willis appeared to value a caring environment, and were each observed to possess various qualities that appeared to have a positive impact on their teaching. Each teacher had a very friendly and positive disposition even when met with adversity from students. Hand (2010) and Jao (2013) describe that students are more or less likely to act out based on how the teacher conducts themselves in the classroom as well as whether students feel valued or as if they belong. Mrs. Willis and Mr. Anderson both claimed to make a dedicated effort to establish a sense of community for their students within the classrooms and the school at large. For example, each of the teacher participants took a very relaxed stance on absent or late students. Both teachers appeared genuinely happy when students entered the classroom, regardless of how late they were, or whether they had been absent the past several days. Furthermore, Mrs. Willis spoke in great detail about her efforts to establish her classroom as a safe and welcoming space for her students. This was observed in the ways she spoke to students as well as the things she did for them (such as bringing them food and drinks). Mrs. Willis felt

that these efforts brought students into her classroom noting that some of her students sometimes were absent from every class except hers in a day. Mrs. Willis, in particular, appeared to be very sympathetic and caring with her students and often expressed frustration in regards to the external factors affecting them outside her class. Kajander, Zuke, and Walton (2008) illustrate what can happen when at-risk students do not feel valued by their teachers, leading to significant student opposition and resistance. This level of antagonism was not observed in either classroom in the current study, however some behavioural problems still existed. Bol and Berry (2005) described the effects of teacher perceptions on their students. Despite the various circumstances many of the students found themselves in, neither Mr. Anderson nor Mrs. Willis ever said to us that they felt a student lacked the potential to be successful in their course. Their observed actions also did not reflect having low expectations for their students. These behaviours relate to each teacher's ideals of valuing students' emotions as well as the placed importance on a supportive demeanor.

Furthermore, each teacher employed an open-minded approach in their teaching strategies. Different styles of lessons were planned ranging from hands on tasks incorporating technology, group activities and more. Axiologically, the data suggests that both Mr. Anderson's and Mrs. Willis's perceived values of what kind of teacher was required in Locally Developed mathematics courses informed characteristics ranging from their demeanor to their lesson planning (McArdle, Hurrell & Muñoz Martinez, 2013).

Relationships.

Jao (2013) strongly urges for the creation of strong student-teacher relationships in Applied mathematics classrooms, describing benefits to social, emotional and academic well-being (Bolard & Tranter, 2018). Thus, it stands to reason that in Locally Developed classrooms,

where many students are significantly at-risk, that these relationships would be especially important. Mr. Anderson and Mrs. Willis mentioned highly valuing relationships in the classroom. Mr. Anderson even explicitly stated that he valued healthy relationships as equally important to curriculum. Mrs. Willis described the benefits of not only teacher-student relationships, but also the relationships that students had with one another. From a researcher standpoint, the various relationships students established (or did not establish) seemed to have a significant impact on their performance in the course. The students who respected Mrs. Willis or Mr. Anderson appeared more willing to engage in classroom activities, or make efforts to catch up on missed work. Conversely, those students that appeared more indifferent to the classroom teacher were regularly unmotivated or disengaged. Through their conduct as well as their comments, it is clear that each teacher deemed it important to both establish and maintain a supportive relationship with their students, crediting improved attendance and performance being a result of these relationships. As argued by Chin and Lin (2001), this valuation of relationships seemed to inform the teaching practice of Mr. Anderson and Mrs. Willis. Each teacher strongly prioritized supporting their students in ways beyond the delivery of curriculum.

Course Curriculum.

Mr. Anderson and Mrs. Willis were both observed to be very comfortable with the mathematics curriculum as well as varying teaching methods. NCTM (2000) and Jao (2013) describe the importance of technology and the impact it can have on student learning. Both of the teacher participants incorporated various forms of technology into their lessons in a variety of ways ranging from videos as conversation starters, to website activities, to entire video lessons. Research such as NCTM (2000), Boaler and Humphreys (2005), Beatty and Bruce (2012), Jao (2013), Macaulay (2015) as well as the Ministry curriculum document for Locally Developed

mathematics all advocate for the use of varied, open, and enriching activities in mathematics to support student learning. Neither Mrs. Willis nor Mr. Anderson appeared to oppose any particular type of activity in their classrooms. On the contrary, each teacher seemed very open and flexible, employing various strategies in their classrooms, often seeking out suggestions and ideas for new activities to try. Mr. Anderson, who liked using worksheets as a means for students to practice their learning, was extremely open minded in his teaching practice as seen in his opting for the basket making activity. Neither teacher expressed any significant concerns with the way that the Locally Developed curriculum had been constructed. Each teacher participant described a desire for more project-based learning to be incorporated into Locally Developed classrooms as they felt these types of activities were more engaging and successful with students. Project-based and hands-on learning seemed to be valued by both teachers as an important means of exploring course curriculum. However, it is worth noting that neither teacher valued curriculum as the most important aspect of Locally Developed mathematics. While each teacher perceived the curriculum as important, neither teacher felt that it should take precedence over other factors such as student well-being similar to that of Jao (2013) which details the benefits of emotionally supporting students in mathematics classrooms. Axiologically speaking, the valuation of student welfare being equally as important as course curriculum is particularly interesting. Many teachers in rigorous subjects such as science or mathematics may value course content above all else (Melville, Campbell & Jones, 2017).

Student Factors

Perhaps the most unexpected outcomes of the study were factors relating to the students. Most predominantly, the teachers stated that the students in each of the Locally Developed classes were experiencing significant difficulties in their lives outside the classroom including

but not limited to: substance abuse, inadequate guardianship, mental health issues, child care and more. As a result, neither Mrs. Willis nor Mr. Anderson felt that many students in their class valued obtaining their mathematics credit. Nor was mathematics class a priority for these students. Mrs. Willis noted that it is hard to make mathematics class a priority when they have such unstable home lives. However, Boaler and Staples (2008) show that even students identified as “at-risk” that are faced with significant obstacles outside the classroom are capable of being successful in mathematics. Despite expressing notable concern for their students, Mr. Anderson and Mrs. Willis felt there was little within their power that could be done to help mitigate these issues beyond giving these students a safe and supportive classroom environment. Hurlington (2010) advocates the practice of fostering resilience in students to better help them succeed. It was clear from observation that some of these students struggled with resilience in the classroom, which is understandable given their personal situations. Each teacher felt it was important to describe various aspects of student’s lives inside and outside the classroom.

Attendance.

Due to many of the tumultuous nature of the students’ lives, many students struggled significantly with attendance similar to the students in Kajander, Zuke, and Walton (2008). One student in Mrs. Willis’s class missed roughly half of the semester, whereas Mr. Anderson had students that missed approximately a third of the semester. Mr. Anderson, who has had more experience teaching Locally Developed classes in the past, says that these results are very typical. Both teachers felt that when the students had something to look forward to, attendance improved, likely explaining why each teacher placed significant value on hands-on and project-based tasks in the classroom. Indeed, on the days where hands-on activities such as the cooking or basket making were planned, attendance improved significantly for both classes. During the

first day of the basket making activity in Mr. Anderson's class, not a single student was late, which had not happened yet during our observations. Nevertheless, neither Mrs. Willis nor Mr. Anderson felt that this was sustainable and still cited attendance as a significant obstacle to their teaching. Both Mrs. Willis and Mr. Anderson described poor attendance as a factor negatively affecting their ability to teach Locally Developed mathematics. When a student had poor attendance, it became harder to maintain those supportive relationships. Catching up students who had missed significant time also interfered with teachers' abilities to deliver curriculum. As a result, each teacher conveyed a desire to improve attendance, so that other factors, such as creating relationships and teaching of content were possible. Again, using the lens of axiology it appeared that teachers' values in regards to student happiness and well-being, shaped much of their goals and motivations throughout the semester as it served the purpose of getting students inside the classroom (Melville, Campbell, & Jones, 2017).

Engagement.

Similarly, when students were present, many struggled to remain motivated and engaged throughout classroom activities. In the case of some, this was due to physical fatigue as students sometimes slept in the classrooms. Others were easily distracted by themselves or their cellphones. Regardless of cause, both teacher participants identified student engagement, especially in regards to cellphones, as significantly affecting their teaching. Furguson et al. (2005) describe that disengagement is a leading cause in students abandoning secondary school before completion. According to King et al. (2009), simply being in an Applied stream results in a decreased chance of graduation for students and often it is mathematics credits that results in students dropping out. It stands to reason that these trends would be comparable perhaps even more significant for those in Locally Developed streams. Thus, getting these students engaged is

pivotal to their future success. As recommended in Boaler and Humphreys (2005), Boaler and Staples (2008), Jao (2013) and NCTM (2000), both Mr. Anderson and Mrs. Willis used varied, less traditional teaching strategies with their students throughout the semester. Even so, engagement and motivation were less than ideal. Some students, despite these various strategies, were rarely, if ever, motivated in the classroom. Mrs. Willis described that some students will be engaged no matter what you do in the classroom while others can be completely impossible to engage on certain days. This poses a difficult problem for teachers of Locally Developed classrooms. When students appear determined to not participate, what can teachers do to try to persuade them, beyond creating enticing and engaging activities? Students' emotions can be quite fragile, and so teachers must determine how hard they can push their students. Mrs. Willis and Mr. Anderson would often sit with such students and gently encourage them and work with the student. Whether or not this strategy was successful, seemed to depend on the student and their mood that day. It is clear that each teacher valued student engagement as it shaped their design of activities as well as how they interacted with students. Both Mr. Anderson and Mrs. Willis created tasks that they hoped would better engage their students. Similarly, each teacher expressed these types of engaging tasks as core aspects of their teaching practice. According to the framework, it is worth noting the strong value that each teacher assigned to engaging and hands on tasks, due to the influence it had on their lesson planning and other actions in the course (McArdle, Hurrell, & Muñoz Martinez, 2013).

Student Confidence.

Existing research such as that conducted by Kajander, Zuke, and Walton (2008) and by Hurlington (2010) identify student confidence as a key factor contributing to student success, with the former study focusing on the context of mathematics. While each of the teacher

participants identified student confidence as a factor that affected their experience teaching Locally Developed mathematics, Mr. Anderson and Mrs. Willis had different approaches in regards to student confidence. Mr. Anderson employed a more pragmatic approach, giving students opportunities to participate in less vulnerable manners. An example of this was when he often had students work on whiteboards so they could discretely volunteer answers and participate. This practical approach focused more on curriculum than student emotion. Conversely, Mrs. Willis used a more emotional approach, working closely with students or conveying a nurturing and supportive demeanor in order to get students to engage. Mrs. Willis's approach aligns with research such as Jao (2013) which describes the benefit of emotional connection in regards to participation. In terms of axiology, the data suggest that each teacher assigned different value to fostering student confidence. Thus, their perceptions and consequently their teaching approaches differed (McArdle, Hurrell & Muñoz Martinez, 2013).

Structural Factors

Mr. Anderson and Mrs. Willis were both hesitant to acknowledge the existence of structural factors negatively affecting their teaching. However, through observations and conversations with the teacher participants some of the current educational practices appeared to be having unintended consequences on Locally Developed classrooms, for example, the process of selecting teachers for Locally Developed classes. The curriculum document for Locally Developed classrooms, and research such as Jao (2013), as well as the data obtained in this study indicate that experienced teachers that are flexible and confident in their teaching practice are better suited to teach Locally Developed. However, both Mrs. Willis and Mr. Anderson said it was not uncommon for new or otherwise inexperienced teachers to be assigned to Locally Developed classrooms. Mr. Anderson even went as far as to say that this is what "usually"

happens in his experience. Oleson and Hora (2013) describe that teachers rely heavily on their experiences as young teachers to shape their teaching practice. Thus, new teachers may use traditional or ineffective strategies when teaching Locally Developed, as they have no other tools or skills to rely on, which Mr. Anderson mentioned during his interview.

Education Gaps.

One of the most predominant factors affecting the teaching of Mr. Anderson and Mrs. Willis was the gap present in students' background education, leading to significant gaps in literacy, numeracy, mathematical understanding and sometimes, social skills. There exists a well-documented education gap in Canadian schools as described in Sandholtz et al. (2004) as well as Bol and Berry (2005). Nguyen (2011) describes the gap between Aboriginal and Non-Aboriginal students. Research such as Ferguson (2005), Kajander, Zuke and Walton (2008), Boaler and Staples (2008), and Hand (2010) describe how these gaps manifest themselves in the classroom and the consequences that result from them. Mr. Anderson and Mrs. Willis both identified an extremely significant educational gap among their students. Some students struggled with simply writing down their names and basic numbers whereas others were likely capable of completing an Applied level credit were it not for issues in their home lives or issues with motivation. Mrs. Willis described how challenging it was attempting to close some of these gaps with each student while still delivering the assigned curriculum. Each teacher identified the gaps present in their students as a significant factor contributing to how their classes functioned. The perceived effect seemed significant and shaped each teacher's expectations for what they could accomplish throughout the semester (McArdle, Hurrell & Muñoz Martinez, 2013).

The issue of education gaps found within Locally Developed brings into question the process of how students are placed in Locally Developed to begin with. The process of streaming

can often have unintended consequences (Clanfield et al., 2014; Stoilescu et al., 2015). Mrs. Willis explained on several occasions that she felt that the Locally Developed stream had become a “holding ground” for all the students who were unsuitable for the Applied and Academic streams. She mentioned one student who had attended close to 14 different schools in a 2-3 year gap. It becomes very difficult to say definitively that students such as this one should be placed in a Locally Developed classroom as it is not beneficial to the student or the teacher. However, this then raises the question of where else these students should be placed. If students are unsuitable for the Academic, Applied and Locally Developed stream, is it possible to create a course or program to support these students so that they may eventually be successful in one of the other streams? Mr. Anderson suggested the possibility of students being split within a Locally Developed classroom in a way that weak students or students with large gaps in their learning would be placed in one group and strong students in another. Whether or not this would be feasible is unclear. However, the effectiveness of teaching all students within a Locally Developed classroom the same or grouping them as such, is something worth considering.

Nguyen (2011) describes the educational gap present between Aboriginal and Non-Aboriginal students in Canada. Mr. Anderson mentions that many of his Locally Developed classrooms in the past have had a notable population of Aboriginal students. This may be one factor contributing to the gaps present in Locally Developed classrooms in Ontario. With such gaps present, it stands to reason that these classrooms require additional support compared to both Academic and Applied streams. Whether it comes in the form of additional funding, professional development, additional staff, or physical resources, both Mrs. Willis and Mr. Anderson felt that more support was needed in Locally Developed classrooms.

Professional Development.

In Ontario, significant time and resources are dedicated to improving student performance on EQAO tests in mathematics, which students write in Grades 3, 6 and 9. In Grade 9, only the Applied and Academic streams write the EQAO assessment. As far as they knew, Mrs. Willis and Mr. Anderson were unaware of any dedicated support whatsoever aimed at Locally Developed mathematics. However, both expressed a desire for it. This is very problematic as students in these classes are the ones being identified as severely at-risk. Similarly, both teacher participants were not aware of any sort of professional development aimed specifically at Locally Developed mathematics. Again, this is unfortunate as according to Mr. Anderson and Mrs. Willis, these are the more difficult students to teach and the most in need of support. Both teacher participants identified a significant need for more support in the form of resources (physical and financial) as well as dedicated support on topics such as inquiry, and other professional development to improve their teaching practice and thus learning for Locally Developed students. Whether monetary, physical, or resources such as personnel and training, each teacher described such resources as something lacking in Locally Developed classes. The value each teacher placed on such resources seemed to be an underlying factor in other highly valued aspects of their practice. Mrs. Willis wanted to ensure her students were receiving appropriate nutrition, but felt thwarted by associated costs. She did what she could, bringing in snacks regularly, but stated she wished she could do more. Similarly, Mr. Anderson expressed desire that he could go on fieldtrips with students or have special guests visit his class, but lack of funding seemed to discourage the possibility. The perceived need for these various resources no doubt had an effect on each teacher's respective teaching practice and the decisions they made in regards to lesson planning and supporting students (McArdle, Hurrell & Muñoz Martinez, 2013).

Summary

Despite being experienced and enthusiastic teachers, both Mr. Anderson and Mrs. Willis feel limited as to what they can do with their students in Locally Developed mathematics.

According to the teachers, prevalent issues such as lack of resources, student attendance, student engagement and motivation, as well as the gaps in student understanding all pose significant challenges to their ability to effectively teach Locally Developed. Whether it is caused by, or a result of the extenuating circumstances, the factors that students experience in their lives outside the classroom are closely linked to other factors such as attendance. It appears that due to these challenges outside the classroom, many students do not value earning the mathematics credit, or doing well in class. School is simply not a priority for some students.

Each of the two teacher participants employed a variety of teaching strategies in their classrooms. Hands-on and interactive experiences, whether it be with technology, tools or manipulatives, seemed to have a positive impact on both attendance and engagement, however technology still comes with many challenges. Similarly, large scale activities like the cooking activity or the basket making, are not feasible without adequate financial support or manpower to properly supervise.

One factor that seemed to have a noticeable positive impact on the students was the establishment of strong relationships. Teacher-student relationships as well as relationships between students appeared to bring students into the building and sometimes got them participating in classroom activities. Each of the teacher participants described the benefits of building and maintaining relationships with their students marking it as a high priority in their teaching practice. These relationships were valued highly by the teacher participants, which, in turn, shaped each teacher's behaviour and practice in the classroom. It is interesting to consider

the valuation of student relationships compared to curriculum, as neither teacher felt that delivering the curriculum was the sole objective of the course. Students “passing” the course was never the main factor considered by either teacher. Both Mrs. Willis and Mr. Anderson cared for their students and attempted to provide a rewarding mathematics experience for their students.

Through the conceptual framework of axiology as well as the interview data, several predominant themes emerged: access to resources, knowledgeable classroom support, teacher capacity, and student factors were all clearly evident. The theme of structural factors, while not explicitly identified by teachers, can be illustrated using the theoretical framework and supported using teacher interview data. That is, the teachers were hesitant to identify and describe structural factors as something affecting their teaching, but structural components such as resource allotment were identified by both teachers. Sub-themes such as curriculum and teacher-student relationships provided the basis for much of the discussion, but relationships between teacher and student and student well-being emerged as a primary focus.

Chapter 6: Conclusions, Limitations, and Recommendations

This study sought to answer the following questions: What factors do teachers perceive as affecting their ability to teach Locally Developed mathematics and what value do teachers assign to these factors? According to the data, there was significant overlap in the points brought up by each of the teacher participants despite coming from very different levels of experience teaching Locally Developed mathematics. These similarities might at least hint at trends applicable within this particular school board. Both teachers seemed to heavily value their students' emotional well-being as equally important as delivering course curriculum, citing numerous circumstances that negatively affect students inside and outside the classroom. As such, the creation of supportive relationships with students was valued highly by both Mr. Anderson and Mrs. Willis, placing this value alongside epistemic values of curriculum and content. The benefit perceived from the creation of these relationships seemed to shape how each teacher approached their mathematics pedagogy, creating lessons and opportunities to interact with students, as has been shown as effective (McArdle, Hurrell & Muñoz Martinez, 2013).

Each of the participants placed importance on relevant curriculum that could be delivered in a variety of ways. Each teacher described the benefits associated with hands-on activities and valued these types of activities as very important in reaching Locally Developed students. Each teacher felt that when activities were hands-on, engagement and attendance improved. With the valuation of interactive tasks came concerns regarding access to corresponding resources. Mrs. Willis and Mr. Anderson each placed notable value on resources such as funding and professional development as it made activities such as the basket making possible. The value assigned to resources seemed closely linked with the desire to improve the quality of student experiences in the classroom. Through the value each teacher placed on relationships and

relevant content these appeared to be strong factors influencing the teachers', "pedagogical identity" (Chin & Lin, 2001, pg 7). Consequently, these values had direct impact on students' experiences in their respective courses.

Conclusions

The data obtained in this study consistently pointed to several factors that the teachers felt had an impact on the teaching of Locally Developed mathematics. With the current demographic of students, many of whom are severely "at-risk," it is all the more crucial that these factors be identified and addressed. I believe that these factors may not be unique to this particular school and pose a significant problem for the future of Locally Developed mathematics if not appropriately dealt with. Factors that include, but are not limited to, engaging mathematical tasks, adequate classroom support and resources, and the creation of a supportive classroom environment may markedly improve the experience in Locally Developed mathematics for teachers and students alike. According to the conceptual framework, these factors were perceived by teachers as significant and the data suggests that teachers assigned notable value to each. These factors are not disjointed from one another and are also connected to other aspects identified by teachers as influencing their teaching. For example, students may perceive the supportive classroom environment as teachers showing care which aids in the creation of strong teacher-student relationships.

As described by these two teachers, more support and resources are needed in order to sustain an engaging mathematical experience. Teachers perceived a clear and significant need for additional resources and/or support when teaching Locally Developed mathematics. Mathematics is a class with seemingly unlimited potential for different types of activities. Some teachers may be willing to do hands-on, project-based activities and assessment, however, not all teachers have

such tools available to them, or may lack the knowledge to implement them properly. Even Mr. Anderson, someone who highly values teaching resources and who has had a lengthy teaching career and has amassed numerous resources over his time teaching, felt that he could use more resources to better serve his students. Teachers also may require more specialized personnel support in Locally Developed classrooms, as the teachers in this study explained that many students struggle heavily with literacy and numeracy and thus require extra attention. With multiple students requiring additional support, it becomes very challenging for a single teacher to meet these needs. Even with SSP support, it remains difficult to reach all students, as an SSP may lack the training or background to properly scaffold specific mathematics learning in a beneficial manner. As Mr. Anderson said, they may just serve to address behavioural issues but struggle to address mathematical understanding in a meaningful way. Both Mr. Anderson and Mrs. Willis valued any volunteer or additional personnel support that was presented to them throughout the term. In addition to personnel and physical support, it would be beneficial to provide Locally Developed teachers or programs with some manner of financial support. A budget allocated to Locally Developed could provide teachers of these courses with numerous opportunities such as: updating classroom tools and technology, organizing field trips or out of classroom learning experiences, bringing in guest speakers, and providing students in need with necessities like food, drink and clothing. When discussing ways to improve their teaching, both participants had suggestions of techniques or resources to implement, however, it was always followed by the concern of how these ideas could be supported financially. The framework suggests that additional resources were highly valued by teachers and appeared to influence various decisions the participants made in their classrooms (McArdle, Hurrell & Muñoz Martinez, 2013).

Teacher capacity appeared to play a significant role in the Locally Developed classrooms that I observed. Teacher capacity was a contributing factor to the creation of a supportive classroom environment and consequently the creation of healthy teacher-student relationships. From the data obtained, a patient, caring and flexible approach to teaching seemed crucial to student performance in the course. With many mitigating factors affecting student learning and attendance, a solid understanding of content and a flexible approach to assessment and evaluation are necessary. Both teachers emphasized the need for patience, empathy, and flexibility when dealing with students as many are quite fragile. Furthermore, each teacher employed a very open-minded teaching practice, incorporating numerous types of activities into their lessons. These classrooms did not resemble traditional, 'teacher lecture, student practice' mathematics classrooms. As found in Jao (2013), relationships between students and between students and teachers were also observed to have a notable impact on student behaviour in the classroom. Mr. Anderson and Mrs. Willis both described fostering relationships as pivotal to student engagement and learning. It would be beneficial to obtain more data on the impact relationships have on Locally Developed students, particularly from a student perspective. The data obtained in this study suggests that significant care must be used when selecting teachers for Locally Developed courses as the selection of a stubborn or less caring teacher could have negative consequences. Mr. Anderson and Mrs. Willis each expressed the value of being patient, supportive, and open-minded when dealing with Locally Developed students, and the importance that these qualities hold for teachers. Again, the participants seemed less focused on what mathematics content was being conveyed, and more on how they were conveying it, and how students were responding to it.

Perhaps the most troubling findings in this study were those factors related to the students. Student factors such as engagement and attendance were key factors that teachers valued when reflecting on their classrooms or planning class activities. Similarly, the need to create a safe and nurturing environment was prioritized (to varying degrees) by both teachers. Many students in Locally Developed, for a variety of reasons, were described by the teachers as extremely at-risk. The term “at-risk” often refers to student likelihood of success or graduation. It is not an understatement to say that some of these students’ lives may be at-risk. Numerous factors such as domestic violence, substance abuse, and inadequate home care resulted in students who were tired, hungry, and who frankly did not care about mathematics or school in general. Some may simply have been coming to school because it was safer than being in their homes. These factors pose a monumental and complex challenge for teachers. What can a teacher do for a student when they are experiencing so much turmoil outside of the classroom? How can a teacher help a student value mathematics for 90 minutes each day when they are faced with such conflict the moment they leave the classroom or school premises? The data here suggests that as a result of these factors, many students have very poor attendance, further limiting the impact teachers can have on their education and their well-being. How can a teacher make a student feel supported and confident in mathematics when that student is absent every other day, or for weeks at a time? More data needs to be gathered on these severely at-risk students so that we may better understand what can be done to help them. Simply being in Locally Developed mathematics reduces the risk of student graduation (King et al., 2009) and so it is quite clear however that these students are in desperate need of aid. Supportive teacher-student relationships were valued quite highly by both teachers, as without these, they felt that actually attaining curriculum expectations would not be possible. The teachers felt that fostering

a healthy rapport with their students helped achieve goals established by the curriculum, as students were more engaged and more willing when these relationships were present. While each teacher valued a supportive environment and the creation of healthy teacher-student relationships, they felt that extenuating circumstances such as those students experienced outside the classroom often inhibited their ability to accomplish these.

While not given explicit attention from teacher participants, structural factors were observed to influence the teachers' experiences teaching Locally Developed mathematics. Having a suitable teacher assigned to teach Locally Developed was deemed important by each of the participants. Mr. Anderson repeatedly expressed the importance of flexibility in how teachers teach Locally Developed mathematics, as well as how they interact with students. Both teachers strongly advocated for the use of interactive and engaging activities in mathematics due to the improved engagement and attendance among their students. It would be beneficial that the teachers allocated to Locally Developed classes be open to such strategies. Mrs. Willis described the necessity of understanding as another necessary characteristic when dealing with students as she was very aware of what some students were experiencing outside the classroom.

Clearly, Mr. Anderson and Mrs. Willis both placed value on course curriculum, as it is a pivotal part of mathematics education. However, curriculum was not valued as more important when compared to other factors, namely the emotional support of students. As mentioned previously, Mr. Anderson explicitly described the creation and fostering of relationships as being equally important as course curriculum. This is an important distinction, especially in mathematics education. Mathematics is often defined by its content and student ability to perform, as seen in standardized testing such as EQAO. The idea of teachers creating a safe and

welcoming environment and healthy relationships with their students, may not be intuitive to all mathematics teachers.

The access to resources and informed classroom support also seemed to be given a high level of importance from both teachers. Both participants allocated high value to resources including but not limited to: funding, professional development, and teaching resources such as lessons and activities. This valuation was informed by various levels of experience teaching Locally Developed mathematics in addition to their experiences in the classroom over the respective terms. The data further suggests that the improvements that Mr. Anderson and Mrs. Willis saw when they conducted activities like that of the cooking and basket making, resulted in such a high valuation of the various resources.

Limitations

The data gathered in this study were obtained from two teachers within the same school in Ontario and so it is not clear if the data is applicable to schools in other areas. A logical extension of this study would be to gather data from different Locally Developed teachers from different schools in the same school board, as well as other provincial school boards to see which trends, if any, would be consistent from one to the next. This project also focused solely on teacher perspectives of relevant factors. It would be beneficial to gather data on student perspectives in regards to Locally Developed mathematics. Data regarding their education and personal backgrounds, as well as their mathematical understanding and enjoyment, could reveal a lot of unseen factors affecting student learning in the classroom. Similarly, it would be beneficial to explore student perspectives regarding their relationship with teachers and how that impacts them. The inclusion of student perspectives may be able to direct future professional development or improve pedagogy in Locally Developed classrooms.

Recommendations

Many of the students present in Mrs. Willis's and Mr. Anderson's classes possessed incredibly large holes in their education resulting in a substantial range in mathematical ability among students in the classroom, for example, the student that Mrs. Willis mentioned that jumped from school to school. It is very unrealistic for students to succeed when placed in such a circumstance. Similarly, it makes it incredibly challenging for teachers of Locally Developed to serve their students optimally when they have some students functioning 3 or 4 years below grade level compared to some students who could be successful in an Applied level classroom with slightly more support. More needs to be done to address these education gaps in Locally Developed. Similarly, more analysis needs to be done on the placement of these students as the teacher participants both felt that current placement practices were not in some students' best interests. Streaming can often have unintended consequences (Clanfield et al., 2014) and this appears to be especially prevalent in the case of Locally Developed. Mrs. Willis felt that Locally Developed has become a default location for all students who do not fit in Applied or Academic level classrooms as some students were placed in her classroom for attendance issues, other behavioural, many due to their level of understanding. The result is a classroom populated by students with extremely different needs. Neither teacher denied the practice of new or inexperienced teachers being chosen to teach Locally Developed classes with Mrs. Willis saying it happened sometimes whereas Mr. Anderson said that it happened often. Teacher experience as well as their perceptions and beliefs can have a dramatic effect on their teaching (Kajander, Zuke & Walton, 2008: Hand 2010). Thus, it seems ineffective to assign new and inexperienced teachers to teach Locally Developed mathematics especially given that these students are the ones being identified as at-risk. In practice, it would be more effective to have teachers who are

comfortable and confident in their teaching volunteer to teach Locally Developed mathematics as opposed to electing a teacher arbitrarily. Likewise, it is strange that neither teacher was aware of any existing programming or professional development targeted specifically towards Locally Developed mathematics. Both Applied and Academic levels receive support in the forms of EQAO preparation, committees, strategies and professional development opportunities. If there is in fact no such existing supports for the Locally Developed pathway, this is a significant problem which should be addressed promptly as teachers are in dire need.

Some of these problems are large in scope and difficult to address quickly. Factors such as the existing education gap may stem from systemic issues in society. Other issues such as lack of support and development are problems that can be addressed by educational bodies. More information is required to ascertain which of these trends are present in other schools. Regardless, more support specifically targeted towards Locally Developed mathematics, be it financial resources, in-class support, or professional development could be very beneficial for both teachers and their students.

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Appendix A

Interview Questions

Teacher interview questions for semi-structured interviews:

1. **What course have you been teaching this year? How do you feel it has been going for you? For the students?**
2. **Is this your first time teaching Locally Developed Mathematics? How did you feel when you first discovered you were going to be teaching LD mathematics?**
3. **What types of teachers are regularly assigned to teach Locally Developed?**
4. **What are your thoughts on the Locally Developed Curriculum? Do you believe it is relevant to students' lives?**
5. **How has the attendance been in your class this year?**
6. **What are some of the largest challenges for you when teaching this level of mathematics?**
7. **What are your thoughts on the level of support teachers of these classes receive from fellow teachers? The principal? The board? Parents?**
8. **Do you believe you have sufficient resources to reach every one of your students? Can you list some resources that would improve your ability to effectively teach Locally Developed Mathematics?**
9. **What can you say about the achievement gap present in these classes? Are students on comparable levels in their understanding/ mathematics skills?**
10. **Do you believe anything can be done in elementary school to attempt to mitigate these problems? What can you say in regards to the current practice that students are often times NOT held back from elementary school to remain with their peers? How does that affect your classroom?**
11. **What sorts of lessons or activities do your students respond best to? Is it possible for every lesson to be like that? Why or why not?**
12. **Is student opposition present in your class? What forms does it take?**
13. **How is student engagement in your class? (Follow up question, what role do cell phones play?) Do you have any students that are difficult to engage? Please elaborate.**

- 14. How would you describe your students' attitudes towards mathematics? Do you believe they are motivated to come to class? Why or Why not?**
- 15. Speaking anonymously, can you give some specific examples of issues the students in your class are dealing with in their personal lives?**
- 16. Do you believe there are societal or structural barriers inhibiting your ability to teach Locally Developed mathematics? Please explain why or why not.**
- 17. Is there anything else that you feel is necessary to add to the dialogue surrounding Locally Developed Mathematics?**

Appendix B

Consent forms



Invitation Letter to School Administrator

(Date)

Dear (Name of Administrator),

Thank you very much for taking the time to read this letter of invitation. As you may or may not be aware, we are mathematics educators and researchers from several Canadian universities: Dr. Ann Kajander at Lakehead University and Dr. Joe Flessa at University of Toronto. Two student researchers will also be assisting with research and data collection, Kelly Sedor and Matthew Valley. Kelly is a graduate student currently enrolled in the MEd program and may use a subset of data collected for a thesis project. The title of the project is “Transitions in Grade 9 Mathematics” and we would like to request your permission to conduct our study at Hammarskjold High School. It is with great care and motivation that we wish to embark on this research to investigate current pedagogical methods being used in Transitions and Locally developed classrooms. This letter is to formally request your permission to conduct our study at Hammarskjold High School. Upon your consent, we guarantee to provide a report of the findings in both written and oral forms to you once the study has been concluded. The study will involve interviewing teachers and students. Interviews will be audiotaped and partially or fully transcribed. Additionally, researchers will engage in classroom observations and document their findings via field notes. Any identifying characteristics of people or locations will be omitted from any and all forms of data.

Our investigation will not alter nor change anything that occurs in any mathematics classroom. The objective of the study is to simply observe the teaching already taking place, as well as learn about teacher and student opinions and perceptions about mathematics in these classrooms. We hope to observe classes regularly for the duration of the period as well as conduct up to two interviews with several teachers and students.

Students who participate in our study will have an opportunity to contribute to the research by sharing their valuable perspectives and opinions about their mathematics courses. Their participation in the study will include participation in interviews conducted by the researchers if they consent. The interviews will give students opportunities to share their thoughts, opinions, and attitudes regarding their mathematics classes in a respectful environment, free from fear of reprimand. It is the hopes of the researchers that this study will improve conversations about mathematics so that teachers may better address the needs of their students. Interviews will be audio recorded and will take place at Hammarskjold during non-instruction time. We may also

collect field notes and make copies of student work samples from students whose parents have consented to the research.

Participation in this study is entirely voluntary and any and all information obtained will be used for the purposes of research alone. Students are free to change their mind at any point and withdraw from the study. If a student is selected to be interviewed, he or she can exercise the right to refuse to answer any and all questions posed. All audio recordings, as well as notes collected for research purposes will be destroyed five years subsequent to the collection of data. There are no known risks to be incurred by students participating in the study. Benefits may include: additional opportunity to demonstrate their learning, offering critical commentary that could guide the future direction of mathematics in locally developed classrooms.

Results of the study may be disseminated in the form of Journal publications, presentations, lectures and a graduate student thesis. In all publications of the findings, the School Board, School, teacher, and students will be de-identified and remain anonymous. We are hopeful that the results of the study will increase awareness and knowledge in regards to Locally Developed Mathematics and Transitions courses as well as aid in the creation of resources to better support both educators and students involved in these courses.

Any experiences and knowledge you can share will provide enormous value to the study.

The Lakehead University Research Ethics Board has granted the approval of this study as has the Lakehead Public School Board. Additionally, this study has been approved and funded by the Ontario Ministry of Education Mathematics Knowledge Network. If you require any more information regarding the ethics approval process, please contact Sue Wright at Lakehead University at, 807 343 8283. You may also contact Dr. Ann Kajander at 807 343-8127 if you have any questions or concerns. We would be happy to clarify any issues you may have.

If you agree to having us conduct our research at Hammarskjold High school, please sign the attached form. A second copy is provided for your records. Thank you very much for your time and consideration.

Yours truly,

Ann Kajander

Ann Kajander



Principal Consent Form

By signing this form, I am agreeing to participate in a study by Dr. Ann Kajander at Lakehead University, and Dr. Joe Flessa at University of Toronto studying Grade 9 Transitions and Locally Developed Mathematics classes and that I have read and understood the following:

I, _____ have read the cover letter and understand that:

1. The child participants, school, and school board identities will be protected.
2. All data collected is confidential.
3. The in-class discussions and interviews will be audio taped and only with permission of participants.
4. All data collected will be presented with the use of pseudonyms.
5. The child or parent may request retraction of any of their responses without adverse consequence and will be given an opportunity to do so.
6. Should a participant choose not to participate, or withdraw from the study there will be no adverse consequence, academic or otherwise.
7. Participants may choose not to answer any question as part of the research without adverse conditions.
8. The participants may withdraw from the study at any time without adverse consequence.
9. There are no known or anticipated risks to the participants.
10. Student participants are expected to benefit from participation in the study by having the opportunity to learn about and contribute to the creation and analysis of literature and its use in mathematics.
11. The participants and their parent/guardian may request a summary of the study.
12. All raw data from the study (audio tapes, written notes, transcriptions, questionnaires) will be held at Lakehead University in a locked cabinet for five years and then destroyed as per Lakehead University regulations.
13. The data collected will be used to prepare articles in academic journals or for presentation at academic conferences and a subset of the data may be used in a Masters of Education thesis, with all participant identities as well as the identity of the school board concealed.

Name of participant

Signature

Date

I would like a summary of the research findings YES____ NO____

Name

Email or Mailing Address (for research summary)



Informed Consent Form (Colleague)

(Date)

Dear (Name of teacher involved in study)

We thank you very much for your interest in participating in our study titled “Transitions in Grade 9 Mathematics”. As you may or may not know, we are mathematics educators and researchers from several Canadian universities: Dr. Ann Kajander at Lakehead University, and Dr. Joe Flessa at University of Toronto. Two student researchers will also be assisting with research and data collection, Kelly Sedor and Matthew Valley. Kelly is a graduate student currently enrolled in the MEd program and may use a subset of data collected for a thesis project. It is with profound interest and passion that we undertake the research to investigate the current climate of Transitions and Locally Developed level mathematics classes in northwestern Ontario. We are researchers funded by the Ministry of Education Mathematics Knowledge Network, and we are interested in studying Grade 9 Mathematics, particularly Locally Developed and Transitions courses. As you may know, there is a lack of relevant resources. Via this study, we hope to contribute to our knowledge and available resources. Any experiences and knowledge you can share will provide enormous value to the study. It is the hopes of the researchers that this study will improve conversations about mathematics so that teachers may better address the needs of their students. The data collection for this study will primarily consist of 1) researcher field notes, 2) interviews with you and your fellow colleagues, 3) interviews with students, and 4) samples of student work. Interviews will be audio-recorded, but no video will be captured. Researchers and research assistants may request to observe classes as often as three times a week as long it does not interfere with classroom activities.

We respectfully invite you to participate in our research study. Upon your written consent we will: 1) provide access, at a later time, the information you provide through the interviews, 2) analyse the data for trends in regards to teaching in Locally Developed/ Transitions classrooms, and 3) report the findings to you in both oral and written forms.

All data will be fully confidential, and your name or school name will not be used or revealed at any time. Any information regarding your identity will remain confidential and identifying characteristics will be omitted. It is important for you to know, if you change your mind at any time, and wish to withdraw from the study, you are allowed to do so. Furthermore, it is your right to refuse to answer any question or questions you wish. Any copies of existing data collected will be destroyed five years subsequent to the publications of findings. There are no known risks or benefits that can be incurred as a result of your participation in the study.

The research findings may be disseminated in the form of Journal publications, presentations, lectures and a graduate student thesis. The Lakehead University Research Ethics Board has

granted the approval of this study as has the Lakehead Public School Board. Additionally, this study has been approved by the Ontario Ministry of Education. If you require any more information regarding the ethics approval process, or would later like a copy of the findings, please contact Sue Wright at Lakehead University at ,807 343 8283. You may also contact Dr. Ann Kajander at 807 343-8127 if you have any questions or concerns. We would be happy to clarify any issues you may have.

If you consent to participate in our study, please sign the attached form. A second copy is provided for your records. Thank you very much for your consideration and assistance.

Yours truly,

Ann Kajander

Ann Kajander



Faculty of Education

Teacher Consent Form

By signing this form, I am agreeing to participate in a study by Dr. Ann Kajander at Lakehead University, and Dr. Joe Flessa at University of Toronto studying Grade 9 Transitions and Locally Developed Mathematics classes and that I have read and understood the following:

1. I have read and understood the cover letter for this study.
2. I voluntarily agree to participate.
3. There are no known or anticipated potential risks of the study.
4. Your students are expected to benefit from participation in the study by having opportunities to express their thoughts, feelings, and attitudes towards mathematics in an environment free from fear of reprimand or retribution.
5. I can withdraw from the study at any time, and may choose not to answer any question without any adverse consequences to me as well as have any of my responses removed from any write-up of the research.
6. Any information I may provide will be safely secured at Lakehead University for a period of five years.
7. I can request a copy of the research findings from Lakehead University and they will be provided to me at the conclusion of the study when the findings have been written.
8. I will remain anonymous in any publication/public presentation of research findings.

Audio Recording: I agree to have class discussions and interviews in which I am involved in recorded electronically and understand my identity will be kept confidential and that audio will be kept securely at [location] for a period of seven years after which they will be destroyed. I understand that not agreeing to audio recording does not exclude my participation from the rest of the study.

YES ___ NO ___

Name of participant

Signature

Date

I would like a summary of the research findings YES ___ NO ___

Name

Email or Mailing Address (for research summary)