Mixing Mathematics with Tribes Learning Communities:
Implications for Decreasing Mathematics Anxiety

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Abstract

Mathematics is a subject area that causes a lot of anxiety within many individuals and is oftentimes a subject that is avoided by many. Over time, the approach to teaching this material has been transitioning to include a more interactive and student-centered model. This research study focused on how elementary teachers are implementing Tribes Learning Communities in their classrooms and what outcomes they have observed for students who experience mathematics anxiety. This study was conducted using a qualitative research approach involving a literature review and semi-structured interviews with teachers working in the Greater Toronto Area who have been actively practicing the Tribes process within their classrooms. The findings suggest that Tribes creates a safe and inclusive environment, which helps decrease mathematics anxiety, as students feel comfortable taking risks while actively engaging in the learning process. Moreover, it was found that Tribes fosters an environment for growth mindsets to flourish. The implications of these findings suggest that more needs to be done to support current and new teachers in becoming better prepared to teach mathematics using the new collaborative model.

Keywords: mathematics anxiety, Tribes Learning Communities, collaboration, inclusion, growth mindset
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Chapter 1: Introduction

1.1 Research Context

The subject of mathematics has been associated with negative stigma for many individuals, typically leading to avoidance of this topic. But why do so many people dislike mathematics? Such a question was posed by Ethan Mook (2013) on TED Conversations and generated multiple answers from various people online. One of the most intriguing responses noted that mathematics is being taught poorly in elementary by teachers who not only dislike the subject themselves, but are also lacking knowledge necessary to create critical thinkers of their students. These points align with research conducted by Geist (2010) in which he states that most teachers have typically learned mathematics through rote memorization and therefore are more susceptible to lack comprehension of concepts. He found that this can cause teachers to feel uncomfortable and inadequate teaching mathematics. Teachers have a large role in the classroom environment and their attitudes and values are the ones that are most likely passed on to their students; many times students implicitly gain negative attitudes about mathematics from their teachers (Stuart, 2000).

Over the past few years, there has been a paradigm shift in the way that mathematics is being taught in elementary schools. In the traditional model, also known as the procedural-formalist paradigm (PFP), educators place a large focus on algorithms and rote learning, often teaching students in steps that must be memorized (Ellis & Berry, 2005). As mentioned by Geist (2010), this process of teaching can diminish children’s will to construct their own understanding of mathematical concepts because emphasis is placed on obtaining the “correct” answer. Furthermore, within this paradigm, many teachers impose tests that look at time as “important” indicators of mathematical skill, which can also contribute to producing negative attitudes
towards mathematics (Geist, 2010). Additionally, research has found that this method of teaching limits students’ ability to create connections between mathematical concepts (NCTM, 1989). As a result, a new model was introduced to focus on these gaps in student learning; this method is called the cognitive-cultural paradigm (CCP) (Ellis & Berry, 2005). This new method focuses on inquiry-based thinking from students. Through this paradigm, teachers emphasize skills needed to apply their mathematical knowledge when problem solving in real world situations. Overall, this paradigm shift is increasingly prevalent within North American education systems as it aims to engage a diverse range of learners and their unique learning styles.

1.2 Research Problem

When contrasting scores in literacy and mathematics in Ontario, one can easily detect a disparity between the levels of importance placed on each of these subjects. In 2014, Brian Desbiens, the Chair at the Education Quality and Accountability Office (EQAO), stated that “Ontario’s elementary schools do a very good job developing student reading and writing skills. We’re still not seeing the same kind of achievement in mathematics, and aggressive efforts to turn that around must continue at all levels of the education system” (EQAO, 2014). Furthermore, EQAO statistics indicate that student scores in mathematics have been decreasing over the years and scores drop even more when students are tested again in grade 6, when compared to their scores in grade 3. Even though many students are able to appropriately demonstrate their mathematical knowledge, they lack skill when applying this knowledge as they problem solve (EQAO, 2014).

When taking a step back and looking at the bigger picture, it can be understood why some students tend to perform poorly on tests. One of the reasons might be due to mathematics
anxiety, which is described as “feelings of tension and anxiety that interferes with the manipulation of numbers and the solving of mathematical problems in ordinary life and academic situations” (Hopko et al., 2003, p. 648). Students may feel overwhelmed by the problems being asked on a test and often tend to ‘freeze’ or ‘blank out.’ This is one explanation as to why many students are not performing well on mathematical tests, such as EQAO. As Greenwood (1984) emphasized, the root of mathematics anxiety was a result of the “explain-practice-memorize” method of teaching or the traditional method. Since this method promotes memorization, there is no emphasis placed on comprehension and reasoning, which are necessary to solve application questions. These skills are built when students are given open ended questions to solve. When there are various answers to a problem, as opposed to just one “right” way of obtaining the answer, students are provided with an opportunity to demonstrate their thinking and explain their reasoning (Morris, 1981). This is another reason why students are performing poorly on assessments, such as EQAO, and problem solving tasks, in particular.

Students’ learning environments and preferred learning styles are both related to the development of mathematics anxiety (Hodges, 1983). Fraser (1998) defines the learning environment as “the social, psychological, and pedagogical contexts in which learning occurs and which affect student achievement and attitudes” (p. 3). If the teacher provides a variety of methods to create an engaging learning environment for students, he/she will be catering to student’s individual learning styles and will therefore be setting students up for success (Hodges, 1983). In a study conducted by Taylor & Fraser (2013), the researchers found that there was a negative relationship between anxiety and learning environments, “suggesting the possibility of reducing students’ mathematics anxiety through creating a positive classroom environment” (p. 310). Tribes Learning Communities (TLC) is a goal-oriented process based on research that
works to support and maximize children’s academic learning and social emotional development (Gibbs, 2006). As previously mentioned, classroom environments impact student learning (Taylor & Fraser, 2013). By implementing the four Tribes Agreements, teachers can create a positive culture within their classrooms. These are standards that each and every student must honour, as a part of the community. They include: 1) attentive listening, 2) appreciation/no put downs, 3) the right to pass + the right to participate, and 4) mutual respect (Gibbs, 2006).

Another aspect which contributes to the research problem is that of teachers’ attitudes towards mathematics. This subject area has been centralized around teaching students with the “facts” and memorizing algorithms and rules. However, in more recent years, the focus has shifted towards understanding the processes by which students conceptualize mathematical problems. This becomes an issue for those teachers who have learned through rote memorization, as they potentially lack complete comprehension of the mathematical concepts they attempt to teach their students (Geist, 2010). As a result, many teachers are not confident in their abilities and mathematics anxiety is developed. Moreover, many teachers who have mathematics anxiety will pass it on to their students. This process is likely to repeat itself, until the cycle is broken – perhaps through implementing reform of the new mathematics curriculum.

1.3 Research Purpose

In the midst of educating students on the principles of mathematics, some teachers seem to have lost their way of creating a stimulating environment for their students. Traditionally, teachers place importance on giving step by step, or procedural, instructions to their students in an attempt to teach them how to effectively use algorithms (Geist, 2010). However, the essence of learning is to build a conceptual understanding of mathematics, rather than memorizing
algorithms. According to Hiebert (1986), researchers have concluded that, “poor performance in school mathematics can often be traced to a separation between students’ conceptual and procedural knowledge of mathematics” (p. 199). In an attempt to build a bridge between this knowledge, Finlayson (2014) outlined the importance of collaboration in small groups. He found that, “working in groups, where students have opportunities to talk about mathematics, ideas of all students are respected and listened to, students are able to share their thinking and work through a variety of steps of a solution” (Finlayson, 2014, p. 111). Furthermore, this type of learning environment has been found to promote math talk as students engage in mathematical discourse at a much higher level than would otherwise be seen in a teacher-directed environment (Stein, 2007). The purpose of my research is to learn how a sample of elementary teachers use Tribes to teach mathematics and to learn what impact they perceive this has on mathematics anxiety.

1.4 Research Questions

The principle question that will be addressed in the research is: how is a sample of elementary school teachers implementing Tribes Learning Communities in their classrooms, and what outcomes have they observed for students who experience mathematics anxiety?

The following subsidiary questions will support the principle question:

1. What elements of Tribes are these teachers using in their mathematics program?
2. What are some of the perceived benefits of using Tribes to teach mathematics?
3. What are the perceived outcomes on math talk after implementing Tribes?
1.5 Background of the Researcher

When I was in grade eleven, I was a tutor for grades nine and ten mathematics. I was responsible for helping students understand concepts within different units of study and clarify any concerns they had with the work they were doing in class. When students came in confused, it was my job to assist them in figuring out what they thought was difficult, then we worked together to solve problems and to build an understanding of the concepts. Since the tutoring program was only during lunch times, there were only a handful of students dropping in regularly, whereas others only showed up before a test. With my experience as a tutor, I noticed that these students had negative attitudes towards learning and “hated math.” It was through this secondary school experience that I noticed how much students disliked this subject and how they would try everything in their power to avoid doing the work. I found this shocking and a little bothersome, as I was one of the few students who enjoyed mathematics – despite the intransigent methods used by many of my teachers.

A similar incident occurred, more recently, when I was tutoring a grade five student. While working on mathematics problems, I noticed that he was performing much better as I worked with him on the questions. I would *scaffold* his learning by providing him with mathematical problems aligned with his zone of proximal development and offered him my support when needed. I would also allocate a work period after each lesson to give him some time to solve the problems, in front of me, so I could monitor the processes by which he completed the questions. Many times, he would hesitate to write down a solution and would look to me to validate his answers. I realized that he had low self-confidence when working on difficult problems and that this behaviour was due to his mathematics anxiety.
The purpose of reiterating these experiences is to demonstrate the negative connotations associated with the word ‘math’ or ‘mathematics.’ As a future elementary school mathematics teacher, I believe that the focus should be on developing positive attitudes towards mathematics, rather than trying to undo and change the existing negative ones. I want to help my students build a strong repertoire of knowledge for this subject. Teaching students in a strict and one-dimensional way, similar to the traditional method, will not allow them to explore their skills and develop a love for the vast applications of this subject area. It will, however, constrain them to think negatively about mathematics. By providing multiple opportunities within the classroom and implementing several engaging activities during the lesson, students will be able to challenge their own understanding, in an attempt to make personal connections.

The second part of my research interest stems from completing my Tribes training in December 2014; I learned more about and began to admire the inclusive nature of the process during this time. Reflecting on my personal experiences as a student, I had always been hesitant to raise my hand because I was afraid of getting the wrong answer and being laughed at by my classmates – this was in all my classes, not just specifically in mathematics. During my practice teaching, I noted some of my students felt the same way. For this reason, I would incorporate aspects of Tribes, such as collaborative group work, to engage my students. Moreover, I would like to continue to learn more about the positive impact this process has on students and eventually implement Tribes within my own classroom.

1.6 Overview

To respond to the research questions stated above, I conducted a qualitative research study using semi-structured interviews with two teachers from the elementary school system. As
previously mentioned, I hoped to better understand how these teachers were using various Tribes strategies, within their mathematics program and to hear from them what outcomes they observed from their students. In chapter two, I review the literature in the areas of the mathematical paradigm shift, teachers’ attitudes, teacher development, mathematics anxiety, math talk, student collaboration, and Tribes Learning Communities. In chapter three I elaborate on the research design. In chapter four I report my research findings and discuss their implications in light of the literature, and in chapter five I discuss the significance of what I learned for the education community and for my own practice as a beginning teacher.
Chapter 2: LITERATURE REVIEW

The literature review is a synthesis of five overarching areas, all of which expand on my research topic – how elementary school teachers are implementing Tribes Learning Communities (TLC) to increase math talk in their classrooms. This chapter begins with an understanding of the paradigm shift in the mathematics curriculum and a brief overview of the reasons for the change. Next, I discuss teachers’ attitudes towards mathematics, including their beliefs and experiences. This area transitions into a short discussion regarding teacher development and what has been previously been researched. Following this, I define and provide insight on mathematics anxiety and subsequently the importance of math talk and collaboration in the classroom. Finally, TLC is analyzed to demonstrate the connection between this process and the mathematics curriculum, to explicitly showcase their overlooked relationship.

2.1 Paradigm Shift

The traditional model for mathematics education, known as the *procedural-formalist* paradigm (PFP), deems mathematics as an objective set of logically organized facts, skills, and procedures that have been optimized over centuries (Ellis & Berry, 2005). Within this method of teaching mathematics, educators are the ones who provide algorithms, while students are required to memorize them and unquestionably repeat the mathematical process, in an attempt to “learn.” Assessment is based solely on the correctness of student answers – their process and reasoning are irrelevant in regards to this model. Advocates of the *Curriculum and Evaluation Standards for School Mathematics* (NCTM, 1989) realized that what had been missing from mathematics education was a focus on how students come to form meaningful understandings and connections between mathematical concepts (Gelman, 1994; Fuson, 1988; Schoenfeld, 1988;...
Steffe & Cobb, 1988, as cited in Ellis & Berry, 2005). For this reason, a new model emerged, which blends cognitive psychological and (socio) cultural aspects, and it is known as the cognitive-cultural paradigm (CCP) (Ellis & Berry, 2005). Some of the new goals of mathematics education, through this new focus, includes: making sense of conceptual connections; articulating original insights; explaining and justifying mathematical arguments; and applying knowledge to new situations (Carpenter & Lehrer, 1999). Curricula designed and implemented in ways aligned with the perspective of the CCP have resulted in students learning to successfully communicate meaningfully about and value mathematical thinking (Ellis & Berry, 2005).

Although there is a shift in the way mathematics is being taught, there still seems to be groups of individuals who believe that the traditional method must be kept alive in schools (O'Brien, 1999). There had been a “math war” taking place over many years and started back in the 1990’s. “Traditionalists fear that reform-oriented, “standards-based” curricula are superficial and undermine classical mathematical values” while “reformers claim that such curricula reflect a deeper, richer view of mathematics than the traditional curriculum” (Schoenfeld, 2004, p. 253). However, the research speaks for itself. Classrooms which demonstrate students learning in reform-oriented ways outperformed peers in traditionally structured classrooms, including measures of mathematical application and understanding (Pruet, Van Haneghan, & Bamberger, 2004). Furthermore, it has been reported that students in reform-oriented classes displayed a stronger interest and motivation towards mathematics (Boaler, 1997). Both of the aforementioned traits are important factors for predicting future course-taking in mathematics. This is interesting because the occupations in our modern society are leaning towards those who have a relatively strong competence in mathematics.
2.1.1 Constructivism

A central aspect to the new mathematics curriculum is the notion of constructivism, which is essentially “a view that asserts that learners develop new knowledge through a process of active involvement. Rather than being vessels that are filled with new knowledge from the outside, students internally construct what they see, hear, or do in relation to what they already know” (Marks Krpan, 2013). The previous understanding about the traditional method of teaching mathematics was that since this knowledge exists apart from human experience, it makes it difficult to learn and comprehend. However, as mathematical reform came to the forefront, researchers began to consider the ways in which students experienced mathematical ideas and concepts and how this was connected to their own lived experiences as critical to the learning process (Ellis & Berry, 2005). Contrary to what is believed by the traditional model, the CCP understands mathematics to be a set of logically organized and interconnected concepts that come out of human experience, thought, and interaction (Ellis & Berry, 2005). As a result, these are accessible to all students if they learn in a cognitively connected and culturally relevant way.

2.2 Teacher Attitudes in Mathematics

Mathematics teachers have been concerned about providing their students with the “facts” about the subject, in terms of algorithms and rules. Research has found that it is common for teachers to believe that students must acquire the skills needed to perform such computational tasks, rather than providing their students with broader educational goals (Handal & Herrington, 2003). One of the main factors for this belief of many teachers in the field is that they had been taught using the traditional approach to mathematics (Geist, 2010). This means that said teachers learned through rote memorization and potentially lack complete comprehension of
mathematical concepts (Geist, 2010). It is for this reason that several teachers do not feel comfortable teaching mathematics since they do not enjoy it themselves, or believe that they are not adequate enough to teach it (Burns, 1998; Stuart, 2000, as cited in Geist, 2010). Spielberger (1972) describes anxiety as a “condition characterized by feelings of tension and apprehension” (as cited in Taylor & Fraser, 2013). This fear can be translated into math and is known as mathematics anxiety. Of course, mathematics anxiety does not develop from the subject area itself, but from the way mathematics was taught to teachers when they were students themselves (Stuart, 2000). Furthermore, many teachers who have mathematics anxiety will pass it on to their students. This vicious cycle is what teachers must break out of and one possible suggestion is by implementing reform of the new mathematics curriculum.

2.2.1 Teacher Development

In any subject, professional development cannot take place unless there is sufficient guidance to support teachers to acquire the skills they need to develop into better educators. Simply by providing teachers with new programs and immersing them into it does not necessarily change their beliefs and practices (Manouchehri, 1998). Moreover, teachers have an obligation to deepen their own understanding of the mathematical content in an attempt to help their students grow and grasp concepts with less difficulty. There are connections between a teacher’s lack of subject knowledge and their ability to plan teaching material effectively (Rowland, Barber, & Goulding, 2002).

The success of any new program relies heavily on the teacher’s abilities to adopt it as a part of their learning style and translate it into their classrooms. Furthermore, Ball (1995) asserts that “teacher development is especially productive when teachers are in charge of the agenda,
determining the focus, nature, and kind of programming or opportunities” (p. 22). Since many teachers were taught mathematics using the traditional method described above, making the switch to the CCP model is a challenge for many. This reform provides challenges for these teachers, as it requires them to think differently about mathematics, in an attempt to strengthen their personal conceptual understanding (CBMS, 2001, as cited in Ellis & Berry, 2005). Making such a dramatic shift will not be easy and will not be quick; it will take much time and reflective thinking in order to alter one’s practice to model that of a teaching style so differently than their personal learning experiences (Lampert, 2001). Based on this inner conflict it is no surprise that when teachers, familiar with the traditional model, try to implement reform – often times feeling uncomfortable – they tend to abandon the shift, and revert back to the traditional method in which they are comfortable teaching (Obara & Sloan, 2009). For this reason, Ellis & Berry (2005) suggested that teachers see themselves as continuous learners of mathematics, be provided with occasions to reform their personal understandings of the subject matter, and gradually transition into the change.

Teacher candidates must be educated in the current, cognitively enhanced understanding of mathematics, in order to move away from the traditional method, which is still being taught in schools across Ontario. Furner and Berman (2003) created a list of the best practices used for mathematics instruction – this can be highly useful for new and experienced teachers. The researchers gave importance to emphasizing the process and problem solving aspects, rather than on computation when solving problems. Significance was also placed on encouraging mathematical communication and discussion coupled with literacy (reading and writing). Moreover, Furner & Berman (2003) also found that encouraging students to share their thinking
processes and justify their answers is essential. And they noted that by using manipulatives, learning mathematics became more concrete.

2.3 Mathematics Anxiety

Mathematics has always been a dreaded subject area for many individuals, but why is that? According to the statistics released by the Education Quality and Accountability Office (EQAO) in August 2014, mathematics scores have been declining yearly, while reading and writing scores have been increasing. The proportion of students improving to meet the standard, from their Grade 3 scores, in Grade 6 has actually decreased by 10 percentage points, from 26% to 16%, over the past five years (EQAO, 2014). Many researchers believe that a major factor for this disparity between levels of mathematics achievement is mathematics anxiety. According to Buckley & Ribordy’s (1982) definition, “mathematics anxiety is an inconceivable dread of mathematics that can interfere with manipulating numbers and solving mathematical problems within a variety of everyday life and academic situations” (as cited in Taylor & Fraser, 2013). Ashcraft (2002) explained that students, who suffer from mathematics anxiety, tend to avoid situations in which they must perform mathematical calculations. Furthermore, he stated that “math avoidance results in less competency, exposure and math practice, leaving students more anxious and mathematically unprepared to achieve” (Ashcraft, 2002, p. 184).

2.3.1 Causes of Mathematics Anxiety

Mathematics anxiety is not limited to students in high school where it is believed that the subject gets “harder,” rather it exists at every level of education. In fact, Jackson & Leffingwell (1999) conducted a study to determine at what age mathematics anxiety first occurred in students and found that it is apparent in early primary grades. Many of the traditional delivery methods of
mathematics in the classroom cater to increasing mathematics anxiety. Some of these factors include obedience to the fixed curriculum, textbook-based learning, teachers give information and students receive it, teachers hold an authoritative role, and students work individually (Finlayson, 2014). When teachers are focused on completing the curriculum, they tend to use textbooks as the basis of their resources and emphasize computation skills. Students became mathematically anxious and unable to perform successfully when teachers did not take the time to check for understanding. In addition, if the teacher sets the pace too fast, there was a greater emphasis on memorization, knowing how to correctly apply the formula instead of focusing on understanding the mathematical concepts (Finlayson, 2014). In relation to the teacher assuming an authoritative role, anxiety occurred when students were afraid to ask questions, thinking that their questions were not intelligent. Furthermore, when students had to answer questions on the spot or when they were given time constraints to complete mathematical questions, their anxiety increased (Finlayson, 2014).

An additional cause of mathematics anxiety is when students had a lack of self-confidence, which can be hindered through failure in mathematics classes, when there is no encouragement given by teachers and family members, or when students constantly hear that mathematics is difficult (Finlayson, 2014). Fear of failure is another cause of mathematics anxiety as there was great importance placed on getting the right answer in traditional classrooms, and when students got the answer wrong, they felt a higher level of stress. When students responded incorrectly to questions, they feared getting laughed at by their peers for not knowing the answer and often felt inferior to their friends who may have responded correctly.

For students, one of the most reoccurring causes of mathematics anxiety is writing tests or exams. There are many reasons for this which Finlayson (2014) described, including the fact
that students would draw a blank on these assessments, they crammed before the tests, they were not well prepared because they did not complete all the assignments, or they completed the work without fully understanding the processes. In any case, when faced with an exam, students did not know where to begin and how to complete the work required of them.

2.3.2 Overcoming Mathematics Anxiety

If the CPP model is implemented by teachers to instruct mathematical concepts, they must ensure that “the emphasis be placed on the process rather than the product” (Posamentier et al., 2010, p. 3, as cited in Finlayson, 2014). Through supporting this constructivist belief, as opposed to passively taking in information, students are actively involved in the process of constructing meaning and knowledge. It is critical for teachers to shift gears so that the focus is on their students, allowing them to learn through making connections to previous knowledge and building upon that. As previously mentioned, at the heart of the constructivist teaching approach is the importance of actively engaging students and creating activities that are interactive, as well as student centered (Ellis & Berry, 2005). Teachers serve more of a facilitator role in the learning process, often encouraging students to be critical and independent thinkers (Ellis & Berry, 2005). Moreover, assessment practices are varied and include projects, checklists, anecdotal notes, conferences, and more, in addition to tests. The aforementioned approaches are applicable to diverse learners (Van de Walle et al., 2014).

Cooperative learning is highly influential in the CPP method of teaching mathematics (Ellis & Berry, 2005). As Vygotsky (1978) stated, learners can be assisted by working with others who are ‘more knowledgeable’ and can be scaffolded in their zone of proximal development, which is the area where students are able to complete work with adequate support.
from others. This validates the notion that “a range of knowledge may be out of reach for the individual to learn alone, but its accessible if the learner has the support of peers or more knowledgeable others” (Van de Walle et al., 2014, p. 6).

2.3.3 Teaching to Avoid Mathematics Anxiety

In addition to overcoming mathematics anxiety, there are various ways to avoid developing this learned response to a negative experience. A great deal of the responsibility attached to this task is held by the teacher, since they must model desired behaviours and change students’ perspectives on mathematics. Morris (1981) suggested that teachers can accomplish this by creating a positive and supportive classroom atmosphere, in which all students are respectful of their peers and do not ridicule them if they need to ask for clarification.

Furthermore, it is up to teachers to explain to their students that mathematics does not mean that there is only one “right” answer and only one “right” way to get to that answer; there must be an emphasis placed on the thought process behind getting to a solution and the fact that it is varied. Research indicates that it is detrimental to students to simply memorize algorithms and that it is more important for teachers to focus on students learning concepts (Wakefield, 2001). Moreover, if teachers used instruction and assignments more concerned with processes and applications, rather than memorization, there would be a relief from mathematics anxiety (Morris, 1981). A good example mentioned by Morris (1981) is that on tests, a teacher could provide the formulas needed, which would ultimately reduce unnecessary anxiety over memorizing them and allowing students to focus on applying the formulas instead.

A key piece of information for educators to understand is that it is vital for them to check for understanding, to ensure learning and understanding has taken place – otherwise building on
“covered” concepts is useless. If students do not understand what they are learning and are too anxious to ask questions, they will only increase their anxiety (Finlayson, 2014). As mentioned before, peer tutoring and collaboration are essential to avoid the development of mathematics anxiety in students. The reason for this is that when “working together in small groups, it is deemed to be less threatening, and learning is often deeper, since students are explaining to each other and thinking aloud” (Morris, 1981, p. 416).

2.4 Cooperative Learning & Math Talk

Cooperative learning is the name given to “a method of instruction in which students work together in small teams towards a common goal and each member is individually accountable for learning the material” (Nattiv, 1994, p. 285). In general, there had been a vast amount of research done on collaborative learning and its positive effects (Artzt & Armour-Thomas, 1997; Cohen, 1994; Nattiv, 1994; Ross, 1995). Webb discovered that particular helping behaviours were highly correlated with achievement gains (as cited in Nattiv, 1994). For example, students who provided and received explanations that were relevant to a topic, displayed significant achievement gains. The opposite is true for students who were given and provided no explanations – they showed lower achievement. “By giving explanations, students become conscious of their thoughts and reorganize their ideas” (Ross, 1995, p. 411).

Another study conducted by King (1993) focused on a grade three class that had a strong community, in which students were encouraged to work together. The various roles were often switched, to allow each student an opportunity to take part in every aspect of the group experience. It was found that the lower ability students remained passive and the high ability students dominated, even when it was a low ability student’s turn to lead the group (King, 1993).
This, along with other studies, showcased that students communicate unequally if reform has not been fully implemented (Ross, 1995). The National Council of Teachers of Mathematics (NCTM, 2000) suggested that “the successful implementation of mathematics education reform requires that teachers change traditional teaching practices significantly, and develop a discourse community in their classrooms.”

Research has indicated that when students are actively discussing mathematical concepts in cooperative group activities, they are strengthening their own understanding of what they are learning (Marks Krpan, 2013). When the teacher and students utilize discourse in an attempt to support mathematical learning of every student in the classroom, it is termed as a math-talk learning community (Hufferd-Ackles, Fuson, & Sherin, 2004). One of the key components to the success of this community is to extend one’s own knowledge, in addition to that of others in the classroom. As mentioned in the NCTM (2000), the Principles and Standards for School Mathematics stresses the importance of learning in mathematical communities, since they promote students’ communication of mathematical ideas and allows students to construct mathematical knowledge. Furthermore, “discussion of mathematical ideas provides opportunities for students to reason, defend, and prove their conceptions to one another” (Hufferd-Ackles et al., 2004, p. 113). When students do not get a chance to discuss the computational processes that they practice, the methods used are often times forgotten and/or learned incorrectly (Marks Krpan, 2013). However, ideas are connected together when teachers provide their students with opportunities to share what they know and communicate mathematically.

Through math talk – talking about mathematical thinking – teachers are able to identify any preconceptions that students may have about a concept (Fuson, Kalchman, & Bransford, 2005). Many times, these pre-existing notions that students bring into the classroom hinder their
learning as students “conclude that the study of mathematics is ‘not for them’” (Fuson et al., 2005, p.219). Students are not expected to use mathematical language spontaneously, but rather grasp such vocabulary through teacher modelling (Fuson et al., 2005). Furthermore, many teachers encourage their students to create visual representations of their work to make their thinking visible – drawings helped students bridge the gap between their “developing understanding and formal mathematics” (Fuson et al., 2005, p. 228). Math talk allows students and teachers to engage in discussions around how and why they approached mathematical problems. Moreover, teachers are able to identify misconceptions in student thinking when students are actively explaining their thought processes (Fuson et al., 2005). Students learn to communicate and communicate to learn (NCTM, 2000).

2.5 Tribes Learning Communities (TLC)

Tribes is a goal-oriented process based on research that works to support and maximize children’s academic learning and social emotional development (Gibbs, 2006). TLC are central to changing school reform models and going beyond the notion that “one size fits all,” where teachers are focused on rote instruction. They acknowledge that students can no longer process and absorb information the same way that they used to and change needs to occur in order to help the children of our future succeed. The mission of Tribes is “to assure the whole development of every child so that each has the knowledge, skills, and resiliency to be successful in this rapidly changing world” (Gibbs, 2006, p. XI).

Tribes is being used in classrooms across Ontario and in various subject areas. However, there has been little research done on the implications of Tribes on mathematics. The following
section sheds light on some of the overlapping themes between Tribes and the new reform model within the mathematical curriculum.

2.5.1 Implications of Using Tribes

There are plenty connections between Tribes and teaching mathematics using the new model of conceptual understanding. The following three aspects are analyzed in closer detail: the pattern of interaction in classrooms, creating a supportive classroom community, and cooperative learning.

A vital step in order to promote learning is moving from a teacher-centered classroom to a student-centered one. The former consists of students passively listening to the teacher, with minimal interaction with one another (Gibbs, 2006). “When teachers depend upon whole class instruction, they themselves talk more than two-thirds of the time, and more than 70% of their “teacher talk” is spent disciplining, lecturing, giving instructions, and asking questions” (Gibbs, 2006, p. 49). This pattern of interaction is usually referred to as the “sage on the stage” model in Tribes. Gibbs (2006) noticed that when classrooms are teacher-centered, they lacked “the transfer of responsibility to students themselves for their own learning, opportunities for students to inquire, to construct meaning, and apply concepts learned” (p. 50). When students are arranged in small learning groups, within the classroom, the amount of “teacher talk” time lessens from 70% to 25% (Gibbs, 2006). So what are teachers to do during the other 75% of the time if they are not leading the class? There are plenty of things they can do, such as “praising, encouraging initiatives, giving feedback, facilitating student communication, and helping students” (Gibbs, 2006, p. 52).
In a student-centered approach, the teacher acts as a facilitator, or a “guide on the side,” in the classroom (Gibbs, 2006). This notion is consistent with the new model of mathematical reform, as the Progressive Education Association (PEA) emphasized that “the teacher is a guide and not a taskmaster” (Kliebard, 1987, as cited in Ellis & Berry, 2005). Teachers are moving away from promoting calculations and the importance of getting the “right answer,” since the significance is now being placed on students’ conceptual processes to arrive at their answers with support from the teacher – this is what Tribes has been working towards.

The four Tribes Agreements are essential in creating a positive culture within the classroom, especially when each student is familiar with, practices, and honours them. These key components are: 1) attentive listening, 2) appreciation/no put downs, 3) the right to pass + the right to participate, and 4) mutual respect (Gibbs, 2006). Some outcomes, of implementing these agreements into classrooms, include “significant decreases in student behaviour problems, improvement in teacher-student relationships, and an increase in students’ liking of school and motivation for academic learning” (Gibbs, 2006, p. 29-30). As mentioned earlier, mathematics anxiety increased among students when they get an answer wrong in front of their friends and also when they felt that a question they had may be seen as unintelligent by their peers. By promoting an inclusive classroom environment, teachers are helping their students feel comfortable enough that they could express themselves without the fear of being ridiculed. This is ideal, as it is the responsibility of “the students, teachers and the whole school community to create and sustain the safe and caring culture” (Gibbs, 2006, p. 33). In addition to the gradual community building process, the agreements ensure that each student has “inclusion (belonging to a small peer group), a sense of identity and value, and a community of supportive peers and adults” (Gibbs, 2015, “A Caring Culture – Re-Culturing,” para.2). It is the teacher’s
responsibility to introduce the agreements to students and ensure they are posted within the classroom. They begin any form of instruction by reminding students of “how we want to be while we work together” (Gibbs, 2015, “A Caring Culture – Re-Culturing,” para.2). There is a transfer of responsibility from teacher to student, as they must honor and monitor the use of the agreements within the classroom environment. Ultimately, by reminding students of and promoting the four agreements daily, children are inclined to think before they speak.

An essential component to building an inclusive environment within the classroom, is cooperation, especially when working with small groups, or tribes. In Gibbs’ book she recognized the work of Drs. David and Roger Johnson, who summarized more than 600 studies, reporting the various benefits of cooperative learning. Some of these gains included greater productivity and academic achievement levels, social competency, self-esteem, social support, motivation, and creating positive interpersonal and intergroup relationships (Gibbs, 2006). In the traditional method of teaching mathematics, students work individually with very few, if any, interactions with their peers. The new conceptual model promotes collaborative learning since “working in groups, where students have opportunities to talk about mathematics, ideas of all students are respected and listened to, students are able to share their thinking and work through a variety of steps of a solution” (Finlayson, 2014, p. 111). As previously mentioned, collaboration allows students to engage in mathematics talk by explaining what they know to their peers and providing opportunities to understand various strategies for problem solving. This belief is consistent with Tribes, since it deems the function of learning groups to enhance student knowledge through cooperative work.
2.5.2 Outcomes of Tribes

The initial purpose of the Tribes process was to prevent substance use and abuse and other behavioural problems during the 1970’s (Gibbs, 2015). It was designed to build inclusion and a sense of community for each student in every classroom, in order to overcome the risk of seclusion and “acting-out” behaviours (Gibbs, 2015). Many schools reported a “significant decrease in student behaviour problems, increases in student self-esteem and self-responsibility, and improvements in the school climate” (Gibbs, 2015, “Initial Design: Substance Abuse Prevention,” para.3). In addition to these predictable outcomes, there were many un-anticipated outcomes which resulted from the implementation of the Tribes process. Some of these include, “teachers realized that they could also teach core academic content in small groups” as a way to reach and involve all students within the classroom; and “individual teachers and whole schools began to request training in cooperative group learning” (Gibbs, 2015, “Initial Design: Substance Abuse Prevention,” para.3).

After learning about the importance of social development and the group process, a revised cooperative learning model was created as the purpose of the Tribes process. This is where the onset of the current Tribes model, which includes a whole school approach, began. Teachers were trained “to build long-term small membership groups (tribes) for peer support and responsibility; teach students essential democratic group skills; and integrate academic concepts into cooperative learning strategies” (Gibbs, 2015, “Second Design: Tribes Cooperative Learning,” para.1). It was at this stage that the four Tribes Agreements, mentioned earlier, were originated as a means of creating a positive culture within every classroom. Some outcomes reported by schools include “significant decreases in student behaviour problems (average: 75% decrease in 3 months); improvement in teacher-student relationships; increase in students’ liking
of school and motivation (for academic learning)” (Gibbs, 2015, “Second Design: Tribes Cooperative Learning,” para.3). Similar to the previous stage, there were many un-anticipated outcomes stated, some of which include: “teachers reported they did not spend as much time managing their classrooms, and that they had more time to teach subject matter; more special education students could be mainstreamed into regular classrooms; and teacher collegiality increased” (Gibbs, 2015, “Second Design: Tribes Cooperative Learning,” para.3).

2.6 Conclusion

Mathematical reform has called for teachers to abandon the traditional methods of teaching this “disliked” subject area. However, many teachers do not know how to go about this shift to implement any other way than the one they learned themselves. Furthermore, mathematics anxiety inhibits teachers who learned math as having a highly computational structure from educating their students using the newer method of knowledge building. The Tribes Learning Communities (TLC) is a process that has become quite popular and adopted by many schools in Ontario. It is through this inclusive community building model that teachers can work towards restructuring their own classrooms to create a positive learning environment in all subject areas, including mathematics. With mathematics test scores decreasing year by year, teachers need to learn how to implement change, within their classrooms, effectively. Therefore, my focus on joining the two areas aims to understand how mathematics anxiety may be reduced through the implementation of the Tribes Learning Communities.
Chapter 3: Research Methodology

This chapter describes the research methodology. Initially, I discuss the research approach and procedures that have been decided upon and implemented for my study. I also consider the instruments of data collection, prior to describing my participants in detail. I include information regarding the sampling criteria and recruitment of my participants, in addition to providing some background knowledge on them. Furthermore, I describe the data analysis procedures and also review the ethical considerations associated with my study. I analyze the methodological limitations and highlight the strengths of my study, as well. Lastly, I provide a brief overview of the key methodological decisions made and the rationale behind the decisions, in relation to the research purpose and questions.

3.1 Research Approach & Procedures

This research study was conducted using a qualitative research approach involving a literature review and semi-structured interviews with two educators. As stated in Creswell (2013), “we conduct qualitative research because a problem or issue needs to be explored” (p. 47). In my study, I could merely investigate my problem solely through existing literature. In order for me to obtain a detailed understanding of the issue, I needed to delve into the environment in which I could gain valuable insights through and directly hearing about the lived experiences of individuals. This allowed me to explore specific scenarios and connect them to theories which have been researched in the literature review portion of my paper.

3.2 Instruments of Data Collection

For this study, I relied largely on a single instrument of data collection, which is my semi-structured interview protocol (see Appendix B). As mentioned by DiCicco-Bloom &
Crabtree (2006), semi-structured interviews are “generally organised around a set of predetermined open-ended questions, with other questions emerging from the dialogue between the interviewer and interviewee/s” (p. 315). These interviews were scheduled in advanced and planned to take between 45-60 minutes. This type of interview process is most commonly used for qualitative studies and allows researchers to gain an in-depth understanding of social and personal matters, while exploring meaning and perceptions to gain a better understanding (DiCicco-Bloom & Crabtree, 2006).

In order to gain some insights into the purpose of my research, which is to understand how teachers are implementing Tribes within their mathematics programming and to learn from them what perceived outcomes this may have on students’ mathematics anxiety, I created an interview protocol designed to target this topic. I began by making my participants feel comfortable and asking them general questions about their teaching experience, such as what grades they had previously taught and what made them decide to become a teacher. Then, I moved into questions that were more focused on the topic being studied, such as their attitudes towards mathematics, student-centered approached to teaching this subject, and background information on Tribes Learning Communities, while paying particular attention to the relationship between the two disciplines. I transitioned into more sensitive topics, such as mathematics anxiety and students’ self-esteem/confidence, and math talk within their classrooms. I ensured to ask such questions at a later time, once a safe and comfortable environment had been established, so my participants felt at ease when sharing their experiences as thoroughly as possible (DiCicco-Bloom & Crabtree, 2006).
3.3 Participants

In this section, I describe the sampling criteria established for participant recruitment and I also elaborate on the various ways that I recruited teachers. Additionally, I included a section dedicated to the background of my participants.

3.3.1 Sampling Criteria

In order to find participants who were the best fit for my study, I designed specific criteria for participation. The following is the list of criteria that I implemented and the rationale behind each prerequisite.

- Educators are Tribes trained – The reason for this is that my research is largely focused on how Tribes strategies are being implemented within classrooms and for a teacher to be able to effectively discuss this topic, he/she must be an expert in this area.

- Educators have at least 5 years or more of teaching experience – The reason for this is that I wanted to ensure that the teachers whom I selected for my study had a few years to develop their teaching style and master their role as a teacher. Although teachers learn each and every day in the classroom, and increase their knowledge after 5 years, I wanted them to have a strong foundation within this field and feel comfortable holding their own.

- Educators are currently teaching, or have taught, mathematics – The reason for this is that my research is primarily focused on mathematics and in order for me to gain significant findings from interviews, my participants must have lived experiences to share.

- Educators are implementing Tribes within their mathematics program – The reason for this is that my whole research is based off of this specific aspect. It is an uncommon subject to implement Tribes in; however, this is the key reason why I am investigating the
topic. In order for me to gain insights into this subject area, I found teachers who are actively engaged in this process.

- Educators are teaching, or have taught, at the elementary school level – The reason for this is that I will be certified to teach the primary/junior level and I want to be able to relate my theory to practice. I want to be able to apply my findings to my own, and of course others’, teaching, in an attempt to enhance student learning.

### 3.3.2 Sampling Procedures, Recruitment

Within a qualitative study, the element of participant sampling yields a large role. There are a few ways to go about selecting individuals for a study; the two I discuss in more detail are convenience sampling and purposeful sampling. The former approach is the least meticulous, such that the subjects are selected based on accessibility (Marshall, 1996). This type of sampling may result in poor quality data, despite being the “least costly, in terms of time, effort, and money” (Marshall, 1996, p. 253). While looking for participants, I relied on an existing contact, an expert in the field of Tribes Learning Communities and a professor at OISE, to connect me with prospective participants. This professor had been a Tribes trainer for years and reached out to her contacts at various schools across the GTA. This was how I found one of my participants.

The second method of sampling is the most common and entails the “researcher actively selecting the most productive sample to answer the research questions” (Marshall, 1996, p. 253). While looking for participants, I implemented various approaches for this technique. For example, during my second practicum experience I attended a mathematics outreach workshop. In addition to learning a lot of useful strategies to teach mathematics, I networked with the coordinators, who attend various schools to connect with as many teachers as possible. This was
how I found my second participant. When I went to meet this participant, I asked her to think about and recommend any other teachers or colleagues who are using a similar approach to teaching mathematics. Unfortunately she was unable to provide me with additional contacts.

Furthermore, I joined various Facebook groups, which serve as a platform for online discussions and resource sharing. Although there are thousands of people in the groups, I was unable to get a reply from any teachers willing to participate in my study. Despite my avid searching, I was unable to obtain more participants and as a result, my research is centralized around the two teachers I had found.

3.3.3 Participant Bios

I had the pleasure of interviewing two participants for my research study.

*Katherine (Pseudonym)*

The first participant, Katherine, was an elementary school teacher in a Metropolitan board. At the time of the research she was in her fifteenth year as a teacher and was teaching grade 6. She had previously taught grades 2-6 and had a lot of experience teaching the third grade. She received her Tribes training while obtaining her Bachelors of Education degree, as it was part of her program.

*Dianne (Pseudonym)*

At the time of the research, my second participant, Dianne, was a vice principal in a Metropolitan board. She had worked as an elementary school teacher for ten years and was in her second year as a vice principal. She had previously taught kindergarten, grades 5, 6, 7, and
covered various primary grades, as well. Similar to my first participant, she received her Tribes training during her Bachelors of Education degree and went on to becoming a Tribes trainer.

3.4 Data Analysis

A vital component to any form of research is analysing the data in a systematic and meaningful way. As such, I took the appropriate steps to most accurately assess my data, in an attempt to yield the most feasible results. I began by transcribing the interviews I conducted with my participants. This process was quite time consuming and tedious, as I had to constantly re-listen to bits and pieces to ensure accuracy. Once I had a completed transcript, I coded them using the research questions as an interpretive tool. Since the method of coding is very subjective, I did what I thought best for my particular research focus. I looked at each interview exclusively, to draw attention to underlining categories within the dialogue. Once both interviews were transcribed and coded, I began to emphasize common categories and then themes across both interviews. I highlighted certain pieces of information that I found relevant and useful in relation to the overarching themes (Wolcott, 1994b, as cited in Creswell, 2013). Moreover, I used Miles & Huberman’s (1994) technique of writing marginal notes to generate a more organized set of information. By taking these additional steps, I was able to synthesize my information into larger categories with more ease. Once I had successfully organized all the data, I began to make meaning from it and made conclusions based on the significance of these themes, in relation to the existing research.

3.5 Ethical Review Procedures

Each participant was given a letter of informed consent (Appendix A) prior to the interview, to review and sign, indicating their willingness to participate in my study. This
document indicates information regarding the content of the study, consent and confidentiality. I went over the consent form with participants in person, to explicitly and thoroughly outline the ethical procedures involved. All participants were assigned a pseudonym and were advised of their right to withdraw from the study. Participants were assured confidentiality of their identities, which allowed them to willingly and openly take part in the study. There are no known risks that my participants faced when engaging in my study and I reminded them that they could refuse to answer any question(s) which produced discomfort.

In terms of the data collected, I assured participants that everything will remain confidential and safe on my password protected laptop and will be destroyed after 5 years. The audio recordings and/or transcriptions were only shared with my course instructor.

3.6 Methodological Limitations and Strengths

When conducting a qualitative study, one will realize that there are many limitations to this type of research. Firstly, the scope of the research is constraining because only teachers could be interviewed. Although teachers provide a lot of insights into the experiences and activities that encompass their classrooms, it would be highly informative to gain the perspectives of students and their parents. Due to ethical parameters, doing such would not be authorized. Furthermore, even if interviews would not be acceptable, conducting surveys would be helpful to acknowledge student and parent views on this topic. Additionally, classroom observations would have been beneficial to further my research. As noted in Creswell (2013), “observation is one of the key tools for collecting data in qualitative research” (p. 166). It is through observations that one can gain an immediate understanding of some of the activities, interactions, conversations, etc. that occur in the natural setting (Creswell, 2013).
Moreover, there are a limited number of teachers that I was able to interview for the purpose of this study. Also, it is unlikely that I would have been able to interview large numbers of educators because this such research is quite tedious. As Creswell (2013) notes, this type of research is highly time consuming and requires a lot of dedication from researchers, as they must sift through a lot of data, in an attempt to reduce it to a few themes and/or categories. Also, if there is only one researcher, as in my case, the possibilities of conducting multiple interviews and analyzing data can be difficult. Also, when there are a limited number of teachers that are being interviewed, the findings can inform the topic at hand, but cannot be generalized to the experiences of teachers more broadly speaking (Myers, 2013).

In contrast, there are many areas in which qualitative research is highly advantageous. To begin with, interviewing teachers is more significant to exploring a topic than surveys, as they provide much more depth and knowledge regarding the problem. This type of research is concerned with meaning, how people make sense of the world, and the perspectives of participants, when they experience certain events (Willig, 2001, as cited in Griffin, 2004). Furthermore, conducting interviews creates an openness which permits the teachers to speak to what matters most to them, in relation to the topic, and allows for new topics, that are not initially considered, to be discussed. Interviews provide a platform in which teachers’ voices and experiences are validated. With this type of research approach, there are many opportunities for teachers to add to, comment on, and express their opinions and beliefs on the topic at hand. Additionally, some teachers believe interviews are an opportunity for them to reflect on their practice and demonstrate their understanding of the topic, in terms of theory and practice.
3.7 Conclusion

In this chapter, I discussed the various aspects involved regarding the methodology used for my study. Firstly, I explained the importance of qualitative studies as my research approach. This was a decision made based upon the parameters of the MTRP and also on the fact that in order to understand my topic, I cannot merely rely on the literature for support; I conducted interviews with educators who have lived experiences in my area of study to fully delve into the situation. For this reason, my instrument of data collection is my semi-structured interview protocol. Much the same, this protocol allowed me to shape and direct the dialogue in such a way that the participants were able to speak directly to the research topic and questions. Furthermore, I included information on the sampling procedures and criteria for my participants, in addition to a short profile to introduce them.

My data analysis section is typical of the steps taken when conducting qualitative research. I began by transcribing the interview dialogues, coded the information as I found necessary, analyzed the codes to create categories within each interview and then established overarching themes across both sets of data, before finally making meaning and drawing conclusions from the information. I also listed some of the key points included in the ethical review procedure. This pertains to the information regarding the content of study, consent, and confidentiality. Lastly, the methodological limitations and strengths of qualitative research were discussed. I believe a disadvantage to be that the experiences described in the interviews are too specific to be generalized to those of other teachers. However, an advantage would be that this type of research allowed me to gain a more in-depth understanding of the content, which could not otherwise be obtained, through the use of surveys. In chapter 4, I report the research finding based upon my interviews.
Chapter 4: Data Analysis

In this chapter, I report and discuss the findings from two interviews conducted with elementary school teachers on their understandings of and experiences with implementing Tribes Learning Communities (TLC) within their mathematics program. While each of the educators had various experiences, levels of understanding and strategies used within TLC, they both displayed a genuine interest and commitment to helping students reduce mathematics anxiety, within their classrooms. Participants’ personal values, opinions, and experiences are presented to better understand the theoretical research, which has been conducted in the area of interest.

After reviewing my transcripts, I organized the information and established five overarching themes, as well as multiple supporting sub-themes, to better understand the various aspects of this research study: 1) Participants believe that in order to teach mathematics successfully, they must abandon the traditional methods, which were attributed to their personal negative experiences with mathematics, as a student, 2) Teachers found mathematics anxiety to be highly prevalent in their elementary classrooms and discuss causes for mathematics anxiety, strategies to help overcome it, and teaching students to avoid it, 3) Participants recommended getting to know your students to effectively select and implement the Tribes strategies that will yield the greatest outcomes, 4) Teachers notice academic, as well as, social benefits for students through the implementation of Tribes in their mathematics program, and 5) Participants emphasized the importance of developing the concept of Growth Mindset to reduce mathematics anxiety, in both students and parents.

4.1 Participants believe that in order to teach mathematics successfully, they must abandon the traditional methods, which were attributed to their personal negative experiences with mathematics, as a student.
When analyzing the data from my two interviews, I found that both teachers expressed their challenges with mathematics as they furthered their education and the concepts became more elaborate. They acknowledged the struggles that they experienced, which resulted in lower marks in mathematics when compared to other subject areas, and realized that there was a gap in their understanding. Dianne stated:

I started to feel less confident. So, my self-esteem started to wear down in math. And in high school, finding it a bit harder, needing more time to learn the concepts and my self-esteem waved in high school math again. I was at the academic level for math but, I would say it was definitely a challenge for me.

Furthermore, when recounting her own experiences as a student, Katherine discussed how her teachers negatively impacted her learning of the material. In one case she mentioned:

I do remember my grade five teacher. She would get upset if we made mistakes and things like that and [was] pretty firm, but not really explaining things.

She also stated the following experience about another teacher that contributed to her negative experiences with mathematics:

I remember I had a grade nine teacher that she would just sort of write out formulas on an overhead and we would just copy and there wasn’t a lot of explanation.

In both of these examples, there is a focus on teacher directed learning, with an emphasis being placed on providing students with the “facts” about mathematics. Gibbs (2006) noticed that when classrooms are teacher-centered, as the ones mentioned above, they lack “the transfer of responsibility to students themselves for their own learning, opportunities for students to use inquiry, to construct meaning, and apply concepts learned” (p. 50). This supports the way Katherine described being taught mathematics and also affirms Geist’s (2010) work that many teachers in the field have been taught using the traditional approach to mathematics.

Additionally, this means that this sample of teachers learned through rote memorization and
potentially lack complete comprehension of mathematical concepts. Dianne, for example, explained that she felt she was “learning” with students.

Educators’ personal beliefs and attitudes towards mathematics can impact the way that they approach and teach the subject. For this reason, I found it surprising that Katherine, who explicitly remembered having negative experiences with some of her teachers, said that it is one of her favourite subjects to teach. Nevertheless, she stated:

Math is not automatic for me. I have to break it down and think it though – I find that really helps me teach it because then it helps me explain it and break things down for students.

Dianne responded that she still found mathematics challenging, which is what I had anticipated my participants to say. However, she elaborated by emphasizing the importance of personal professional development for her to gain a better understanding of the material and making a conscious effort to seek out valuable resources. This contradicts research that states teachers commonly do not feel comfortable teaching mathematics when they do not enjoy it themselves, or believe that they are not adequate enough to teach it (Burns, 1998; Stuart, 2000, as cited in Geist, 2010). Despite their negative experiences with mathematics, my participants took control of their own learning and better prepared themselves to give their students a positive experience. As noted in research done by Rowland, Barber & Goulding (2002), there are linkages between a teacher’s lack of subject knowledge and ability to plan teaching material effectively. Also, in order to move one’s practice to model that of a teaching style so differently than one’s prior learning experience, requires reflective thinking (Lampert, 2001). Katherine acknowledged this when she said:

I continue to go back and think about my own experiences and how I can duplicate positives and eliminate the negatives.
This finding is significant since the research is primarily focused on how some teachers prefer not to change their style of teaching because many times it is difficult to alter their conceptual understanding of the subject. However, what my research illustrates is that there are teachers who recognize the negative impacts of teaching mathematics using the traditional method. Additionally, they understood the effects of this negativity on mathematical abilities, confidence, and self-esteem and therefore, altered their perceptions in an attempt to break this cycle of teaching mathematics.

4.2 Teachers found mathematics anxiety to be highly prevalent in their elementary classrooms and discuss causes for mathematics anxiety, strategies to help overcome it, and teaching students to avoid it

When conducting my interviews, participants acknowledged the prevalence of mathematics anxiety in their classrooms, and throughout their teaching careers. They both had a significant amount to contribute to this overall theme, which is why it has been divided into three subthemes. Firstly, I will discuss these teachers’ understanding of the causes of mathematics anxiety, specifically related to students’ past experiences with this subject, and also the impact of their current learning environments. Secondly, I focus on how they worked to overcome students’ mathematics anxiety by creating a welcoming environment and emphasizing active student engagement. And last, I report how these teachers used elements of the Tribes program to create a collaborative and supportive classroom atmosphere. All three subthemes will highlight participant responses and connect with the research literature in this area.

4.2.1 Teachers believed that mathematics anxiety can be caused by previous experiences that students bring with them or due to their current environment

When determining the cause of mathematics anxiety, based on participant responses, I constructed two categories: 1) recognizing that students have had negative past experiences with
mathematics, which they bring with them, and 2) the conditions of their current classroom environment. Throughout their lives, students will encounter many situations that may cause mathematics anxiety. Participants observed that some of the earliest experiences several students have with math stems from within their homes, which may be where their mathematics anxiety first developed. Both participants believed that parents impact their children’s perceptions of mathematics and their attitudes towards this subject can be attributed to mathematics anxiety. Katherine explained that sometimes parents accept that a struggle with math will be inevitable, as they say:

‘It’s okay if they’re not good at math, I’m awful at math’ or ‘I’m bad at math’ or ‘I can’t help them with their math homework.’

This type of attitude allows students to think that it is an acceptable way to feel about mathematics and that their struggle is expected because it is “hard,” which can lead to avoidance of the subject and eventually, mathematics anxiety. This supports the research done by Finlayson (2014) who found that when there is no encouragement given by family members or when students constantly hear that math is difficult, they are more susceptible to having mathematics anxiety. She also found that when there is little to no support at home, students are less likely to engage in mathematics activities in school. Moreover, research suggests that when students respond incorrectly to questions, they fear getting laughed at by their peers for not knowing the answer and often times feel inferior (Finlayson, 2014). In light of this, it was no surprise to me when Dianne mentioned that if a child had been put down by a student, or even a former teacher, he or she will be more likely to develop math anxiousness.

According to both participants, one of the most common causes of mathematics anxiety is test anxiety. Dianne explained that she would have students miss class on days that a test was
scheduled. This information mirrors Finlayson’s (2014) research in which various reasons for test anxiety were described. For example, the fact that students would draw a blank on these assessments, they crammed before the tests, they were not well prepared because they did not complete all the assignments, or they completed the work without fully understanding the processes. Regardless of the underlying cause of test anxiety, students who had negative experiences with math tests and obtained low scores on these assessments, tended to lack self-confidence in their abilities and, as a result, were at a greater risk for developing mathematics anxiety.

In addition to previous negative experiences with mathematics, participants indicated that students’ current learning environments impact the likelihood that they will have mathematics anxiety. The role that teachers play in the development of a child’s mathematics anxiety is unparalleled. Firstly, if a teacher was taught through the traditional approach to mathematics, in which the emphasis was placed on rote memorization, then they potentially lack complete comprehension of mathematical concepts (Geist, 2010). For this reason, many teachers do not feel comfortable teaching mathematics and develop mathematics anxiety. Dianne was well aware of the existing research around teachers’ mathematics anxiety and stated that another cause could be teacher translated anxiety. She noted:

There are lots of studies out there, that if teachers have math anxiety, then that gets picked up in the kids – that could be subconsciously or more overtly.

Additionally, she also emphasized the value of providing students with feedback on assessments. When students receive low marks, teachers should aim to provide some constructive feedback for the child in an attempt to show that their efforts have been acknowledged. Dianne noted making comments like, “I really like the way that you did this...,” is more helpful to students
than just seeing a big “X” on their page. Feedback allows students to not only feel satisfied with the grade they received, but also recognize where they lacked understanding and where they can learn from their mistakes.

Lastly, both participants stated that teaching styles and instructional strategies make an impact on students’ levels of mathematics anxiety. They said that if the content was boring and not engaging for them, then students were sure to tune out and have gaps in their understanding. Also, they stated that many students would resent being in a class where an authoritarian teacher fed them facts through a textbook. This supports research done by Finlayson (2014) who found that many of the traditional delivery methods of math catered to an increase in mathematics anxiety. Some of these factors include obedience to the fixed curriculum, textbook-based learning, teachers give information and students receive it, teachers hold an authoritative role, and students work individually (Finlayson, 2014). Furthermore, when teachers demonstrate a lack of care for student learning and are more focused on completing the curriculum, they tend to use textbooks as the basis of their resources and emphasize computation skills. In this fast pace teaching style, there is a greater emphasis on memorization and knowing how to apply the formula instead of focusing on understanding the mathematical concepts (Finlayson, 2014). These findings are significant because teachers can make a conscious effort to be aware of the way they approach mathematics in their classrooms. As Eldridge Cleaver said, “If you’re not a part of the solution, you’re a part of the problem.”

4.2.2 Mathematics anxiety can be overcome by creating a welcoming environment and by emphasizing student contribution through active engagement

As research suggests, there are many different causes of mathematics anxiety and the chances of having students with this phobia in our classes is inevitable. However, if teachers are
equipped with the tools and knowledge necessary, they can help their students overcome this learning impairment. Through conducting my interviews, I have come to learn that there are two major methods teachers can implement to support their students: 1) by creating a welcoming environment, and 2) providing all students the opportunity to make contributions.

First, I learned that by creating a welcoming environment, teachers are able to aid their students to overcome mathematics anxiety, since they are able to create inclusion within their classroom and eventually build a community. Both participants attempted to foster their communities using the Tribes process of teaching and learning. The first step is to ensure every child feels safe and included in the learning space. Typically, in the beginning of the year, most students come in feeling nervous, timid, and reserved; this tends to last about a few weeks, until they feel more comfortable in the class. When a child has mathematics anxiety, they avoid situations in which they must engage in the subject material. However, by creating an inclusive environment for students, teachers are able to help those students overcome this anxiousness and feel safe enough to make a mistake and learn from it. Dianne mentioned: “kids can reach their maximum potential if we provide an atmosphere of emotional, social, physical, and intellectual safety for them.” This is very much in line with the mission of Tribes, which is “to assure the whole development of every child so that each has the knowledge, skills, and resiliency to be successful in this rapidly changing world” (Gibbs, 2006, p. XI). Katherine explained that whenever she noticed students showing signs of mathematics anxiety, such as hesitation when answering a question or refusing to participate, she would go back to the community agreements and address them as a whole class. This way, she reminded her students of the expectations put in place for the entire class to ensure that they have been acknowledged by everyone. Then, she
would have a private conversation with the student and work on resolving the issue. This is how Katherine worked to maintain a safe and inclusive environment for her students.

Furthermore, there are a few specific ways that teachers can create a welcoming environment to ensure all students, especially those with mathematics anxiety, feel safe and included. Research suggests that having varied assessment practices such as projects, checklists, anecdotal notes, conferences, in addition to tests, is beneficial for a diverse range of learners (Van de Walle et al., 2014). However, just the word “test” can cause unwanted anxiousness. So, Dianne suggested changing the language around this form of assessment and calling them “quizzes,” so students do not feel excessive pressure to perform well. She also suggested that playing classical music, during a quiz, creates a relaxing environment for students; Mozart is recommended as his music has been researched to create synaptic connections in mathematics. Also, in the beginning of every quiz, Dianne put a “feeling question” as an emotional check in for her students. She asked:

How are you feeling about the quiz? What did you do to prepare? How do you think you’ll do? And then at the end, she would, again, ask – How are you feeling?

This allowed her to get a sense of where the math anxiousness was on every quiz. Also, students do not get asked that very often and it gave them a confidential voice. She noted that many of the students would answer with, “I’m really nervous,” but by the end of the quiz, their response would change. She found this to be beneficial when talking to parents because they were able to see the assessments and understand what their child was feeling at that moment.

Once students have moved into the stage of community, in which the entire class is in unison, the mathematics anxiety is, for the most part, alleviated. My participants have used Tribes throughout the year as a means of prevention of this phobia, and as Katherine stated,
students feel safe in their community. At this stage, students are well aware of their roles and expectations in the classroom; the four Tribes agreements have been embarrassed and their behaviours reflect this. The culture of acceptance has been set up and for that to happen, students are attentively listening to one another so that when one student shares something, they know that nobody will ridicule them for it. Additionally, community circles are encouraged to be used frequently, as they are key to creating a welcoming environment for all students to express themselves.

Second, I learned that when working in their Tribe groups, students feel valued when they have a contribution to make. However, the opposite is true too; if students feel they do not have anything to add, they feel self-conscious about their learning abilities. For this reason, it is our job, as teachers, to change their concept on what making a contribution means. Since students are in Tribes and working together with a small group of peers, the stage of influence is vital for this redirection of opinion. Katherine referred to “Tribes talk time” as every groups’ opportunity to share their ideas with their tablemates and if someone does not have anything to contribute, this allows them to be influenced by what has already been shared. Through talk time, learners be assisted by working with others who are ‘more knowledgeable’ and can be scaffolded in a manner that is reminiscent of Vygotsky’s zone of proximal development (1978). It is through this peer support system that learning can occur and all students feel capable of sharing the ideas during the whole group discussion.

Additionally, through authentic challenges and active participation, all students are able to make contributions. By having an engaging mathematics program, students will feel inclined to get involved in any activity. Teachers can rely on the dynamic strategies available in the Tribes manual to find innovative ways that get their students up and moving. For example,
“Mingle to Music” is a popular activity that both my participants recommended. This activity is where students dance around as music is played and when it stops, they must get into a partnership/group to have a dialogue. Teachers can use this strategy for academic work and have students discuss a problem or for the purpose of community building, in which students can engage in a casual conversation with peers. The importance of actively engaging students and creating activities that are interactive, as well as student centered, allows children to construct meaning and knowledge, as opposed to passively taking in information (Ellis & Berry, 2005).

One of the four Tribes agreements is giving students the right to pass/the right to participate. This is what Dianne had to say about it:

Right to pass I use as a democratic right, but it’s not a right to pass when there’s work that I want to see. Right to pass for me, is around feelings. So, when we’re in a pairing or a community circle, they have a right to pass on sharing personal things. Academic work – not so much. They can have a go around, to buy them more think time, but I still expect them to contribute to the group.

This was surprising to me, since I thought teachers used the right to pass for academic work as well. However, after learning about the terms and conditions she had put in place for the use of this agreement, I agree that it should be used in terms of personal feelings, rather than work. I believe this provides students with a sense of accountability, as they must be engaged in the activities and work, which will allow them to contribute something meaningful to the whole group discussions.

4.2.3 Students can be taught to avoid mathematics anxiety through cooperative learning in small groups and by fostering a positive and supportive classroom atmosphere

In addition to helping students overcome mathematics anxiety, teachers can use Tribes to teach their students how to avoid it. Through analyzing the information provided by my participants, I have categorized this into two main ways: 1) cooperative learning in small groups,
and 2) by fostering a positive and supportive classroom atmosphere; each one of these methods contains aspects that must be integrated in order to achieve successful outcomes.

A vital component to the effectiveness of the process is to have tribes or small groups, in which students can work together to accomplish tasks. Within this framework, it is optimal for students to share ideas with their tribemates, as a means of engaging in cooperative learning. Morris (1981) found that when “working together in small groups, it is deemed to be less threatening, and learning is often deeper, since students are explaining to each other and thinking aloud” (p. 416). When students are given a task and share their understandings in their groups, they are able to demonstrate their thinking and facilitate learning to their peers. The pressure is alleviated as students are more concerned about sharing their opinions than the correctness of their answer and being selected at random. Moreover, when reporting back to the whole group, Katherine found that when students shared an idea that was not theirs, they gave credit where it was due. She noted that students would often say:

‘My tribe thought… or ‘My tribe said this…’ or they’ll even name someone in their tribe. This way, students did not feel self-conscious for feeling as if they took someone else’s idea and instead, acknowledged that they were simply sharing it. It allowed students, who did not have an understanding right away, to share someone else’s learning, which in turn helps build their own knowledge of the concept. Ross (1995) found that “by giving explanations, students become conscious of their thoughts and recognize their ideas” (p. 411). Dianne’s method of sharing ideas with the whole class, using the document camera, supports this research. Here, her students were able to share their thinking aloud, while the others provided feedback on the work being showcased. She said:
My kids got really good at being able to say if it wasn’t the best strategy, or good job we liked this, or have you thought about this…? So it wasn’t the teacher giving the feedback, it was from the kids, and they felt empowered.

When students are able to assess each other’s work and provide areas of improvement, they are learning to think critically and are becoming active agents in their comprehension of concepts.

When students are engaged in cooperative learning, my participants emphasize the importance of establishing a sense of accountability, so that each group member is actively engaged in the learning process. First and foremost, inclusion must be produced, in order for students to feel comfortable in their tribe and be able to openly express their opinions. Katherine stressed the importance of forming that sense of belonging because then students will not feel distraught if they make a mistake. Similarly, teachers can guarantee student accountability by assigning roles, within each tribe, which will allow everyone to be responsible for a different task to contribute to the group’s overall success. Dianne believed that by providing students with task oriented roles, they will be actively engaged, and each child knows what he or she is expected to do. However, Katherine said that she found assigning roles to be restrictive and tends not to do so anymore. Instead, she said that:

I would talk about the roles, but I would let them fit the roles that they felt comfortable fitting that day and as long as everybody is engaged in some way.

King (1993) conducted a study that focused on what happened when students got an opportunity to switch roles in their groups, to allow everyone to be involved in the various aspects of the experience. It was found that the lower ability students remained passive and the high ability students dominated, even when it was a low ability students’ turn to lead the group (King, 1993). This indicates that the success of cooperative learning is dependent on having clear expectations and instructions for each role. Teachers must explicitly define the duties of each member in order
to effectively implement the assigning of roles within groups. Educators should act as a guide on the side to help facilitate and monitor activities in each tribe, providing support where needed. This will allow the lower ability students to gain assistance from the teacher when needed, instead of being dominated by the other members of their group and becoming a passive learner. Despite their differing opinions on assigning roles within groups, both participants emphasized the importance of small group collaboration to foster math talk.

The foundation of cooperative learning is the ability to actively discuss mathematical concepts, which evidently strengthens students’ own understanding of what they are learning. Dianne believed that students should be able to explore with manipulatives and collaborate with peers, in order to gain a fuller understanding of mathematical concepts. She cited the work of John Hattie, suggesting that in his book, Visible Learning for Teachers, working with peers and collaborative work was rated as one of the most effective strategies used by teachers. Furthermore, she acknowledged the importance of engaging in math talk, not only within the different tribes, but also in the classroom. She mentioned that we must:

Encourage kids to come up with a fuller answer, not just write the number down, but to go through processes and to be able to share how they got to that stage. They need to be able to explain their thinking and to do a think aloud in math. And if they are able to do that with another partner, then that helps to reinforce if that’s an efficient strategy.

Dianne’s claims are supported by research done by Hufferd-Ackles et al. (2004), who found that the “discussion of mathematical ideas provides opportunities for students to reason, defend, and prove their conceptions to one another” (p. 113). Math talk allows students and teachers to engage in discussions around how and why they approached mathematical problems.

The second method which educators can implement in teaching their students how to avoid mathematics anxiety is by fostering a positive and supportive classroom atmosphere. This
can be done through the constant use of incorporating and modelling the four Tribes Agreements. Both participants agree that spending time in the beginning of the year, and then subsequently reinforcing the agreements daily, helps build a positive classroom climate. Dianne explained that teachers and students must work together to understand what these agreements look like, sound like, and feel like, to ensure each student is well aware of the norms and expectations in the class. She suggested that through this understanding, the basis of group functioning is established. As previously stated, she mentioned that:

Kids can’t talk about math until they feel comfortable with each other, they’ve been taught how to listen, they’ve been taught the norms in the class, about what respectfulness is.

There is a transfer of responsibility from teacher to student, as they must honour and monitor the use of the agreements within the classroom environment. Dianne also mentioned the importance of discussing mutual respect, in terms of what it means for the environment. I found this interesting because many times mutual respect is taught in terms of how we should treat one another, yet it is also important to discuss it in terms of the learning space. In addition, mathematics anxiety increases among students when they get an answer wrong in front of their friends and also when they feel that a question they have may be seen as unintelligent by their peers. Morris (1981) conducted a study in which it was found that teachers can model desired behaviours and change students’ negative perspectives on mathematics by creating a positive and supportive classroom atmosphere. In this space, students are respectful of their peers and do not ridicule them if they need to ask for clarification. If students do not understand what they are learning and are too anxious to ask questions, this will only increase their anxiety, which is why it is essential to introduce the Tribes process at the beginning of the year (Finlayson, 2014).
In addition to having a positive classroom climate, ensuring that students are supported by their peers is imperative. Since a lot of the work students do is in their tribes, it is important that they feel encouraged and welcomed within their groups. Dianne emphasized the constructive role of peer learning and allowing students to build close relationships within their tribes. She said:

You have to have really good group processes in play. Kids need to know how to work together. They need to know how they listen and how they talk to one another in order to set up a conducive math environment.

Katherine also recognized the importance of working collaboratively in small groups.

I find it really powerful because sometimes they just get into frustration mode on their own and all they need is having the opportunity to talk things through. So doing problems in tribes, or partners in tribes, is fairly nice when getting into a complex problem.

This notion of working together to accomplish tasks and solve problems is very much in line with research conducted by Van de Walle et al. Their study found that “a range of knowledge may be out of reach for the individual to learn alone, but its accessible if the learner has the support of peers or more knowledgeable others” (Van de Wall et al., 2014, p. 6). In order to ensure student success, teachers must recognize the strengths and needs of their students and place them into a tribe, accordingly. This similarity with my interview finding demonstrates that students have individual skills and abilities that they can contribute to their group in a variety of ways.

One aspect that I had not considered and found surprising was how much importance was placed on the Tribes trail. Through my interview with Dianne, I slowly began to realize that this trail was the foundation of building a classroom community and understanding how it works was essential. Even though the process begins at inclusion, then moves to influence, and finally ends
at community, we must understand that this process is fluid; you need to go back and forth through the stages whenever needed. For example, when a new student arrives, you go back to inclusion and use those strategies. Dianne mentioned: “I often used it when I felt a disconnect with my kids. We’d stop and we’d go back to inclusion – let’s talk more about who we are and connect again.” I learned that the stage of inclusion is throughout the year and it is not just about student to student, it is about student to teacher, and teacher to student and really building those strong relationships. Dianne also explained that at the stage of influence, when students start to demonstrate behavioural issues due to their levels of comfort with one another, is when they would learn about I-messages and how to use them more effectively. This allows everyone to take ownership of their own feelings and express themselves, without putting the blame on others. Understanding the different stages of the Tribes trail will help teachers establish the group dynamics, which remains the same for every subject. Furthermore, Dianne suggested that teachers put the poster of the Tribes trail in their rooms to track class progress by marking it with an arrow. She said:

My students knew they reached the stage of community because I would move an arrow on my Tribes trail in the classroom. So they knew the signs of what it meant to have an effective classroom.

As the arrow is moved along the trail, the levels of mathematics anxiety decrease. Students begin work as a support system and are able to articulate their mathematical knowledge. Since they feel secure amongst their peers, they are able to take risks and engage in novel mathematics activities that would have caused anxiety in the beginning of the year.

4.3 Teachers believe that getting to know your students will allow you to select the Tribes strategies and elements that will yield the greatest outcomes
The Tribes manual is a valuable resource that provides teachers with the background information needed to effectively implement the Tribes process. It contains general descriptions of various strategies, which can be used in the classroom for all subject areas. There is a matrix in the back of the book that pinpoints strategies that are appropriate for the three stages of the Tribes trail. The book teaches you about the strategy itself, but does not explain how to incorporate it into mathematics – this must be done by the teacher. Dianne said:

If you’re working on your learners getting to know one another, it will tell you what activities you can work on. And then, okay, how can I do that in a math class? If you’re in the stage of influence, you have kids that don’t really work well in your groupings, then go to that matrix and look at what are some of the strategies I can teach for influence? And then think how can I use them in the math class? So that matrix is key.

What I found surprising is that teachers can use just about any strategy and alter it to be used in their mathematics program. My participants recommended using the engaging strategies, that get students up and moving, as students enjoy these more. However, Dianne stressed the importance of getting to know your learners before selecting certain strategies. She explained that her kids loved music, which is why in that particular class, they used the strategy “Mingle to Music” often. Ultimately, choosing strategies to implement are easiest when students’ interests, strengths, and weaknesses are identified.

Furthermore, when introducing a new strategy, my participants suggested that teachers remember to model it at a personal level before using it at an academic level. According to Dianne, this is the biggest mistake Tribes trained people make. Due to the novelty of the process, teachers tend to forget that you need to teach the strategy to students first, just as you would anything else. Dianne provided an example of how she would use the 4 corners strategy at a personal level, before applying it to mathematics.
What I would do is – ask how are you feeling today? I would have a picture of a river, a mountain, a lake, and a forest. And they would get used to that strategy at a personal level; this is what it means to me. So then, I could get into an academic level and I may have a formula in each of those 4 corners – tell me what formula will get this answer on the board. They knew the strategy, it was engraved, then they could apply it to a content-specific area.

Dianne also mentioned that as a teacher, one must be creative when thinking about how to use specific strategies for mathematics. She recommended inviting students to help come up with ways to apply known strategies into this subject, as well. For example, saying, “We really know the strategy Mingle to Music, how do you think we can relate that to math?” This way, the teacher has more support and does not always have to come up with new techniques independently.

As previously mentioned, Dianne would frequently use this Tribes strategy. The way that she incorporated mathematics into this method was as follows: when the music would stop, she would tell students to, for example, get into the square root of 25. And then the students would shout out 5 and create a group. She also used this strategy as a means of promoting collaboration and conversation on mathematical concepts. Dianne explained that she would ask students what questions they still had about the unit they were learning about, for example integers. This allowed students to reflect on their personal learning and understanding of the content and be able to share it with others. This strategy could also be used as an exit ticket because students are actively engaged in discussions about their thoughts and feelings on a subject and the teacher can circulate and overhear some common concerns.

Another specific strategy that was used by both participants was that of community circles. The more common way to use this strategy is to have a whole class discuss to address an issue, which is the main technique that Katherine used. In contrast, Dianne would always have a community circle in the opening of the week, the closing of the week, and then throughout. The
size of the groups varied depending on the task she needed them to do. Sometimes it would be in
the students’ math groups, typically a quad, and they would have a talking symbol to pass
around. She described what students would talk about using the following example:

So it might be, I want you to say what number you’re feeling like today – so it would be
more kind of like a check question [that] I would do.

She also discussed the importance of not always having to push the tables aside to create room
for the whole group community circles. Her class found creative ways of making a circle around
the existing desk formation and the activities would be fairly quick. For example, at the end of a
mathematics lesson, she would ask how are you feeling and students would reply with a single
word – an I-feel telegram. This is significant because it illustrates that doing community circles
does not have to be strenuous but, can be done as a consolidation piece and used as an exit ticket
for students. There are many ways that community circles can be creatively incorporated into the
classroom, for all subject areas, including mathematics.

Generally speaking, some of the Tribes strategies that these teachers successfully
incorporated into their mathematics program include the following: gallery walks to share
student work, think-pair-share to engage in collaborative math talk, my life in numbers as an
inclusion exercise to communicate information about students in mathematical formulas, one ball
– three ball pass when talking about math concepts, 4 corners as a diagnostic to learn more about
what students know about rates and ratios in the world, and stand on the line when discussing the
different ways to represent values from 0 to 1 (e.g. fractions, decimals, words, etc.).

4.4 Teachers notice academic, as well as, social benefits for students through the
implementation of Tribes in the mathematics program
There are many academic benefits of effectively executing the Tribes process within one’s mathematics program, as stated by my participants. Katherine noted that students’ overall confidence and abilities as learners was positively impacted, which was a result of their active engagement in their own learning. She also mentioned that: “I do find the variety of techniques attribute to their overall unit understanding and their end of the year understanding.” There are minimal gaps in knowledge, due to the holistic understanding of concepts. This benefit is further recognized by my participants because they affirmed that they witnessed an improvement in student grades on various assessments. This was a finding that I had anticipated, since the research recognizes that when teachers move away from the sage on the stage model and more towards a student-centered approach, it allows them to more genuinely support students by “giving feedback, helping students, and facilitating student communications” (Gibbs, 2006, p. 52).

Another expected benefit was the increased levels of math talk in the classroom, which was noted by both my participants, as gradually moving from low to mid to high levels of engagement. Dianne believed the reason for this outcome was: “Because [of] the ability to articulate what students were feeling, what they were thinking because of the norms that were set up in the classroom to make a safe math culture.” Additionally, one could extend this to include collaborative processes, which are centralized to Tribes, as being another reason for the increased level of math talk seen by these teachers. This is very much in line with the research done by Finlayson (2014) who states that since students are “working in groups, where they have opportunities to talk about mathematics, ideas of all students are respected and listened to, students are able to share their thinking and work through a variety of steps of a solution” (p. 111). Collaboration allows students to engage in mathematics talk by explaining what they
know to their peers and providing opportunities to understand various strategies for mathematical problem solving. This notion is consistent with Tribes, since the process deems the function of learning groups to enhance student knowledge through cooperative work.

From the aforementioned benefits, one can acknowledge that there was an increase in the levels of participation from students. Dianne explicitly discussed the impact Tribes had on her students with special needs and the introverts in the class. She stated:

Kids that would normally not talk, were putting their hands up. Those kids that would never speak. Or at least they were speaking out in groups and I could hear them. Or they would come up during a group presentation and at least say something.

This notion addresses one of the unanticipated outcomes of using Tribes, which is that “more special education students could be mainstreamed into regular classrooms” (Gibbs, 2015, “Second Design: Tribes Cooperative Learning,” para.3). I believe this finding illustrates the power of the Tribes process and how effective it can be when a safe and inclusive learning environment has been effectively established.

The most anticipated and significant finding on the benefits of implementing Tribes is that these teachers noticed a decrease in mathematics anxiety. Both of my participants believed that the community aspect allowed students to feel comfortable and safe enough in their classroom to answer questions and take risks in mathematics. Katherine said that her students felt good about themselves as learners, were able to learn in their own style without having to worry about their peers saying anything to them. In terms of mathematics anxiety, Dianne noticed a reduced number of absentees during a quiz in math. Moreover, she stated:

[Tribes] allowed my more introverted kids and those who didn’t have necessarily high math smarts, to feel comfortable, to take a risk, and put up their hand and ask a question.
This is what I had hoped to find when answering my main inquiry question and conducting my research. I was delighted to learn that by promoting an inclusive classroom environment, these teachers enabled their students to feel at ease, so they could express themselves, answer and ask questions, without the fear of being ridiculed by their peers. And, as a result of their efforts, mathematics anxiety, as well as test anxiety, was alleviated. Gibbs’ (2006) research on the importance of and enforcing the four Tribes Agreements supports this finding; by reminding students of and promoting these agreements daily, children were more inclined to think before they speak. This finding is significant because all across the province, numeracy scores are declining and mathematics anxiety is one of the main attributers to the low student achievement and we want to reverse this trend. My research study suggests that mathematics anxiety could be alleviated through the implementation of Tribes, according to a small sample of educators.

There are more than just academic benefits attributed to the use of Tribes, since there are social benefits that are a result of using this process as well. Katherine was inclined to establish Tribes in her classroom in order to allow her students to feel a sense of belonging to a community and creating interpersonal skills. She knew, based on her own school experiences, that community could be a significant missing part of the learning environment. She recounted:

Sometimes not feeling included, sometimes feeling shy about giving an answer. There was quite a bit of bullying going on back then too. And just not feeling part of a community, not being supported by my peers.

The Tribes processes was aimed to avoid the feelings and experiences described above; it was designed to build inclusion and a sense of community for each student in every classroom, in order to overcome the risk of seclusion and “acting-out” behaviours (Gibbs, 2015). If students felt a sense of belonging, they would feel safe enough to respond to challenges and therefore reduce mathematics anxiety because they would not be fearful of being ridiculed for getting an
answer incorrect. Additionally, Dianne expressed how her students and parents loved the process. She mentioned that parents would come back to her the following year and say that their child was happiest in her class and now, they are having a rough year and having anxiety. Not only does this demonstrate the benefits that Tribes has on students, but it also emphasizes the importance of having a whole school approach to this process. Throughout the year, students work towards feeling safe in their classroom community and letting their guard down and the next year all of their progress can be lost if they have a teacher who does not use Tribes or similar community-building practices. As Dianne mentioned, this may lead to students becoming more anxious and quite possibly having more severe issues in the future.

Another benefit of using Tribes is that it provides teachers with strategies for teaching kids how to work with one another and develop problem solving skills. When time is taken, at the beginning of the year, to establish norms and build community, teachers are less likely to stop and address behavioural issues towards the end of the year. Since the class knows how to deal with conflict, they are able to resolve issues without any interruptions to the curriculum delivery. Dianne explained that:

By the end of the year, my kids were sailing through the curriculum. They knew how to work together, they knew how to resolve conflict quickly, they knew how to talk to one another. So, I wasn’t dealing with all those behavioural issues in the spring that typically fall in a classroom because my kids had reached the stage of community – and they knew it.

According to Gibbs (2015), this was one of the unanticipated outcomes of Tribes that teachers reported; they noticed that “they did not spend as much time managing their classrooms, and that they had more time to teach subject matter” (“Second Design: Tribes Cooperative Learning,” para.3). This finding is significant because not only are educators able to efficiently do their job and teach students about content in various subjects, but they also enable their class to gain
lifelong problem solving skills. Students are able to successfully express themselves through I-messages, when directly facing an issue, and can also mediate in conflict resolution amongst peers.

4.5 Participants emphasized the importance of developing the concept of Growth Mindset to reduce mathematics anxiety, in both students and parents

When conducting my interviews, I began to see an unexpected theme emerge amongst both participants, wherein they stressed the importance of teaching growth mindsets. Both teachers acknowledged that Tribes fosters an environment for growth mindset to flourish. This was an unanticipated outcome for my research study because I had not initially considered growth mindsets being associated with Tribes. Carol Dweck has largely been involved in the research around this concept and has defined mindsets as, “people’s beliefs about human attributes, including abilities” (2014, p. 10). She states that there are two types of mindsets that exist: 1) a fixed mindset in which “people believe that basic talents and abilities are fixed traits; some people are well-endowed and some aren’t and you can’t do much to change that,” and 2) a growth mindset, which is where “people believe that basic abilities can be developed through hard work, good strategies, and good mentoring” (Dweck, 2014, p. 10). According to my participants, it is vital to teach students to start looking at their learning through a lens of having a growth mindset as soon as possible. One of the most effective methods that my participants mention is by having an open discussion around the topic of making mistakes and emphasizing the importance of the process, rather than the product. Katherine and Dianne acknowledged the benefits of this concept for teachers, since many times we are looked at as having all the answers, all the time. They both felt that they were given permission to be able to tell students that they did not have the answer and gained confidence in telling students that they would get back to them.
One of the foundations of having a growth mindset is to accept that we are going to make mistakes and understand that it is through our mistakes that we learn. One way to approach this topic is directly having a conversation around students’ comfort levels with making mistakes. This allows for teachers to discuss the importance of focusing on the thinking process, rather than the answer. Katherine noted:

Even if it’s not the perfect answer, it’s being proud of your thinking and your journey that is really important. The end answer might have a little mistake here and there, but we’re actually more interested in the process and the thinking.

This supports and creates a connection to the research done on Tribes, which recognizes that when teachers move away from promoting calculations, using standardized algorithms, and the importance of getting the “right answer,” the significance is now being placed on students’ conceptual process to arrive at their answers, supported by the teacher. Additionally, teachers can rely on Tribes strategies, such as gallery walks, to dispel any misconceptions, in mathematical thinking, that arise in student work. This allows students to feel empowered because they are able to recognize the errors and may also provide feedback to their peers, which in turn, enables them to solidify their own learning. Moreover, if a safe and inclusive environment is in place, students who made the mistake will not be ashamed of their work and will instead, learn from it. Gallery walks are an excellent strategy to illustrate to students that there is more than one way of arriving to the final answer. Dianne mentioned:

Allowing kids the freedom to share and explore different answers; there’s more than one way to arrive at the answer, there’s more efficient ways, but there are lots of ways.

I believe this supports what Katherine said about helping students feel proud of the work they are doing. She also stated that students should:
...not worry about being perfect, [they should] worry about the thinking and trying and the thinking through and persevering.

As teachers, we want all of our students to be successful and show what they know. However, when we restrict them to using traditional pen and paper methods, we limit their thinking. This is why we must encourage our students to use the method that works best for them and incorporate multiple intelligences into our assessments. By allowing students the option to select a technique that supports their learning and the way that they understand a concept, we are providing them with the tools needed to succeed. Even though there is an emphasis being placed on inquiry-based and hands-on learning, especially in mathematics, I had not considered this aspect, which is why this finding is significant. Both of my participants discussed the positive outcomes which resulted from integrating multiple intelligences into their mathematics program. Dianne noted that by having a choice board, students were able to select and work in the confines of one of their stronger smarts. So for example, when conducting a summative assessment, she would ask the students to demonstrate all their learning and understanding about a certain mathematics strand; on the math choice board, they had options like ‘create a mind map for the concept, create a rap, create a poem,’ anything that would get students to show their thinking. Katherine also mentioned that it was vital to teach her students about learning styles and allowing them to be comfortable working in their own way, without worrying about how other people approached a task or problem. Also, she noted:

Educating people who are very strong at math, who are number smart, that understanding it’s wonderful, but everybody is good at math in their own way and I think sometimes if you’re very strong at math, you can purposefully or not purposefully make people who don’t think that way feel uncomfortable about their math abilities.
I believe that in order to accomplish the above, Tribes must be established within the classroom, so that a safe and supportive environment can allow all students to feel proud to learn in their own way.

Teaching students to have a growth mindset is only half the mission. If children learn to change their thinking at school, but go home to a family that have a fixed mindset, there will be a backlash in the progress made. As a result, teachers must educate parents about what it means to have a growth mindset and how they can support their children at home. Katherine explained that during her school’s meet the teacher night, she introduced the concept to parents through a video by Jo Boaler, another expert in this area of work. She said:

I found that just those three minutes of watching that video and talking about it and talking about our school initiatives, are really powerful for parents. And hopefully, through more parents meetings, I’ll feel more comfortable breaching the topic and helping them understand growth mindset and that sort of thinking of we’re not so good at math is just not a helpful way to think and not a powerful mindset to have to help you in the future.

Through discussions, she was able to explain to parents that praising their child’s efforts, rather than their abilities and intelligence, creates a growth mindset. I believe it is important to provide parents with the language they need to help support their children. For example, students are more likely to have a fixed mindset when they are given praise such as, “Nice job, you’re very smart,” when compared to students who are given compliments like, “Nice job, you worked very hard,” which is more likely to develop a growth mindset. Research shows that students who understand that their brain grows through learning from their mistakes, are more likely to show “greater motivation to learn and earn higher grades and higher achievement test scores” (Dweck, 2014, p. 10). Furthermore, Katherine noticed that the video helped parents feel better about themselves as learners and they understood that it was acceptable not to be perfect in mathematics, which is a vital step towards student success.
Overall, this finding surprised me because I had not made connections from Tribes to growth mindsets. My research has been primarily focused on and narrowed into the Tribes process that I had not considered a combination of strategies to support students. This finding signifies that there are additional strategies available, that when used in conjunction with Tribes, can allow for an environment that fosters the maximum student achievement.

4.6 Conclusion

In this chapter I reported the research findings and discussed them in relation to the literature. I identified five overarching themes, as well as multiple supporting sub-themes that offered responses to my research questions. My research aligns with studies conducted in the past, in various ways. For example, the causes of mathematics anxiety and strategies to overcome it. Also, my study found that teachers noticed academic, as well as, social benefits for students through the implementation of Tribes in their mathematics program – this also aligns with the existing research. My research also makes a unique contribution to the literature because I was able to find a correlation between the implementation of Tribes and the lowered levels of mathematics anxiety in the classroom. The most significant finding, which I had not anticipated, was the importance placed upon the concept of growth mindset to reduce mathematics anxiety. This finding promotes the use of Tribes, along with this ideology, to create the most conducive environment for student development and growth. In chapter 5, I report the implications of my findings, specifically for myself as a new teacher and more broadly for the educational research community. I also identify areas for future research, based on what I have found, and make recommendations for those in the field of education.
Chapter 5: Implications

In this chapter, I review the findings of my research study regarding how elementary teachers are implementing Tribes Learning Communities (TLC) within their mathematics program and whether this has any implications on students’ mathematics anxiety. Moreover, I discuss the implications of my research in terms of the larger educational research community and personally, as well. I then make some recommendations for improvement in mathematics education and conclude by addressing further areas of research.

5.1 Overview of Findings & their Significance

The previous chapter aimed at analyzing the data and to report findings, through participant responses and connections to the literature. Five overarching themes, as well as multiple supporting sub-themes, were established to better understand the various aspects of this research study.

First, I discussed educators’ attitudes towards mathematics, both as a student and a teacher. I found that participants began to have negative experiences in math as they moved in to higher grades and the concepts became more complex. Additionally, the negative experiences were, in part, due to teacher-directed learning, in which the emphasis was placed on obtaining the “right” answer, rather than students’ thinking processes. This supports research conducted by Gibbs (2006), in which she noticed that when classrooms are teacher-centered, they lack “the transfer of responsibility to students themselves for their own learning, opportunities for students to use inquiry, to construct meaning, and apply concepts learned” (p. 50). The most significant finding was that despite their own negative experiences, these teachers decided to end the cycle of negativity towards mathematics and committed to teaching their students using a more
supportive approach. This contradicts the existing research, which suggests that educators tend to teach the way they have previously been taught, as students.

Second, I analyzed a central theme of my research – mathematics anxiety. I created three subthemes to elaborate on my findings. The first area focused on the various causes of mathematics anxiety. It was here that I found that some of the causes are due to negative past experiences, which cannot be changed. However, there are other factors which are a result of a student’s current learning environment and the significance is that teachers have the ability to create a conducive learning space for their students to create positive experiences. The second area was concerned with how to overcome mathematics anxiety. I found that one way teachers can do this is by creating a welcoming environment, which builds inclusion and community. This is significant because Tribes fosters the creation of healthy and positive interpersonal relationships to help students feel comfortable (Gibbs, 2006). Also, this allows students to feel valued and respected in their tribe, allowing them to willingly make contributions to enhance personal and peer learning. The last subtheme was dedicated to teaching how to avoid mathematics anxiety. I found that with Tribes in place, cooperative learning could take place effectively. Students were able to freely share ideas, be accountable for participating in activities, and enhance understanding through math talk. This was significant because learning is student-centered; children are actively engaged in their own concept development and are able to explore multiple strategies set forth by their peers (Hufferd-Ackles et al., 2004).

Next, I synthesized what participants had to say about the Tribes strategies they would recommend. I found that knowing your learners is beneficial when selecting and successfully implementing new strategies. Participants encouraged the use of the more vigorous strategies, as they were greatly enjoyed by students. I also found that teachers must model new strategies at a
personal level before using it for academic work, to ensure students have complete understanding of the activity. The significance of this section was that any activity can be used and applied to mathematics – you just need to think creatively. Also, inviting students to come up with new ways to use a known strategy in math is one method to work together as a community.

Following this, I explained the implications and benefits of using Tribes. First, I noted the various academic benefits this had, such as students becoming actively engaged in their own learning and creating positive experiences. Also, there was an improvement in grades because there were minimal gaps in student knowledge and understanding. Moreover, math talk increased because students are involved in collaborative processes and are able to better articulate their thinking (Finlayson, 2014). This was significant because I found that there was an increase in participation for all learners, including those with special needs and introverts. This finding supports that of Gibbs (2015) research that found “more special education students could be mainstreamed into regular classrooms” when using Tribes (“Second Design: Tribes Cooperative Learning,” para. 3). I also uncovered the most important finding for my research study – proof that these teachers noticed a decrease in mathematics anxiety due to their use of the Tribes process. This finding was significant because numeracy scores have been declining across the province and by recognizing that there is a relationship between the implementation of Tribes and decreased mathematics anxiety, we can encourage more teachers to effectively integrate the process in classrooms to create more positive outcomes for our students. I then discussed the multiple social benefits due to Tribes, such as how the process allows students to build on their interpersonal skills as they cultivate relationships with peers and teachers. Additionally, students are able to acquire and develop problem-solving skills, which leads to a decrease in behavioural issues. This is significant because students can take ownership of their conflicts and
independently resolve them, so that educators can concentrate on teaching the curriculum and get more accomplished without interruptions.

Lastly, I discussed the importance of teaching students to have a growth mindset to reduce mathematics anxiety, which was additional finding that I had not anticipated to find. Both participants acknowledged that Tribes fosters an environment for growth mindset to flourish. They emphasized framing the language to be positive, so students could see making mistakes as a means of learning and growing, rather than getting upset about it. I also found that there was more of a focus being placed on student processes, instead of the answer. This was significant because we are now allowing students to explore in their own learning style. Also, we are placing an importance on multiple intelligences in the classroom to provide students with the opportunity to use their strengths, setting them up for success, and no longer confining them to traditional pen and paper tasks. Another important finding from this theme was how teachers can change the parents’ mindset from fixed to growth to aid their child’s learning. This was significant because I learned how important the language we use with students can be, in terms of praising them for their efforts, rather than complimenting them on their intelligence. The former is more likely to develop a growth mindset and the latter, a fixed mindset.

5.2 Implications

In this section, I discuss the implications that my research has for the broad educational community, which includes teachers, parents, school boards and even the ministry of education. I then discuss what impact my research has on my personal teaching practice, as a new teacher.
5.2.1 Broad: The Educational Research Community

The findings from any research impact a variety of groups of individuals in the broader scope; there are implications for teachers, parents, school boards, and even the ministry of education. In regards to the impact on teachers, I believe that new and experienced teachers can gain a lot from my research. For example, they may want to transform their learning environments for their students to be conducive to those that have mathematics anxiety. What they might do is build inclusion within their classroom, create Tribes so students feel supported, and even introduce the four agreements so students feel respected and that their opinions are valued. Also, by creating Tribes, teachers are enabling students to engage within a collaborative setting and to express their thinking with their peers. As my research indicates, when students discuss ideas and their thinking in partnerships or groups, they are less pressured when reporting back to the whole group because they are able to share any idea, even ones that are not their own. As a result, mathematics anxiety is reduced and students feel more comfortable participating, which is an important aspect for teachers.

My research has implications for parents, as well, as they are a vital component in their child’s learning. There are various reasons as to why parents may be unable to help their child with their homework, including unavailability, conflicting work schedule, and even a lack of understanding. As noted by my research, mathematics anxiety can be in part attributed to parents’ attitudes towards the subject. If teachers promote the concept of having a growth mindset, it enables parents to change their own attitudes, which positively affects their children’s’ beliefs. My research underscores the significance of parents as positive supports and their role in encouraging effort from their child, rather than refusing to try because of fear of
failure. This is the type of attitude that I would hope many individuals would adopt to decrease the stigma around mathematics education.

My research has illustrated the impact that Tribes Learning Communities can have on mathematics anxiety, as told by a small group of elementary school teachers. Mathematics anxiety impacts low scores on standardized testing, such as EQAO. Thus, the fact that my research indicates that these teachers have noticed a decrease in mathematics anxiety because of the implementation of Tribes, is beneficial for school boards. Since all across the province we are trying to increase test scores, we should consider implementing Tribes, or key elements of Tribes such as to create an environment that encourages understanding of mathematical processes and applying them in a meaningful way for our students.

Although we could create environments to support test-taking, I believe that the bigger issue is with standardized testing itself. Tests create unwanted anxiety, not just in mathematics, and do not effectively assess the true abilities of students. This is why I believe my research affects the ministry of education. There is a lot of research, including my own, that has been done to prove the positive outcomes of collaborative learning. Tribes is a highly supportive process that builds on teamwork and inclusion of peers to succeed, academically and socially.

We must re-evaluate the importance of standardized tests and the implications these have on students’ mental health and wellbeing. If students are gaining valuable knowledge through peer interaction and support, why must their grade be derived from a single test that does not consider individual needs or students’ multiple intelligences? Our world is highly connected and many times one does not work in solitude, so why is there so much emphasis placed on tests? I believe my research challenges this model of assessment and raises some important questions that should be considered by the ministry of education.
5.2.2 Specific: My own Professional Identity and Practice

The reason I decided to conduct this research was to learn more about how to resolve the stigma behind mathematics education. I have learned that mathematics anxiety is a large contributor to this. In order for students to develop a positive attitude, during adolescence and in adulthood, we must build an inclusive learning environment for everyone to explore their potential. Although further research is necessary, my research study has illustrated that implementing Tribes Learning Communities has implications for reducing mathematics anxiety.

As a new teacher, I want to ensure to create a safe and inclusive environment for my students. My goal is to make every student feel valued and respected within my classroom, which I hope to do by incorporating elements of TLCs. Since I have already become Tribes trained, I am aware of the fundamentals that this process entails. However, in order for me to successfully implement it, I must further my professional development and gain insights from experts, such as my participants.

My research has allowed me to understand the seriousness of mathematics anxiety and how it greatly impacts students’ abilities and health. I would like to build inclusion within my classroom first and foremost, so that students are willing to take risks and participate in lessons. I intend to use Tribes Learning Communities as the foundation for the expectations within my classroom. Additionally, I have learned the value of teaching students to have a growth mindset and will emphasize the importance of this concept, through explicit modelling and reinforcement. I want to empower my students to believe that they are capable human beings and they can accomplish whatever they put their minds to. I want to do this by providing my students with choice and ownership over their work. The various choices will allow for multiple
intelligences, to ensure that every student is capable of being successful in the task they select. Also, by valuing student efforts and their thinking process, instead of the correctness of their answers, I will encourage risk taking. Moreover, I am not a mathematician and there will be times where I make mistakes; I will use those opportunities to model the concept of having a growth mindset and learning from my errors.

5.3 Recommendations

After understanding the positive outcomes of integrating Tribes within mathematics programming, I would recommend a few actions to be taken, that will further support this research.

- It is important that school boards require all teachers to be participate in professional development that focus on math talk and collaboration within small groups.

I believe that it is necessary for all teachers to participate in mathematics workshops that will allow them to improve their practice. Since math talk and collaboration are two aspects of the mathematics reform that may be novel to practicing teachers, attending such PD sessions will allow them to gain valuable resources and strategies to implement within their classrooms.

- Each school board should have a team of mathematic experts to facilitate PD in various areas within mathematics

This is important because it will allow teachers with the opportunity to learn from experts. Moreover, some of these professional development sessions may include topics such as, mathematics anxiety: how to identify it and teaching how to avoid it, how to increase math talk within your classroom, how to ease students into having a growth mindset in mathematics, etc.
These sessions can be centralized around the issues that teachers believe to be challenging within their mathematics program. The workshops would ideally be a way to address the concerns that teachers experience so they are able to gain support and resources to move forward.

- Teachers should alter their mathematics assessments to include the notion of having a growth mindset

I believe that if teachers are integrating growth mindset within their practice, then they must also attribute this concept to their assessments. By acknowledging the existence of multiple perspectives, students are able to show their thinking process when answering open-ended questions. I feel that these types of assessments are more impactful, rather than those that require a single right answer. Moreover, this form of questioning provides a window into student thinking and enables educators to inform their teaching.

5.4 Areas of Further Research

When I think about my research, I still wonder what Tribes strategies teachers are incorporating within their programming and which have the highest levels of effectiveness, in terms of student engagement and growth. This would be one area of research that I would recommend be looked into further. Moreover, this would allow new teachers to have a guide of successful strategies to use in their own classrooms and would eliminate the trial and error step when implementing the Tribes process. Also, through my research, I have come to understand the importance of having a growth mindset. Both of my participants mentioned this as being a vital aspect within their mathematics programming. This is the reason why I would like to learn more about the implications of enforcing a growth mindset for students’ levels of mathematics anxiety. Furthermore, my research indicates that there is a relationship between implementing
the Tribes process and the levels of math talk within the classroom. I would recommend this area of research be explored further so that we can understand how and in which ways Tribes is beneficial for increasing math talk. Also, I would like to learn more about the impact of integrating multiple intelligences on mathematics anxiety.

5.5 Concluding Comments

I believe that research should be done not just to further existing research, but also to benefit those directly impacted by these changes – the students. My research illustrates that a sample of teachers have perceived students’ levels of mathematics anxiety to decrease as a result of implementing Tribes Learning Communities. This research demonstrates that when teachers create a safe and inclusive environment in their classrooms, then their students may feel more inclined to participate in risk-taking activities in mathematics. Moreover, with the collaborative processes embedded in Tribes, students may also learn to value learning together using multiple strategies to problem solve. Through a combination of knowledge building lessons focusing on the process rather than product, hands on learning, collaborative processes, and a community building activities, teachers have the potential to alleviate the prevalence of mathematics anxiety that students experience and contribute to positively developing not only students’ attitudes towards math but also their mathematical understanding.
References


Dweck, C. (2014). Teachers' mindsets: "every student has something to teach me": Feeling overwhelmed? where did your natural teaching talent go? try pairing a growth mindset with reasonable goals, patience, and reflection instead. it's time to get gritty and be a better teacher. Educational Horizons, 93(2), 10-15.


Appendices

Appendix A: Letter of Consent for Interview

Date: ________________

Dear ________________,

I am a graduate student at OISE, University of Toronto, and am currently enrolled as a Master of Teaching candidate. I am studying how elementary teachers use Tribes to teach mathematics and to learn from them what implications they believe this has on math anxiety, for the purposes of investigating an educational topic as a major assignment for our program. I think that your knowledge and experience will provide insights into this topic.

I am writing a report on this study as a requirement of the Master of Teaching Program. My course instructor who is providing support for the process this year is Dr. Angela MacDonald-Venic. The purpose of this requirement is to allow us to become familiar with a variety of ways to do research. My data collection consists of a 45-60 minute interview that will be tape-recorded. I would be grateful if you would allow me to interview you at a place and time convenient to you. I can conduct the interview at your office or workplace, in a public place, or anywhere else that you might prefer.

The contents of this interview will be used for my assignment, which will include a final paper, as well as informal presentations to my classmates and/or potentially at a conference or publication. I will not use your name or anything else that might identify you in my written work, oral presentations, or publications. This information remains confidential. The only people who will have access to my assignment work will be my research supervisor and my course instructor. You are free to change your mind at any time, and to withdraw even after you have consented to participate. You may decline to answer any specific questions. I will destroy the tape recording after the paper has been presented and/or published which may take up to five years after the data has been collected. There are no known risks or benefits to you for assisting in the project, and I will share with you a copy of my notes to ensure accuracy.

Please sign the attached form, if you agree to be interviewed. The second copy is for your records. Thank you very much for your help.

Sincerely,

Misbah Din

Phone number: ________________
Email: __________________

Instructor’s Name: __________________

Email: __________________

Consent Form

I acknowledge that the topic of this interview has been explained to me and that any questions that I have asked have been answered to my satisfaction. I understand that I can withdraw from this research study at any time without penalty.

I have read the letter provided to me by Misbah Din and agree to participate in an interview for the purposes described. I agree to have the interview audio-recorded.

Signature: ________________________________________

Name: (printed) ____________________________________________

Date: ___________________________________________
Appendix B: Interview Questions

Section A: Background Information

General Background

1. How many years have you worked as a teacher?
2. What grades and subjects do you teach? Which have you previously taught?
3. Have you ever worked at any other school(s)?
4. Can you describe your current school, in terms of demographics, size, program priorities, etc.?
5. Are there any other roles you fill besides a teacher at your school?
6. What made you decide to become a teacher?

Topic Specific Background

7. Can you tell me about the mathematics program followed in your school? How would you characterize the approach to teaching math in your school?
   a. **NOTE**: Probe as necessary – re: inquiry based, student centered, transmissive, memorization, etc.)
8. How and when did you learn about Tribes?
9. When did you become Tribes trained?
10. What was it about Tribes that attracted you to the process and decide to become trained?
11. What do you believe are some of the benefits of Tribes?
   a. More specifically, thinking back to your experiences in the classroom, what do you believe are the benefits of using Tribes in mathematics?
12. Why did you decide to use Tribes in math?

Section B: Beliefs

13. How did you feel about mathematics as a student?
14. What is your attitude towards mathematics now?
   a. **NOTE**: If they have changed – **ASK**: What do you think is the reason for this change in your attitudes towards math from when you were a student to now?
   b. **NOTE**: If it has not changed probe – re: the experience of teaching math while experiencing math anxiety
15. Could you please share what your mathematics teaching philosophy is, if you have one?
16. How do you believe students should learn math?
17. What are some key pedagogical considerations and approaches that you believe are important and why?

18. What do you believe is the biggest challenge with math education?

19. In your experience, how common is math anxiety among students?
   a. What indicators of math anxiety can you see from students?
   b. What do you believe are some of the causes of math anxiety?

20. What do you believe are some of the benefits of using Tribes for math education?

Section C: Practice/Implications

21. Generally speaking, how do you use Tribes to teach math?
   a. What aspects of Tribes do you draw on and why?
   b. How do your students generally respond to this approach?

22. Can you give me a specific example in which you used Tribes components to teach a mathematics lesson to your students? Be as descriptive as possible
   a. What were your learning goals?
   b. What opportunities for learning did you create? Please tell me what the students did and why
   c. What outcomes did you observe from students? What indicators of learning did you see?
   d. How did you assess students?
   e. What resources did you use to support the lesson? (e.g. manipulatives, media, etc.)

23. How, if at all, do you enact elements of Tribes as responsive pedagogy for students experiencing math anxiety?
   a. Can you give me an example of how you have done this? How did your students respond?

24. Another component of my research is about math talk in the classroom. What are you doing in your classroom to generate math talk amongst your students?
   a. How do the students respond to this?

25. What are some strategies that you believe work well to engage your students? Which ones don’t work so well? Please provide examples that explain your reasoning.

26. Which aspects of Tribes do you believe increases math talk in your classroom?
   a. Why do you feel this way?
   b. What are some indicators of this?

27. How high/low were the levels of math communications in your classroom at the beginning of the year vs. the end of the year?
   a. **NOTE:** If there was a change, **ASK:** What do you think was the reason for the change in these levels?
   b. How do you know this? What are some indicators?
28. Overall, can you summarize what outcomes you have observed from students in math that you attribute to the implementation of Tribes communities in your classroom?

Section D: Support/Challenges/Next Steps

29. What are some resources that support you and that you would recommend for implementing Tribes in a math program?

30. What are some challenges you face when implementing Tribes for math education?
   a. How do/did you respond to these challenges?

31. What advice, if any, do you have for beginning teachers who are committed to implementing Tribes to support their math instruction?