

Experiencing a Shift in Relationship Towards Disaffections with Mathematics in the Classroom

by

Alexis Bowman

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Name: Alexis Bowman

Degree: Master of Science

Title: Experiencing a Shift in Relationship Towards
Disaffections with Mathematics in the Classroom

Committee: **Chair: Laura D'Amico**
Adjunct Professor, Education

Peter Liljedahl
Supervisor
Professor, Education

Sean Chorney
Committee Member Associate
Professor, Education

Rina Zazkis
Examiner
Professor, Education

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Abstract

Disaffection with mathematics is a widespread experience, with individuals expressing varied reasons for their dislike of the subject. This research focuses on the narrative of four individuals who underwent a shift from positive to negative attitudes toward mathematics during their journey from kindergarten to grade 12, examining how this disengagement has impacted their adult lives. Using Clandinin and Connelly's narrative inquiry framework, the study creates and analyzes the stories of these individuals. Through this examination, it becomes evident that there is no single cause for students' negative relationships with mathematics; rather, each person's experience is shaped by a unique combination of themes and influences.

Keywords: disaffection; mathematical relationship; narrative inquiry

To my family, whose unwavering support has been a constant throughout my Masters program. They remained steadfast in their belief in me, even during times when I doubted myself.

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Chapter 1.

Introduction

From my earliest memories in school, mathematics has always been a subject I have enjoyed learning. Growing up in a small farm school, there were only 90 students spanning from kindergarten to grade 7. Consequently, the majority of my classes were classes that had split grades- and I frequently found myself in the older grade of these split classes. This naturally led to me assisting my peers that were in the grade below me- particularly in mathematics. This is the place where my initial memory of my affection for mathematics originates. It was not until grade eight, when I switched to a middle school of over 300 students, that I realized not everyone enjoys mathematics. It seemed like such a strange concept to me at first. Why would you not enjoy doing mathematics? It is so straight forward. There is one right answer and most often, one way to get there. There is no guessing involved, you either get the correct answer or you do not. When I began high school in grade 9, I enrolled in the honours program and my love for mathematics flourished. I took mathematics 10 honours, and for the first time, I struggled. I distinctly remember failing my first quiz. I got 1/8. I felt SO embarrassed. The teacher must have marked it wrong by mistake. So, I compared my quiz to my friends, and sure enough, I got 1/8. I was stunned. I did not know what to do or how to move forward. That course was eye opening to me because for the first time, I did not get the mathematics concepts being taught right away. The feeling of defeat was so overwhelming. I could not fathom the idea of enrolling in mathematics 11 honours. So, I enrolled in 'regular' mathematics 11. However, I quickly discovered that in mathematics 10 honours, we completed over 50% of the mathematics 11 curriculum. This made my mathematics 11 year so easy. I found myself picking up the material with great ease, which was drastically different than my experience in grade 10 and felt my love of mathematics returning. Since I found myself grasping the material with ease, I would often help my peers around me.

I already knew before this I wanted to be a high school teacher, but it was in my grade 11 and grade 12 year that I solidified my desire to become a high school mathematics teacher. I discovered during those two years that I was able to assist my peers with a topic that came as quite a challenge for many. It was not so much that I

loved the specific topics I was learning, rather, I lived for the moment when a peer would finally say “ahhhh I get it!”. I felt a rush of joy every time I was met with success in explaining a path to a solution to a peer who was troubled with a problem.

Fast forward to my third year of university, I was taking an upper-level mathematics course, and up until this point, my courses had been manageable. I had struggled with some topics, but with support from my professors and peers, I was able to gain understanding and confidence and successfully made it through each course. Until this one. It was the first time where I truly discovered what it meant to struggle in the mathematics class. I thought I had experienced this feeling in mathematics 10 honours, but this course brought struggles I had never experienced. Each class, I felt as though I was blindly copying down notes as fast as I could off the chalkboard. I would go home after the lecture, open my notebook to work on my assigned homework questions, and my lecture notes looked like they were written in a different language. There were days where I finally felt like I was catching up, and then bam, I was lost again. I met with my professor, I worked with peers, I watched videos online and felt like I exhausted every avenue I could. At the end of the semester, I remember looking online, and not believing what I was seeing. I had failed. Me. A student who was studying to be a high school mathematics teacher- failed a mathematics class. I just sat there and cried. How could I be so passionate about wanting to teach this subject, yet not be able to complete the requirements for me to get there?

As challenging as that experience was, it fueled my already burning desire to want to teach students a topic that was often misunderstood and disliked. During my first few years of teaching, I would watch students walk into my classroom, and just sit at their desk with the look of defeat on their face and in their physical demeanour. And we had not even started the course. How am I supposed to teach a group of students something that I am so passionate about when they have already written me off because I teach mathematics? Not because of how I am teaching them.

During the first week of each new semester, I spend time going around to each student in each of my new classes. I ask their name, some form of random question to help students who are more reserved engage in conversations- questions such as what is your favourite five cent candy, or what did you have for breakfast?- something that is risk free and help students engage. Then I ask them why they chose this course. For the

last few years, I have taught Mathematics 9 Honours, Foundations of Mathematics 11, Foundations of Mathematics 12, and Pre-Calculus 11. When I ask students why they have chosen to enroll in the class they are in, the most common answers are as follows: I need this class for university or a future program I want to study, I did good at mathematics last year so I took this course, I did not do good in mathematics last year so I took this course, my parents made me take it, I need this course to graduate. The answer that always intrigues me, is the response of “I did not do good last year so I took this course”. For those who have answered “I did not do good last year”, I ask why they believed that? What makes them hold this identity and what have they experienced that has shaped their self-belief regarding mathematics? In this conversation, if past experiences do not come up on their own, I will weave in the question of what was mathematics classes like for them in the past? It is so fascinating to listen to the variety of responses from students.

Those who had a positive experience in the past, are often the students who say they did good last year or describe their mathematics ability as something they are proud of. When working through challenging material, these students can be the ones to demonstrate determination and a willingness to work through the challenges. This is not always the case for students who have had positive experience. While some students may not consider mathematics their favourite subject or particularly enjoyable, those with positive past experiences and self-belief regarding the subject are often more inclined to approach with great tenacity. When I ask students about the reasons they attribute to their success last year, or in their past, the most common reasons are as follows: they have enjoyed the type of instruction/structure of the class, the teachers who they had for mathematics, it comes easy to them, or they have received help and support from home.

For those who have say they did not do well in the past, when asked why, it often is answered with a grade or a percentage. “I did good in the past, but then I only got 60% last year” or “I usually got it but last year it just did not make any sense to me”. A very common answer is something to do with the instruction. When I ask my students more probing questions, I often get answers about the way in which the teacher taught/paced the course was too quick. One day they understood what was going on, but the next, they felt totally confused. This often would lead students to making comments about how they felt anxious coming to class the next day because they were still trying to grasp the previous day’s material and they were not ready for something

new. At this point, some students explained how they felt confident enough to approach the teacher and ask for help. However, some described the remainder of the class as a snowball effect. They felt as though they could never catch up and kept falling further and further behind. They would begin trying to avoid class by skipping, or those that did not skip, felt defeated and tried to avoid the feelings of frustration. Many students enter my classroom with the assumption that because I am their mathematics teacher, I have never encountered difficulties or challenges with the subject. This is where I have the unique opportunity to share my past experiences with my students regarding the struggles I have had in mathematics during both my high school and undergraduate experiences.

Although to some, this time of asking students about their past experiences may be viewed as wasted instructional time, to me, this is one of the most valuable moments I have with my students. It sets the stage of common understanding. It helps me learn where my students are coming from. I get to hear stories and experiences of how students have perceived and experienced mathematics classes in their past from their point of view. I often find myself referring to these notes throughout the semester as a check in point for accountability to see if I find myself falling into the habits or routines that students have shared their distaste for.

Yet despite this prep work at the beginning of the semester, I still, countless times, will have students say something along the lines of “I really enjoyed your class, but I am already worried about mathematics next year” or “I really enjoyed your class, but I still do not like mathematics”. This phenomenon of having a positive semester and a positive interaction with mathematics, but still walking away fearful or nervous about future interactions with mathematics has always had me perplexed. How is it that students can simultaneously be having a positive experience in my course while being worried about what mathematics classes in the future will hold?

When someone asks or it comes up in conversation that I am a high school teacher, particularly a mathematics high school teacher, I often get one of two responses. It is “That is amazing! Mathematics was always my favourite subject” or, “I do not know how you could do that for a job. I hated mathematics and could not imagine being a mathematics teacher”. I have always been so intrigued by the distinct starkness and polar opposite responses to mathematics in general. When I ask further probing

questions to those who said they hated mathematics, I often heard something along the lines of “I used to like it, but then.....” or “I have never liked mathematics and was happy once I graduated and I never had to do it again”. The first response was the one that has always had me intrigued.

After reflecting on my conversations with the many students I have taught over the last 6 years in mathematics class and the conversations that have occurred with adults reflecting on their past experience in the mathematics classroom, I wondered if I specifically looked at those who once had a positive encounter with mathematics, but later had a negative encounter, how that influenced their beliefs about themselves as a whole? After I taught them, if I put my personal experience with them aside, what would their overall journey look like? I am curious to know if their ‘in the moment answer’ at the beginning of the semester when I taught them, would differ from their overall perspective of mathematics after they graduated. Throughout my conversations with my students, I have discovered there are many different stories about why a student says they are not good at mathematics or do not like mathematics. For this paper, I have chosen to place emphasis on the emotions and attitudes factors that influences students’ perception of their ability in mathematics, and their belief about how they perceive their performance and success.

In my research, I hope to gain insight into what causes students to change how they feel about mathematics. Particularly the circumstances when this change influences and contributes to a change in relationship in mathematics from positive to negative. What factors are contributing to this distaste to mathematics? Is there any impact on individuals lives after they graduate high school based on their experiences in the mathematics class, and if so, what are the impacts?

Chapter 2.

Literature Review

Affective factors play a significant role in the mathematics classroom. Affective factors are emotional factors that have the ability to impact learning. Mandler (1984) states how “many affective factors arise out of the emotional responses to the interruptions of plans or planned behaviour” (as quoted in McLeod, 1992- Mandler 1984). These emotional responses can shape students’ attitudes and beliefs towards mathematics in the classroom (McLeod, 1992). Following the response to these events, students develop “cognitive evaluation of the interruption [to provide] meaning to the arousal” (McLeod, 1992). Through this evaluation process, the affective factors can have a profound impact on students’ motivation, engagement, and ultimately their success in learning mathematics. Students’ self-confidence and self-efficacy beliefs in their mathematics abilities greatly influence their willingness to take on challenges and persevere through difficulties. For my thesis, I will focus specifically on the affective factors of beliefs, self-efficacy, emotions, anxiety, and disaffection.

2.1. Beliefs

Beliefs are convictions and ideas that individuals hold about the truth or existence of something. An individuals’ beliefs influence their perception of topics and ideas and whether they deem these ideas to be true or not. How students approach problems or tasks in the mathematics classroom and their level of engagement in the learning process, is intricately tied to their underlying belief about the subject they are engaging with.

Consider the students who hold the belief that mathematics has real-world applicability. They are going to believe that the concepts they learn in the classroom can be translated and utilized in practical, everyday scenarios. Students are likely to be more engaged while also holding a genuine interest in the topics being taught in class. These positive beliefs build a connection between the mathematics being learned in the classroom and its practical application. This connection can enhance students’ motivation and curiosity.

On the contrary, a student who does not share this belief may encounter challenges in maintaining focus in class. If they perceive a disconnection between the mathematics being taught in the classroom and its real-world application, they may question the relevance about what they are learning. This can lead to a perception that classroom mathematics is irrelevant and an inefficient use of time. This negative view and disconnect of classroom mathematics and real-world mathematics can negatively shape the learning experience and engagement with the topics being taught.

Beliefs can play a significant role in shaping how individuals' approach and engage with problems and situations that they are faced with. Beliefs, when compared to attitude and emotions are considered the most stable (McLeod, 1992). They are "developed over a relatively long period of time" and are slow to change (McLeod, pg. 579, 1992). Beliefs play a central role in shaping students' "attitudinal and emotional responses to mathematics" (McLeod, pg. 579, 1992).

Dr. Carol Dweck has done much research about beliefs in the classroom and categorizes beliefs into two categories: fixed beliefs and growth beliefs (Dweck, 2006). These are often referred to as fixed mindset and growth mindset. Students who hold a fixed belief view 'intelligence' as fixed and unchangeable. Whereas those with a growth belief view 'intelligence' as having the ability to change and are capable of growth through effort and learning. This has an impact in the mathematics classroom as those students who have been met with challenging situations, who hold the perspective of fixed beliefs, may maintain, and hold the belief that they are not capable of achieving more in the future than they have in the past. This belief and mindset can significantly influence their attitude towards learning and their response to challenges. Due to their lack of belief that they can grow and change, when faced with challenges, they perceive each task as difficult and may only see the risk of failure. They see this challenge and believe that the reason they have to work hard is because they do not have the intelligence, or skills required to complete the task. Instead of seeing setbacks as opportunities for learning, setbacks are interpreted as indicators of their lack of ability. Success is not attributed to the hard work that has been put in prior to the success, rather success can be viewed as a result of being 'naturally smart'. This view of self can also influence the belief students hold about how they are seen by their peers. These students tend to place a higher value on how their performance look to their peers. They have an increased tendency to avoid tasks that make them look less competent in front

of their classmates. When students hold a fixed belief, this inhibits their potential in future courses and places them in a stagnant mindset.

Those students who hold a growth belief may have experienced similar trials and challenging situations, however, they do not view these as roadblocks. Students with a growth mindset believe that abilities can be developed through effort and learning. They have a positive attitude towards learning and believe that their mathematics abilities can be developed over time. When faced with a challenge, they are more likely to take on the challenge and embrace the problem than those with a fixed mindset. Challenges can be viewed as opportunities to improve problem solving skills and implement skills that they have gained through previous encounters with challenges. When faced with a mathematics problem in particular, students with a growth belief are more likely to tackle the problem step by step and engage with their peers for help if they get stuck. One of the major attributes that sets apart these two groups of students, is that those with a growth belief view mistakes as learning opportunities. Rather than being discouraged by mistakes and walking away from the problem, these students will embrace the mistake as they know it is a natural part of the learning process (Dweck, 2006). Empowered by their ability to turn challenges into opportunities for improvement, these learners develop resilience which then strengthens and equips them to be able to overcome future challenges. This resilience is closely tied to self-efficacy. Self-efficacy plays a fundamental role in how students perceive and approach challenges.

2.2. Self-Efficacy

A particular type of belief is self-efficacy, which is a person's belief in their ability to do something. Self-efficacy, as defined by Bandura (1994, pg. 1) "determine[s] how people feel, think, and motivate themselves and behave". Individuals with a strong sense of self-efficacy experience an enrichment in human achievement and an increase in personal well-being. The way in which an individual views their self-efficacy holds the power to shape multiple aspects of their life and everyday interactions. Bandura (1994) describes the four distinct sources of self-efficacy as the following: mastery experiences, vicarious experiences provided by social models, social persuasion, and individuals stress reactions.

1. Mastery Experiences

Mastery experiences are born from overcoming obstacles. When humans take setbacks and difficulties, and transform them into opportunities for resilience-building, individuals experience a boost in self-efficacy; “once equipped with the necessary tools for success, they demonstrate resilience in the face of challenges and swiftly recover from setbacks” (Bandura, 1994, pg. 3). This positive cycle remains consistently, therefore contributing to elevated levels of self-efficacy every time a challenging task is successfully completed.

2. Vicarious Experiences provided by social models

The next source is vicarious experiences provided by social models. When individuals watch someone else around them achieve a goal that is like their own, they begin to possess the possibility that they too can complete and achieve this same task. This model must be someone whom they view as similar to themselves.

3. Social Persuasion

Thirdly is social persuasion. Individuals who receive verbal persuasion regarding their proficiency to excel in specific activities are more likely to put forth high levels of effort and maintain those levels of effort when compared to those who focus on self-doubts and failures when faced with challenges; “They measure success in terms of self-improvement rather than by triumphs over others” (Bandura, 1994, pg. 3).

4. Stress reactions and physical states

The last source of self-efficacy is reducing people’s stress reactions and altering their negative emotional proclivities and misinterpretations of their physical states. Individuals with strong self-efficacy beliefs are more likely to experience lower levels of stress and anxiety. Bandura clarifies and states that “it is not the intensity of someone’s emotions, but rather how they are perceived and interpreted” (Bandura, 1994, pg. 3).

In the school setting, students with higher levels of mathematics self-efficacy tend to demonstrate greater effort, persistence, and academic achievement in mathematics. On the opposing side, students with lower levels of mathematics self-efficacy demonstrate lower results in the areas mentioned above. Those who identify as

having lower self-efficacy are more likely to not engage in problem-solving and will tend to avoid any situation where they may be required to use mathematics to solve a problem or overcome an obstacle. School provides the opportunities and environments where students cultivate and gain the essential knowledge and problem-solving skills necessary to participate in society once they graduate or are apart from the school setting.

2.3. Emotions

Unlike beliefs, emotions are more fleeting and less stable. But they can have a powerful effect on shaping students' experiences in mathematics. Emotions represent a personal and subjective reaction to a person or circumstance. In the mathematics classroom, emotions shape the experiences and feelings students have while learning. Within the classroom, students can experience a diverse spectrum of emotions. On one end, there are positive emotions like joy, excitement, pride, and hope which can bring students feelings of happiness. On the other end, negative emotions such as sadness, anger, fear, and frustrations can cast a negative outlook on the students' learning experience making it more challenging. These emotional responses are not only present in the moment but can be carried into future learning environments. The presence of positive emotions can create an atmosphere of motivation and engagement and can better enhance a learning environment. In contrast, the presence of negative emotions can hinder engagement levels and diminish the joy of learning and can negatively impact students' academic performance.

While some of these emotions may last for longer periods of time, it is possible for students to experience a range of these emotions in a short period of time. For example, if a student is assigned a task where they are unsure of how to solve it, this task may lead to a sense of uncertainty and frustration. As they persevere through the problem-solving process, they can gain insight into a way to solve the question and therefore can complete the task. Once the task is completed, the emotional pendulum swings from an emotional state of frustration to a state of pride or excitement (Op 'T Eynde, 2006, pg. 204).

The prevailing belief is that students who encounter negative emotions in the classroom lack motivation to participate in lessons or complete their work. It is commonly

perceived that these negative emotions reflect a lack of interest and disregard for the tasks at hand. However, Op 'T Eynde (2006), challenges this perspective in his study titled "Accepting Emotional Complexity", stating that negative emotions do not necessarily indicate a lack on value or interest in the work being studied "at the same time, experiencing negative emotions would indicate that students really care about solving the problem and are motivated. After all, only those who attach value to finding the solution are predisposed to become frustrated" (Op 'T Eynde, 2006, pg. 204).

Op 'T Eynde also emphasizes the need for teachers to not only teach students the process involved in solving mathematical problems, but also the importance for teaching students how to cope with emotions (frustration and anger) that come along with this process (Op 'T Eynde, 2006). Emotions have been and will continue to be a prevalent aspect of the school systems and have the potential to significantly impact the teaching a learning processes of both the teacher and the learner (Williams,-Johnson, Cross, Hone, Aultman, Osbon, Schutz, 2008). Learning to cope with these emotions can help alleviate the feeling of anxiety when students are placed in situations where they are unsure of what the next step may be.

2.4. Anxiety

Another affective variable is anxiety, which can be described as "the feeling of fear, tension, or apprehension that many people experience when they are engaging with mathematics" (Maloney, 2017, pg. 116). Richardson and Suinn refer to mathematics anxiety as the negative reaction that people experience when placed in situations that require mathematical problem solving (Richardson and Suinn 1972). This engagement can occur in a variety of events ranging from interactions in the mathematics classroom to interactions with mathematics in everyday life- such as grocery shopping or budgeting. Individuals, particularly students in classroom, can feel the effects of mathematics anxiety in different ways. Some students may experience physical responses such as increased heart rate, sweaty palms, and unrest as they are sitting in the classroom. Whereas other students may experience cognitive symptoms such as a hard time focusing, a decrease in mental ability to focus on the problem at hand. Beilock (2014) states that mathematics anxiety prompts students to complete two different mental tasks at once. The first is to solve the mathematics problem. The second to deal with the "worries about mathematics (including the worries about getting the problem

wrong, looking foolish, and what others may think of them)” (Beilock, 2014, pg. 28). This results in students have less working memory to be able to devote to the problem solving and therefore, their mathematics performance is hindered overall. As Maloney puts it

“Because mathematical reasoning requires a high degree of cognitive resources and because we only have a limited-capacity system, when students have to attend these negative thoughts and ruminations, they are left with insufficient mental resources to perform their best in the mathematics task at hand. In this respect, the anxiety is both unpleasant and detrimental for performance.” (Maloney, 2017).

When students working memory is inhibited, there is often a tendency to avoid the task at hand and a lack of desire in wanting to engage with the problem in front of them. These negative engagements often influence students’ future interactions with mathematics as when they are presented with a problem later, their memory goes back to previous negative experiences they have had rather than viewing the problem as something new that is unrelated (Yackel et al, 1991). These memories and perceptions, in some cases, influence a student’s future careers plans as students may change programs or avoid certain paths if a mathematics course or studying mathematics problems is required (Hembree, 1990, Dowker et al., 2016).

It is not uncommon that a teacher’s perspective and feelings towards mathematics are passed down to their students. If a classroom teacher has experienced or experiences mathematics anxiety, this can be sensed and passed down unintentionally to their students. As Stuart (2000) states, the mathematics anxiety does not often come from the mathematics itself, rather it comes from the previous engagements that the classroom teacher has had when they were a student. This is most notable in classrooms where teachers themselves are unsure of their own mathematics abilities (Burns, 1998). Wadlington & Wadlington (2008) address the notion that many students who experience difficulties in mathematics are learning in “mainstream educational classrooms” and are not being taught by teachers who have majored or dedicated their time to specifically teaching mathematics (pg. 2). As anxiety is often intertwined with students’ experiences in the mathematics classroom, it serves as a significant indicator to the potential development of disaffection.

2.5. Disaffection

Disaffection and affection in the mathematics classroom are closely related as both refer and involve students' emotions, attitudes, and feelings towards mathematics. Similarly to affective factors, disaffection has the ability to impact learning, however, the term disaffection "has been used operationally to mean negative attitude or emotion" (Lewis, 2013, pg. 2). Disaffection invokes a sense of discontentment or dissatisfaction towards a particular topic or idea. In the mathematics class, disaffection often leads to frustrations and a loss of interest with the mathematics concepts being taught. Gareth Lewis describes disaffection in the mathematics class as a "decline in attitude towards mathematics" (Lewis, 2013, pg. 2). It becomes evident that attitudes and emotions play a crucial role in shaping the diverse experiences that students go through.

Emotions are interwoven into the experiences that students have in the mathematics classroom. Lewis states that emotions "weave in and out of experience and are a significant factor in students' responses and behaviour" (Lewis, 2013, pg. 15). As students journey through their schooling, their responses and interactions with mathematics will be ever changing. Students may have a positive attitude toward mathematics one year and then the next year, their attitude or emotion can change and become negative. This may be due to a variety of factors. Lewis separates the factors into two types- contingent factors and classroom factors (Lewis, 2013, pg. 15). Contingent factors are events that occur outside the classroom "such as illness, influence of parents and life events" (Lewis, 2013, pg. 15). Although these events do not occur inside the classroom, they still contain the capability to play a significant role in shifting students' emotions and the ripple effect can still be seen in the classroom. Classroom factors, as described by the name, are factors that are found inside the classroom- "such as distraction/behaviour in the class, the style and attitude of the teacher, or the nature of the tasks, and the pedagogy" (Lewis, 2013, pg. 15). Neither the contingent nor the classroom factors may be experienced by students all the time. It is possible that these factors come and go, and as a result, are constantly changing and shifting the emotions of students as they learn and engage with the material they are working on. Disaffection can come and go as "relationship with school mathematics is subject to considerable ebb and flow, and the dynamic of their positive versus negative experience shifts in both the short (lesson) and longer (yearly) term timeframe" (Lewis,

2013, pg. 15). In the subsequent discussion, the term disaffection will refer to the specific shift from a positive to negative outlook, which will be explored in this paper.

2.6. Research Questions

Taking all these things into consideration, it is evident that there are many affective factors that significantly impact students' experience within the mathematics classroom. These experiences not only have immediate implications in the classroom, but also have a substantial impact on the direction of individuals' academic journeys and career pursuits. In the subsequent discussion, the term disaffection will refer to the specific shift from a positive to negative outlook, which be explore in this paper. The research questions in which I hope to answer are as follows: While exploring how some students experience a shift in relationship in mathematics from positive to negative, how and when does this shift occur? What are the influences behind this shift? How do these influences lead to disaffection with mathematics? How does this relationship from positive to negative influence their interaction with mathematics today as an adult?

Chapter 3.

Methodology

To be able to answer the research question, to explore the stories of those students who have become disaffected with mathematics, I needed to see a person's history with mathematics in its entirety. To see this history, I needed two things- participants who had specifically experienced a positive to negative shift in relationship with mathematics throughout their kindergarten to grade 12 mathematics journey, and a way to look into that experience. For this, I have chosen to use narrative inquiry for my methodology.

3.1. Narrative Inquiry

My research methodology is based upon qualitative research- more specifically narrative inquiry research. Narrative inquiry is a form of qualitative research that seeks to understand the meaning and experiences of individuals or groups of people through their stories (Clandinin & Connelly, 2000, Czarniawska, 2004, pg. 17). This method of research focuses on the stories people tell about their experiences and how these stories shape their identities and understandings of the world (Clandinin & Connelly, 2000). The aim of narrative inquiry is to gather meaning through the collection and analyzation of these individuals lived experiences.

Dr. Jean Clandinin has played a prominent role in the development of narrative inquiry, specifically in the field of educational research. Clandinin's approach to narrative inquiry focuses on the importance of understanding the stories that individuals tell regarding their experiences. Dr. Clandinin emphasizes that "it is particularly important that all participants have a voice" (Clandinin, 1990, pg. 4). Her research has also focused on interpreting the meaning that these individuals place on their experiences- "...is a way of knowing that involves a process of self-insertion in the other's story as a way of coming to know the other's story and as giving the other voice" (Clandinin, 1990, pg. 4). Clandinin and Connelly have developed a framework that highlights the following elements: temporality, sociality, embodiment, and contextuality (Clandinin & Connelly, 2000). This framework is often referred to as the Clandinin and Connelly model.

1. Temporality

This element of narrative inquiry refers to the way in which individual's stories unfold over time. This element describes how individuals' future interactions with different events are influenced by their past. Previous experiences and circumstances have the potential to positively, or negatively impact the future. Someone's past interactions with situations have the ability to change the trajectory of their future- as described later in my research. For my research I explored these temporal aspects through interviews and conversations with each participant.

2. Sociality

The element of sociality refers to the social context in which an individual's stories take place. Sociality is a key element because each person's lived experience is going to be influenced by the social and cultural factors around them. Some of the influences seen in my research range from social relationships (such as friendships), teacher-student relationships, and cultural norms in the mathematics class. Sociality also focuses on how individuals interpret their lived experience compared to others around them.

3. Embodiment

Embodiment refers to the way in which individuals' experiences influence their physical and sensory responses that are attached to their memories. Past experiences have the ability to stir up emotions, physical feelings, and sensations that are woven together with each memory. Embodiment is a key element that can provide insight into the impact of an individual's past experience by focusing on the responses that are brought to the surface when speaking about these past lived experiences.

4. Contextuality

The final element of narrative inquiry is contextuality. This element addresses the way in which individuals' lived experiences are influenced by their specific context in which they occur. This element is of great value because it speaks to how each individual has a unique context in which their story took place. By analyzing the context where their story unfolded, it can bring light to the uniqueness of each individual.

While keeping the four elements of narrative inquiry in mind, Clandinin and Connelly then go on to describe the process of using narrative inquiry as an approach to research. The process of using narrative inquiry as a research method are as follows:

1. Identifying the research question: Clarifying the question and context in which the research will take place.
2. Selecting participant's: The researcher will select participants who fit criteria that matches the research the question.
3. Data collection: Data, stories, and lived experiences will be collected through a variety of ways from the participants. These can include interviews, focus groups, and observing participants. The goal of this data collection is to gain insight into the experiences that individuals have had with regards to the research question.
4. Writing a narrative story: Researchers then represent the stories and lived experiences for each participant through a variety of means. For my research, I have taken these experiences and provided each participant with a written biography based upon the lived experiences they have shared.
5. Data analysis: During this step, the researcher identifies themes and patterns within each participants lived experience. These can be unique to the individual, or a common theme across multiple participants.

Within the Clandinin and Connelly model of narrative inquiry, there are a variety of approaches to analyzing the data that is collected. "Data can be in the form of field notes of the shared experience, journal records, interview transcripts, other's observations, storytelling, letter writing, autobiographical writing, documents such as class plans and newsletters, and writing such as rules, principles, pictures, metaphors, and personal philosophy" (Clandinin, 1990, pg. 5).

For my study, I have chosen to take the approach of biographical study. This approach prioritizes an individual's personal experience and the social context in which they occur (Mitchell, 1981, pg. 72). By interviewing each participant and gaining insight and engaging in an in-depth exploration of their past experiences, I will be able to develop a narrative write up that encompasses their individual stories and the way in

which these stories have been shaped by the different events in their life. These events include past relationships, personal encounters with the material being studied, significant and pivotal moments in time, and how these events influenced future encounters with similar situations. The final piece to biographical study is taking this knowledge, analyzing it through narrative analysis to identify key themes and to see if there are any patterns that have appeared in each participant's story (Polkinghorne, 1995).

3.2. Research Procedure

Since this is a topic that has intrigued me for quite some time, I have previously had many conversations with individuals regarding this topic. These individuals include family, co-workers, acquaintances, and others. When I decided to move forward with this topic for my research, I drew from the pool of individuals whom I have previously had conversations with and knew that there was some aspect of shift in relationship with mathematics. I created a Google survey (described below) and sent this survey out via email to those whom I already knew and had had previous conversations with regarding their shift in relationship with mathematics. I was precisely looking for those who had experienced a positive to negative shift. The Google survey had the following questions:

1. Rate your attitude towards mathematics (scale of 1-10)*
2. Rate how good you feel you are at mathematics (scale of 1-10)*
3. Rate your overall relationship with mathematics in elementary school (K-5)*
4. Describe in a sentence or two your reason behind your rating to the above question
5. Rate your overall relationship with mathematics in middle school (6-8)*
6. Describe in a sentence or two your reason behind your rating to the above question
7. Rate your overall relationship with mathematics in high school (9-12)*
8. Can you give/recall a quick story that contributes to your memory of mathematics in K-12.

*On the scale, 1 was poor and 10 was excellent

3.3. Selection of participants

After reviewing the answers to the recruitment questions on the google form, I identified which participants demonstrated a shift from a positive to negative relationship with mathematics throughout their kindergarten to grade 12. It was critical for my research that participants specifically demonstrated a positive to negative shift in mathematics. There were many participants who participated in the google survey who were not selected to move forward with the interview process due to their answers not meeting the criteria for my research. These answers included the following experiences: no shift (either participants have always had a positive relationship in mathematics class, or participants always had a negative relationship) or a shift from negative to positive.

The participants who demonstrated a positive to negative shift in experience in the mathematics class were then contacted and asked if they would like to participate in an interview to share their story and experience of their journey in mathematics throughout K-12. Of the twelve individuals who completed the recruitment survey via google form, four were selected. The selected participants are Carla, Sydney, Maureen, and Lily. All names have been changed to maintain anonymity.

During the recruitment survey and during the time when selected participants were asked if they were willing to move forward with an interview, both potential and selected participants were reminded that they were able to opt out of the process at any time with no implications.

3.4. Interview Questions

Following the selection of the participants from the google survey, one-on-one interviews were then scheduled and conducted in a non-stress setting. The participants were again reminded that they were able to opt out at any point if they wished to not proceed with the interview process. The four interviews were conversational in nature and began with general, open-ended questions about their relationship with mathematics as a student and their experience with mathematics both in and outside the classroom and what their current interaction is like with mathematics now. The general open-ended questions were sent to each participant prior to the interview so they were able to know what types of questions would be asked during the interview. Based on their responses

to these starter questions, further questions were asked in response to their answers which allowed me to draw specific details about both their thoughts and views on mathematics that pertained to their unique story.

Elementary Questions

Can you share a memory you have of your mathematics experience in elementary school?

Do you remember working on mathematics outside of school during elementary school?

Were mathematics or mathematics concepts (counting, language, flash cards) etc part of your childhood growing up?

Middle School Questions

Can you share a memory you have of your mathematics experience in middle school?

What was your middle school/junior high school like?

Grade 7-9 or grade 6-8? Was the elementary school K-7 then a jump to high school?

Do you remember working on mathematics outside of school during middle school?

What was the instruction like while you were in mathematics class?

What was your friend group/social circle like with mathematics? What was the overall general feeling?

High School Questions

Can you share a memory or memories you have of your mathematics experience in high school?

Can you share a positive memory from this time?

Can you share a negative memory from this time?

What was your instruction like in mathematics in high school?

Do you remember what stream/course in mathematics you took in high school?

Was there a particular reason for choosing this stream/course (streams really emerged after 2013)

If you worked on mathematics at home (outside the class) in high school, what was the environment at home like while you were working on your homework?

Did you have a tutor for mathematics during high school?

General

Are you able to pinpoint a memory, or a time when you experienced this shift from positive to negative enjoyment in the mathematics class?

Can you share the details of this story?

How did this memory/experience impact your thinking?

How did this memory/experience impact how you thought about mathematics in general? And specifically?

How did you feel going back to class (or going to the next level/grade of mathematics) after you had this experience?

Does this experience still impact you today? Can you list/describe any examples of how this impacts you or influences your experience with mathematics now?

Was practicing mathematics part of your childhood/teenage years outside the mathematics class? (flash cards, practice in the summer, worksheets from outside resources etc)

3.5. Writing a mathematical biography

After the interview was conducted, I then took each recording and wrote a mathematical biography for each participant. This biography shared the events, stories, and experiences that were shared during the interview. Each biography begins with the participants experience in elementary school, then moves to middle school and/or high school. Finally, the biography incorporates the influences and repercussions of participants past mathematics experiences with their current job and interactions with mathematics.

3.6. Send off for tweaking/feedback from each participant

Following the interview and biography write up, I sent each participant their written biography and asked for feedback and correction. I then adjusted each write up to reflect the feedback and correction provided and sent off the write up back to the participant. This process occurred until the participant was satisfied with their written biography. Following the completion of the written biographies, the biographies were then coded and analyzed to find common themes and similarities across the four participants.

Chapter 4.

Participants Stories

In this chapter I introduce each of the participants along with their narrative that communicates their relationship with mathematics throughout K-12. After each participant's narrative, I have included my own analysis of their story.

4.1. Carla

Carla began her elementary schooling enjoying the times when the class would work on mathematics. Her elementary school was kindergarten to grade 7, and high school was grades 8 through 12. Carla describes mathematics being a breeze in her primary school years (kindergarten to grade three). She would complete the work assigned in class and did not have to take any of her work home to finish.

When her class started learning about negative numbers in her intermediate years, (around grade 4) this is one of the first moments Carla remembers struggling and becoming frustrated with not understanding the concepts being taught. Until this concept, Carla had felt confident in her understanding of mathematics and enjoyed being in the class. She recalls that in elementary school, if she worked hard enough at a problem or concept, she would eventually understand it. It might take a lot of work, but it would just click. This is contrary to her high school experience in Carla's opinion, as she felt she graduated and genuinely never learnt certain concepts. The mathematics just never clicked.

At the end of Carla's grade seven school year, her teachers suggested that she go into the accelerated mathematics stream. She does not have a specific memory of a conversation about being placed into the acceleration program. Once she began the accelerated program, she discovered that it meant that she was placed a year ahead in mathematics than her peers. In grade eight, she was enrolled in mathematics nine, in grade nine, she was enrolled in mathematics ten and so on. From grade eight, until grade eleven, she was a year younger than the peers in her mathematics classes.

In regard to specific curriculum or concepts where Carla struggled, she does not have a memory of a particular concept that was challenging as she worked through mathematics nine, mathematics ten, and mathematics eleven. The notion of “reading a sentence over and over and not being able to comprehend what is it saying” is how Carla describes her experience in mathematics eleven. She would watch her teacher explain the solution to the problem, but never understood the why or how behind the solution. There was never much frustration in the classroom as she describes herself as a social butterfly and was often chatting with friends rather than working on the assigned work in the classroom. It was, however, when she went to complete her homework on her own time that she became frustrated with the material. Carla experienced frustration as she knew that her teacher had shown how to solve a question, but she was unable to replicate the solution on her own at home.

She remembers her dad helping her with her homework at home, particularly with negative numbers in elementary school. Carla would not consider her parents to be high academic people, which meant to her that her parents could help her with the basic concepts, but they struggled to provide academic support for her on the higher-level concepts in high school. Carla remembers going home and feeling the frustration of not being able to complete the homework that was assigned. She described this feeling as a disconnect between the classroom and her home. Carla remembers her father talking about the importance of school, which was encouraging, however, her mother often spoke about how, in her opinion, school was not of high value. While in the classroom, she does not remember feeling frustrated, as her focus was often not fully on the material being taught.

Carla describes herself as a social and outgoing person during her school years. She enjoyed spending time with her friends and remembers being told by her teachers to stop chatting in class. She describes her socialness as her own demise because her focus was drawn away from the classroom. In high school, Carla and some of her friends were part of a soccer academy at her high school. She attended a different high school than her catchment school to be a part of this program. They had soccer practice every morning and this is one of the most impactful influences that had a negative effect in her classroom experience. During early morning practices, the soccer coach would often have the girls still running on the field when the first school bell rang. This meant that Carla and her friends were often late for their first period class, which for Carla,

happened to be mathematics class. Carla's schedule remained like this for grades 8-11. She felt as though her teachers wrote her off to an extent for being late to class and often assumed that she was not serious about her academics and only her athletics- which for Carla, was not the case. Carla often felt the tension of wanting an A in class and wanting to be social with her peers. This led to Carla believing that she could not be serious about her academics and athletics at the same time. In Carla's grade 12 year, she was able to get a spare first block which meant that she had time to shower and get ready for her courses after her soccer practices. In Carla's opinion, this spare block significantly helped her with being able to focus on her academics.

Carla first noticed her distaste for mathematics when she was in grade 10. This stemmed from the fact that grade 10 ended with students writing a mandatory provincial exam at the end of the semester. Carla had heard from her peers that this exam was very challenging, and when she faced it herself, it rocked her confidence as she felt as though her performance on the exam did not match the ability that she had demonstrated throughout the semester.

The major turning point for Carla in her relationship with mathematics and her journey in school occurred in her grade 11 and grade 12 year. Throughout those two seasons of soccer, Carla suffered roughly five concussions. She was diagnosed with a brain bleed and regularly struggled with lingering symptoms afterwards in-class. These included: nose bleeds, lack of ability to focus, blurred vision, and being sensitive to sensory around her. In mathematics 12 (during Carla's grade 11 year), she had gotten 74% as her final grade. Carla felt traumatized by this mark as it was notably lower than her previous grades in any course. She decided to retake the course in her grade 12 year as she thought she understood the material and was her marks were only influenced by her concussions. During the time that she was retaking the course, Carla suffered three out of her five concussions. This was a major influence in her overall ability to complete the course as she missed many days of school combined with the lack of ability to focus in class due the concussions. This was, and still is, a major influence in Carla's shift in relationship with mathematics.

The most significant side effect of Carla's concussions was short term memory loss. Due to her many absences and extenuating circumstances, Carla's teachers offered her the opportunity to write her exams later to have more time to study. In her

grade 12 year, while enrolled in mathematics 12 for the second time, Carla's teachers offered her the opportunity to write the exam at a later date. The hope was that this would provide her more time to study and process the material from the course. However, due to mathematics 12 having a provincial exam (similar to mathematics 10) and there was limited flexibility that was provided to Carla due to the province wide mandates for these exams. The only option in grade 12 was to write her provincial mathematics exam with the second semester group of students. While this seemed like a great opportunity at first, Carla quickly discovered the true extent of short-term memory damage. This side effect had a vast negative impact on the success in her re-enrollment of mathematics 12. When she went to write her final exam at the end of second semester, she felt as though she had lost all her information. After this point, Carla felt defeated in her ability to complete the course.

At the end of the course, Carla ended up earning a lower mark, of 56%, the second time she took the course. This was a challenging reality for her to accept. When Carla looks back at her choice to retake the course, she feels discouraged and wonders "what was the point" as her mark did not improve. Carla mark in mathematics 12 did not influence or inhibit her future career choices. While she does not actively seek out opportunities to engage in mathematics, she does not shy away from them either. Carla's current occupation is bookkeeping, and while there is a lot of mathematics involved in this job, Carla views the mathematics as different. To her, the skills required for booking keep are very different from the skills she needed in the mathematics class. In past mathematics courses, she felt as though it was up to her to decide which formula to use and how a question should be interpreted and solved, however, bookkeeping is the opposite. Carla enjoys her chosen career path as she describes the job as someone telling her what to do, and then she just does it. She does not need to determine which formula or which approach to take to solve a problem. It is laid out before her, and she just needs to follow the same steps for each situation.

4.1.1. Analysis of Carla Story

Carla began her relationship mathematics in a very positive way during her early years. She looked forward to learning the material in her beginning years of school. Even as Carla was faced with more challenging concepts, such as negative numbers, she was able to persevere, still meet success, build self-confidence in her abilities, and

maintain a positive self-efficacy. This led to her being asked to join the accelerated program at the end of her grade seven year. However, a variety of external circumstances began to shift her relationship with mathematics throughout high school. This began with the soccer program and how early morning practices resulted in Carla and her peers being late for mathematics class. This caused Carla much anxiety as she often missed valuable information given at the beginning of class and she felt as though her teachers labelled her tardiness as a lack of care for the course and her academics. These interactions exemplify the social aspect of Carla's interactions, as they highlight the influence of her teachers' perceptions on her relationship with mathematics.

Carla's initial aversion to mathematics stemmed from her experience in mathematics 10 where she had to write the provincial mathematics exam at the end of the course. She felt the pressure of having to perform well on the exam along with the perceived difficulty from her peers. This was the beginning of Carla's lack of confidence in her mathematics abilities.

Carla's struggles intensified in grade 11 and 12 as she suffered multiple concussions which significantly negatively impacted her ability to focus, be engaged in class, and comprehend the mathematics concepts being taught which lead her to feel unsuccessful in her schooling. She suffered from many concussion symptoms which inhibited her ability to achieve the mark that she desired for her mathematics 12 course. These symptoms include nosebleeds, difficulty focusing, blurred vision, and sensitivity to stimuli.

Carla's experience of earning a lower grade in mathematics 12 during her grade 11 year, despite achieving higher grades in her mathematics classes in previous years, deeply affected her. This led her to retake the course in grade 12 as she was convinced that her performance was influenced by her concussions rather than her understanding of the material. During her grade 12 year, Carla suffered from more concussions which exacerbated her preexisting struggles with short term memory loss. Due to her memory loss, Carla's teachers were accommodating and offered her more time to prepare for her provincial exam. However, due to the nature of the provincial exams, there was minimal flexibility with scheduling and Carla's only option was to write the exam with the group of students during second semester. When her exam was approaching, Carla sensed a loss of all her knowledge due to her concussion symptoms. Carla's confidence in her

abilities was shaken and her disaffection with mathematics had reached its highest point. She realized that her success did not surpass what she had previously experienced.

Today, Carla does not actively pursue mathematics-related opportunities, however, in her current job as a bookkeeper, she does not avoid them. Carla's definition of the mathematics that she currently interacts with is different than from how she would describe the mathematics she had to complete in high school. To her, the mathematics involved in her current job includes very clear direct steps that allow her to follow the same process over and over. She is not required to decide what formula to use or how to approach a problem- which is where much of her frustration came from in her grade 12 mathematics course. External circumstances still remain the major contributor to her shift in relationship with mathematics from positive to negative throughout her schooling. This shift emphasizes the embodiment aspect of Carla's experience, as her frustrations with high school mathematics stemmed from the cognitive demands, which were severely inhibited by her concussions, which is contracting with the clear and repetitive tasks in her current role as a bookkeeper.

Like Carla, Maureen's shift towards a negative experience in the mathematics classroom stemmed from an external circumstance.

4.2. Maureen

During elementary school, Maureen's experience with mathematics in the classroom was positive. She really enjoyed when her class would study problem solving and word problems. To her, it was like a puzzle, and puzzles were viewed as logical, and they had context. There was a reason for why each problem needed to be solved and the answer had relevance to it. The use of manipulatives for Maureen in elementary school was nonexistent. She remembers working through many logic and puzzle books. She never had homework to complete outside the classroom. Mathematics outside the classroom was not a part of her home life.

Fast forward to grade 7 and 8- and Maureen's experience in the mathematics class stayed reasonably consistent. Maureen was able to complete the questions and concepts assigned with ease and found that she did not have to put in much work outside the classroom in order to be successful in her mathematics courses. Although

she had the same teacher for grade 9-11, her experience in the mathematics class began to shift. It was not until her grade 10 year that she noticed the concepts being taught in class becoming more challenging, yet she was still able to feel successful in her studies. Maureen went to a small high school which led to her being taught by the same teacher for mathematics for grades 9-11. Despite having the same teacher, Maureen began to notice the mathematics becoming challenging and her starting to struggle in mathematics 11.

Another distinctive feature of Maureen's small school was the existence of two main academic tracks- the academic track, and the non-academic track. It was often perceived from her classmates that you were either "smart or you were not". For Maureen, course planning did not require much effort as the course planning sheets already had courses pre-set on it and students did not have much say. All students were required to do was to take home to their parents that had the selected courses on it, and parents just had to sign the course planning sheet. Because of the divide in academic tracks due to the pre-set courses, there was a big divide in peer groups. Although Maureen was in the academic stream for grade 9-11, she felt as though there was no choice to switch into the lower-level mathematics class due to this academic and non-academic divide.

Despite facing challenging concepts, Maureen believed she had no choice and had to stay in the academic stream. While in high school, Maureen had a desire to continue onto post-secondary studies and therefore decided to take all the mathematics and science classes in high school she could to prepare for future studies. For her, this was the expectation placed on her from both her parents, and herself. Maureen remembers thinking about what it would be like if she made the jump from one mathematics class to another, and she remembers thinking about how it would not only be an academic jump, but also a social one.

In grade 12, Maureen and her family moved to Alberta. Maureen entered her grade 12 year at her new school with the mindset of this year being a new slate. She would have new teachers and was hopeful that the challenges she had last year, particularly in mathematics, would not be present. In spite of this new hope, Maureen began grade 12 mathematics, she noticed a significant difference in her experience in the classroom than she had in previous years. From the beginning of her new course,

she did not feel prepared for the class. Maureen felt as though she had no idea what was going on or being taught. She would sit in class and be quite confused with the material. Maureen would be focused and engaged during the lesson at school, and then later go home to complete her homework, but was unable to complete the work assigned as she often did not know what to do with the formulas and questions assigned. To her, it was not that the teacher was unhelpful, she felt as though the teacher did help her along, however, she had never struggled with mathematics in the past and was unsure what to do moving forward. Maureen made a friend in her mathematics 12 class who assisted in explaining the questions and concepts to her from class. This friend was not great at mathematics in Maureen's eyes but was very generous with her time and was happy to help Maureen with her work in class. The most beneficial aspect to this friend was how she knew what questions to ask in order to get the answer from the teacher. In the end, Maureen felt frustrated because she did not feel as though she was truly understanding the question nor the process to solving the question-rather she was only receiving the answer.

Maureen's parents provided support when she came home and worked on her assigned homework. Her dad had gone to college, and so to Maureen, this led to her perceiving him as "super smart". However, she felt as though there was a disconnect between the way she was taught to solve a problem at school compared to how her dad would go over it with her at home. She felt significant pressure from her parents to do well in school-particularly from her dad. Maureen perceived this as an expectation of achieving all A's in her courses. This paired with the new curriculum in Alberta caused much stress and a very quick turn to dislike of mathematics. For Maureen, the feeling of being in that grade 12 classroom and not knowing what was being taught is still something she carries with her today.

Maureen finds herself most overwhelmed by negative emotions when her high school aged children come home with their mathematics homework. Simply being in the presence of her kids doing mathematics triggers intense anxiety within her. Despite not actively participating in the mathematics tasks or answering questions regarding the mathematics from her kids, she still feels physically unsettled. The anxiety is so profound that she cannot even bear to watch them work through the problems or engage in discussions about the concepts they are learning.

Maureen currently finds herself feeling comfortable managing and practicing basic financial calculations and, what she describes as, practical skills; additions, subtraction, multiplication, and division. However, she experiences considerable discomfort when confronted with higher level mathematics- particularly when variables are involved. Due to this physical reaction, Maureen avoids interacting with mathematics if possible. Maureen feels as though she is so far behind that in order to catch up, she would need to go back to grade 9 and retake the course. Her sense of inadequacy in mathematics leaves her feeling ineffective.

4.2.1. Analysis of Maureen's story

Throughout elementary school, Maureen loved the aspect of problem solving. She thrived when working on the subset of problems that were viewed as puzzles. For Maureen, these questions were an enticing challenge to complete as each question had a logical solution. In elementary school, Maureen embraced a growth mindset. She saw puzzles and logical problems as chances to push herself and acquire new knowledge. Maureen's interaction and positive relationship with mathematics stayed consistent from elementary until grade ten when she began to notice the level of challenge of the questions increase to an uncomfortable level. Prior to this Maureen had never faced much challenge in the mathematics class. Regardless of being able to solve the problems with ease, Maureen remained a diligent student and completed the work that was assigned. Despite encountering challenging material, Maureen maintained a positive emotional state. When she first faced challenging problems in mathematics 10, she was able to utilize the support around her from her teacher and her peers was still able to complete the work assigned.

Grade 11 is when Maureen noticed a more significant change in her ability to complete the questions as many questions required a higher level of understanding and problem solving. Part of this was due to the way that her high school streamlined their courses. As Maureen had a desire to pursue post-secondary schooling, this meant that she needed to stay in the academic stream. She felt as though she did not have a choice and felt forced to stay in this track. Despite struggling with the limitations of the streamlining of classes, Maureen, as described above in her grade 10 experience, found solace in the supportive social networks with her classmates. The idea of sociality highlights how Maureen's connections with her peers had positively shaped her

experience thus far. However, for courses such as mathematics 11, Maureen felt as though she was stuck in the more challenging course, and this is when she first started to notice a shift in her relationship with mathematics. Here is where we see the beginning of Maureen's disaffection with mathematics.

The most significant shift and negative influence occurred when prior to Maureen beginning mathematics 12. Maureen's move to Alberta prior to her grade 12 year was the most impactful external influence on Maureen's experience with mathematics. Moving to a new school in grade 12, Maureen began the school year with hopes of a fresh start. However, her struggles with mathematics persisted which created a sense of unpreparedness and confusion. Maureen faced a challenge to her self-perception, leading to a shift in her self-efficacy. This can be attributed to the change in school, having to make new friends in her grade 12 year, and a change in curriculum due to moving to a different province. Although Maureen began to struggle in mathematics eleven, she still considered herself to be an academic student who strived for success in the classroom. When she began grade 12, her identity as a student was challenged. Maureen no longer picked up the content with ease, rather, she felt overwhelmed and lost for the first time in her schooling experience. Maureen felt that no matter how hard she tried, she was not able to succeed in understanding the course content that was being taught in mathematics 12. She had a teacher and peers who were helpful and provided support, however, Maureen's identity as a strong student shifted throughout this semester.

Maureen's negative experiences in the mathematics class in grade 12 left a lasting impact on her, leading to a persistent disaffection to the subject. Maureen still carries this identity of "I can not do the mathematics" with her today. Her intense anxiety arises when her high-school aged children bring home their mathematics homework. Despite not being the one responsible for solving the problems and her children not seeking her assistance, she still experiences physical discomfort at the mere thought of being asked to participate. These emotions are still stirred up when Maureen is even around mathematics. Adding complexity to her discomfort, Maureen associates a heightened sense of anxiety with mathematics. The idea of engaging with mathematics concepts trigger not only negative emotions, but also an underlying aversion to the subject. This feeling of anxiety creates a barrier between Maureen and her engagement with any activities involving mathematics. Maureen's embodiment with mathematics has

a profound influence on her present-day experiences and perceptions of the subject. To Maureen's delight, she does not have much mathematics interaction with her current job. The only mathematics-related activities she finds herself comfortable with are those related to basic operations and finance.

Next, I will introduce Sydney and how she experienced a similar change in self-perception, however, unlike Maureen, Sydney's experience occurred at an earlier grade level.

4.3. Sydney

In early elementary school, Sydney enjoyed the aspect of problem solving during the periods where her class studied mathematics. For example, when she was taught multiplication facts through times tables, she felt as though she truly grasped the material, which in return, made class time enjoyable. For both grades three and four, Sydney had the same teacher who incorporated aspects of a reward system. This reward system encouraged and rewarded good behaviour from the students. Sydney discovered that having a teacher whom she enjoyed being taught by, significantly increased her motivation in class. Since she enjoyed mathematics during the school year, Sydney's parents would often purchase mathematics activity books for her to practice her mathematics skills during the summer months. This was not on the recommendation of her teacher nor her parents, rather it was something she genuinely desired to work through and complete on her own.

Sydney's elementary school was kindergarten to grade 6. After grade 6 she went to a middle school for grade 7 and 8 before moving onto high school. In Sydney's opinion, the instruction between elementary school, particularly her intermediate years, and middle school was consistent.

When course planning for grade 9, her first year of high school, Sydney was given the option to take mathematics 9 essentials. The way in which this course was described to her was that it was "like regular mathematics, but easier". At this time, Sydney's mindset was that she would like to do as little work as possible as she enjoyed being with her peers and being social. If taking essentials 9 meant easier mathematics and she would be required to do less work, then this course intrigued her.

During this mathematics 9 course, Sydney had a group of peers whom were at the same level as her academically, and socially. Sydney and her peers would complete the work assigned in class, then with lots of extra time, they would spend the time socializing as they had completed the assigned work from her teacher. Sydney did not realize how easy the mathematics was for her because she was not aware of the topics she was missing from the regular mathematics 9 course. To her, the mathematics felt easy, but when she thought back to her elementary and middle school years, the mathematics had always seemed easy for her, so she did not think anything of it. At this point, Sydney was not aware that choosing to enroll in this course would have the potential to influence acceptance to post-secondary education. At the end of Sydney's grade 9 year Sydney selected her courses for grade 10. Sydney had a dream of being an elementary school teacher. When looking at the requirements for this program at the end, it was brought to Sydney's attention that she had to take regular mathematics 10, not mathematics 10 essentials. This meant that she had to go from Essentials 9, to regular mathematics 10. Sydney opted to take regular mathematics 10 in order to keep doors open and to meet the requirements for her secondary school program. When Sydney entered mathematics 10, it was then that she realized how easy the essentials 9 course had been. Sydney found mathematics 10 to be one of the first times that she had struggled to understand the material. Sydney would partially comprehend the concepts being taught in class but when she went home, that is when the frustration began. When trying to complete the assigned questions at home, Sydney often felt lost and confused and remembered some of what was taught in class, but not enough to be able to feel successful in completing her homework. At the end of mathematics 10, Sydney was able to grasp enough of the course and work through enough concepts to pass and move onto Mathematics 11.

It was then in Mathematics 11 that Sydney experienced a drastic shift in relationship with mathematics. For the first time, Sydney felt as though she truly did not understand the concepts. It was more than being confused. One of the units in particular that caused a lot of strife was quadratic equations. Sydney's primary source of frustration came when she tried to work on her homework at home. In class, she felt as though she semi-understood the material; enough that she could work through problems in class with some assistance. However, when she left the classroom, she found herself struggling to remember the steps to solve a particular problem and becoming very

frustrated. At the end of the course, Sydney did not pass mathematics 11. This failure had a significant impact on her self-esteem. To get into the teaching program she wanted to pursue after high school, she needed to pass mathematics 11. Since she had not passed, Sydney felt her dream slipping away and the frustration of not understanding the mathematics compounding. Since mathematics 11 was a requirement to graduate and for her post-secondary program of choice, Sydney decided to retake the course during her grade 12 year with the hopes of earning a passing grade.

Sydney's time at home was split between her two parents (one parent during the week, and the other one weekends). Her mom, whom she spent the week with, was very supportive of Sydney and her schoolwork through her high school journey. Sydney's mom would often be sitting down with her encouraging her and supporting her through her work. During her grade twelve year (her second time in mathematics eleven), Sydney's mom hired a tutor. Sydney found that this tutor provided the extra support that she needed. One way in particular in which this tutor helped, was filling in the gaps from past mathematics courses. With the support of her tutor and teacher, Sydney was able to pass mathematics eleven the second time. Although Sydney passed the course, she did not feel as though she truly grasped the concepts taught in the class.

In high school, Sydney felt as though the use of calculators was forced upon her. The skills she once mastered- long division, multiplication facts, mental mathematics with multiple operations- were slowly fading. She felt herself becoming reliant on using technology as a tool.

Sydney went on to pursue her desired education program in post-secondary school. As part of this program, Sydney was required to enroll in a course called mathematics for elementary teachers. On Sydney's first attempt at this course, she did not pass, and was therefore required to take it a second time as this course was mandatory for her program. The second time she enrolled in this course, she also went to a local tutoring company to receive help and support to pass the course. Not passing the course the first time was devastating and confusing for Sydney as this course, given the title, was supposed to cover the mathematics that she has fond memories of from her elementary school years. However, she quickly realized that this was not the case. This course covered content that she did not remember studying herself as a student. Sydney successfully passed the course the second time, however, shortly after this she

realized that she did not want to become a teacher. She loves kids, but she did not have the desire to teach them anymore. This trajectory highlights the temporal aspect of Sydney's journey, demonstrating how her experiences ultimately guided her toward a new career path in administration and office work, where she had found her true passion.

Mathematics is still part of Sydney's current job, however, the mathematics that she is required to complete can all be completed with a calculator. To Sydney, this is not her definition of "real mathematics". Real mathematics involves solving a problem and she does not have to use a calculator. The type of mathematics she is now required to do has to do mainly with finance and aspects like tax percentages. She is able and often encouraged to use a calculator or the online programs available to her. The memories from her time in high school are associated with stress, and if she can avoid these stirring up these feelings today, she will choose so.

4.3.1. Analysis of Sydney's story

Sydney excelled in school during her elementary years. She enjoyed all her subjects; however, she was particularly fond of the opportunities when the class studied mathematics. She was fascinated by the problem-solving questions. Sydney enjoyed these types of problems so much, that she often would work through extra books or material on her summer vacation out of pure enjoyment. Another aspect to mathematics that Sydney also enjoyed was the mental mathematics. When learning about mental mathematics strategies for various topics (such as multiplication, and long division), she felt very supported by her teacher. Sydney held a confident and optimistic belief about her mathematics abilities during elementary school.

Sydney's enjoyment in the mathematics class continued during her initial years in high school. Upon entering grade nine, she had the option to enroll in the essentials nine mathematics course. Sydney effortlessly navigated through the material. Along with her peers, Sydney grasped the concepts taught with ease. During the remaining class time, her and her classmates would often use that extra time to socialize.

After high school, Sydney had the dream of becoming an elementary school teacher. After discovering the requirements for her desired post-secondary program,

Sydney was required to switch streams and enrolled in regular mathematics ten. Transitioning to the regular mathematics ten course was a demanding shift for Sydney, both mentally and academically. When Sydney had previously signed up for the essentials nine course, she was unaware that this course would not fulfill the requirement for her desired post-secondary program. When Sydney began regular mathematics ten, there were a few concepts that were challenging to her, however, with a strong work ethic, she was able to persevere through the challenge and was successful. Sydney was able to maintain a growth mindset and a positive belief about her capabilities in the mathematics class despite facing challenging concepts that built off prior knowledge she did not feel as though she possessed due to her enrollment in the essentials nine course.

The real challenge came for her when she took mathematics 11. This was the first time that Sydney faced topics where she felt that no matter how hard she tried, she was unable to understand the concept. Technology, in the form of a calculator was a focus in the course. This was a challenge for Sydney as she felt forced to not rely on the mental mathematics skills she had previously built in prior courses. Sydney encountered a profound shift in her comprehension of the mathematics concepts being taught, particularly quadratic equations. Although Sydney felt like she somewhat grasped the material in class, when she went home to complete her homework, she struggled to retain and apply what she had just learnt. The disconnect between classroom learning and her independent completion of her work at home intensified her frustration and lack of belief that she possessed the ability to be successful in mathematics. Sydney's experience in mathematics 11 was when she experienced her shift in relationship with mathematics from positive to negative and her disaffection for mathematics truly developed. She knew that she needed to pass this course to be able to apply to the program she wanted to for post-secondary, however, she felt defeated as no matter how hard she worked, she was not understanding the concepts being taught. This experience of defeat significantly impacted Sydney's self-efficacy and emotions, as the setbacks she faced influenced her confidence levels and brought negative emotions as a response when she was problem solving.

In her grade 12 year, Sydney had to re-take mathematics 11 and she knew she needed to pass the course both to graduate high school, and to be able to apply for the post-secondary teacher program. Sydney's mom hired a tutor for her second time

through mathematics 11 and this helped Sydney fill in some of the gaps she had from her previous mathematics experience. With the help of a tutor, her work ethic, and her teacher, she was able to pass mathematics 11 the second time she took the course. The anxiety and stress she experienced during her high school years in mathematics further hindered her ability to succeed in the subject, creating a cycle of negative emotions and academic setbacks.

Sydney pursued her desired education program in post-secondary school, which included the one mandatory mathematics course. After not passing the first time she took the course, she was determined to succeed the second time. Failing the course initially was disheartening and puzzling for Sydney because she expected the course to cover the mathematics she fondly remembered from her elementary school years. Sydney grappled with the conflict of feeling disheartened by not passing the course while simultaneously experiencing discouragement and confusion. These negative emotions stemmed from the realization that the content she expected to study held positive memories from her childhood. However, the outcome she was living did not match her memories. Shortly after this experience, Sydney realized that she no longer desired to become a teacher. Sydney's disaffection with mathematics significantly influenced the decisions she made regarding her future career.

Mathematics still plays a role in Sydney's current job, but primarily involves tasks that can be accomplished with a calculator or using the assistance of computer programs. This version of mathematics does not align with her personal definition of "real mathematics". To her "real mathematics" is what she struggled to comprehend in high school. Her memories of high school mathematics are associated with stress, so if she can avoid evoking those feelings today, she prefers to do so.

4.4. Lily

When Lily was in elementary school, she was often the student that was walking around and helping her peers and considered herself a class tutor. Throughout her elementary years, Lily would describe mathematics as one of her favourite and better subjects. It was not a topic that she struggled in. When she was learning mathematics, she was able to pick up the concepts with ease. Despite being able to easily pick up the material, Lily found that she did have to work hard in class and always ensured that she

completed all the work assigned. Because she strongly cared about her schoolwork, she would regularly have all her homework completed, and if something was incorrect, she would go back to recheck her work to see what she did incorrectly and fix her mistakes.

Lily's strong work ethic and diligent completion of her work assigned continued to propel her through her later elementary years (grade 6-7) and into early high school. In elementary school Lily earned straight A's, and in early high school, Lily continued to earn A's along with some B's. This significantly changed once she got to grade 12. Up until grade 12, Lily's interaction with both her teachers and her mathematics classes as a whole had been positive.

In mathematics 12, for the first time, Lily found that she was struggling to understand the material taught in class. She continued to struggle despite maintaining her strong work ethic and study skills. One of the challenge Lily faced in grade 12 was knowing when to use which formula when solving a question. She felt as though she was not being taught the need for each formula and when to use which one. Previously, Lily would be given a question, and would be able to solve the question relatively easily as she often knew where to start. However, in mathematics 12, Lily was met with confusion regarding the abstractness of the material being taught.

Another contributor for her frustration was her mathematics 12 teacher. When Lily would ask for help, her teacher would often reply with "think harder" or "try harder". Lily found herself frustrated by this response and felt as though the support she was asking for was not being provided. Lily would try to complete the work assigned and would attend the tutorials provided by the school. However, these tutorials were student run, and her mathematics teacher did not attend these help sessions herself. Lily felt as though she had done everything in her power to ask for help and tried to work towards understanding the material, but instead she was left with continued confusion. Every day, Lily would still attend class and would still put forth a strong work ethic but felt as though she just wanted to give up. Unlike her past classes where the teacher would wander around to check in with students, this grade 12 teacher did not walk around the classroom nor check in to see if students needed help. Lily was wrestling with the idea that she was doing the steps that were suggested to her to receive support, and yet after completing these steps, she still had not received the help she needed.

After being met with frustration over and over, Lily's self-confidence started to fade. Lily's final grade for her mathematics 12 course was 52% overall. She found this to be very upsetting as this was lower than any mark she had earned in the past. This low mark rocked her self-confidence and influenced future opportunities. One of these opportunities was that Lily missed out on scholarships due to this mark. This was met with more frustration as mathematics 12 was not a mandatory course, so Lily's frustration came from the fact that she could have chosen a different course and may have earned a higher percentage than she had in mathematics. Mathematics 12 was not a required course for her future plans of going into the teaching program.

Lily enrolled in the teaching program and enjoyed the fact that she could choose the courses she wanted to take based on her major and her minor. However, Lily still actively arranged her courses so she could avoid taking any mathematics classes during her post-secondary degree. Lily pursued a minor in psychology and was very strategic in her course planning in order to avoid statistics. In the program that Lily was enrolled in, she was offered the opportunity to pursue two bachelor degrees. In order to pursue this opportunity, she would have had to take a mathematics course. Lily had such negative memories due to the impact her high school mathematics class experiences left on her, that she opted out of the opportunity to pursue the two degrees and stayed in her current track which lead to one bachelor degree and a certification in education. Lily could not fathom the idea that she could enroll in this required mathematics course, and if she did not pass, this one course would be the reason that she would not be able to receive her teaching accreditation.

During Lily's first few years of her teaching career, she was given junior mathematics courses as part of her teaching load. When she first saw these courses on her teaching load, she instantly had doubts whether she would be able to teach these courses due to her negative experience and lack of self-confidence with the topic of mathematics. However, despite her negative memories of mathematics in high school, Lily felt successful in teaching these junior mathematics courses. She found that her past and negative experiences helped her connect and identify with the struggle that her student have and may have in regards to mathematics.

4.4.1. Analysis of Lily's story

School came easy for Lily in elementary school. She found herself often finishing work early and helping her peers in her classes- particularly in mathematics. Regardless, she would still strive to ensure that she was completing all her work and going back and correcting any mistakes that might have been made. Lily's strong work ethic propelled her through school- earning A's and B's from elementary school to high school. This consistent success not only reflects her dedication but also contributed to a positive sense of self-efficacy in her mathematics abilities. However, Lily's experience took a drastic turn when she encountered mathematics 12. For the first time, Lily faced situations where her work ethic alone was not enough to achieve the desired grades.

Lily's frustration with mathematics began when she was working through problems where she was unsure of what formula to use. Lily favoured questions that were repetitive in nature, and the content she was learning in mathematics 12 was different than she had seen in the past. Since Lily had also been able to complete her work with relative ease, this new emotions of not knowing what to do was a confusing feeling during this new experience.

When she had reached out to her teacher for assistance, she was often given the advice to work harder, or think harder. This led to more frustration from Lily as she felt as though she was doing everything she could and was putting in the work that her teacher was requiring, but yet she was not receiving any reward for her hard work. Lily's relationship with mathematics took a drastic shift through her mathematics 12 course as every avenue that Lily explored for help, she did not receive the support and help that she required. This experience had a significant impact on Lily's self-efficacy as mathematics was once a subject that she thrived in. Lily earned a 52% at the end of the semester and this mark had a significant influence on her future plans.

When Lily joined the teaching program, she appreciated the flexibility of selecting courses based on her major and minor. Nevertheless, she still organized her schedule to avoid any mathematics classes throughout her post-secondary education. Arranging her schedule in this manner served as a means to steer clear of enrolling in a mathematics course. To consider temporality in Lily's story, it is evident that her challenging encounters during her senior year of high school had a significant impact on her post-

secondary education. For Lily, her reluctance to experience failure again in the mathematics class was how her mathematics anxiety presented itself. In her program, Lily had the option to pursue two bachelor's degrees, but it required her to take a mathematics course. Due to the negative impact of her school mathematics experiences, Lily decided against pursuing the two degrees and opted to stay on her current path in her program. The idea of enrolling in the required mathematics course was inconceivable for Lily, as the possibility of failure jeopardized her teaching accreditation and future career plans. Lily's story shows how her struggles with math were tied to her own challenge and the support she lacked, while also highlighting how her interactions with her teachers influenced her perspectives and decisions regarding future math courses in post-secondary education.

Chapter 5.

Circumstantial Themes

5.1. Early success in Mathematics

Despite having struggles in their later years in high school, each of the four individuals all experienced early success in the mathematics class. Carla, Maureen, Sydney, and Lily all went to elementary schools that were kindergarten to grade seven. Although each participant had a positive experience in elementary school, they all had slight differences in their early journeys with mathematics.

For Carla, elementary school mathematics did not require a lot of effort. It was “a breeze and was totally fine”. Even if she faced a problem or lesson that seemed challenging, she was able to work through the problem on her own and achieve success. Carla maintained a positive sense of self-efficacy throughout her elementary school years.

C: I guess it was not crazy hard. I would learn it in class, and even when I had to work through it, I could figure it out.

Due to her early success in the mathematics class, Carla got asked to take part in the accelerated mathematics program when she went to high school. Through an evaluation process, Carla was offered the opportunity to skip grade eight mathematics and move onto grade nine mathematics with a cohort of her peers.

C: I got the accelerated mathematics where you got to go a year up. So I basically skipped grade 8 mathematics.

Maureen also experienced early success in mathematics and really enjoyed the concept of problem solving. To her, these questions were concrete and had context. This made the questions easy to grasp. As these types of questions heavily relied on logic, Maureen found herself navigating through them with ease which built a confident belief in herself but also created favourable emotions towards mathematics.

M: I really enjoyed problem solving. The types of problems like if this car is driving this fast, and that car is driving that fast, when will they meet? Those types of problems. Those kinds of problems, I think they

are called word problems. I loved them. They were like a problem to solve because they were logical and had context.

Similarly, Sydney also has distinct memories of enjoying the problem-solving process that was taught in elementary school.

S: I loved the process of problem solving. I distinctly remember really enjoying it in grade 3 and grade 4.

However, unlike Maureen, Sydney enjoyed her early elementary years so much that during the summer, she would often work through mathematics activity books and did not view it as a 'must do' activity, rather, it was something she chose to engage in.

S: On summer vacation I would get the activity books and I loved working through them. I think my parents suggested them, but I loved them. It was not an unwanted chore.

When Lily was in class, she would often complete her work early and would then go to assist her peers. During her elementary grades, mathematics came easy, and she did not have to put in a significant amount of work to complete it.

L: I would often be the one who was walking around helping my friends because I was done early, and the material always seemed easy to me. When I was younger, I did not really have to think much of it.

Even though she found mathematics to be relatively easy, she consistently put in the necessary effort to ensure that she fully grasped each concept, reflecting her commitment to a growth mindset.

L: Even though it was easy, I still made sure I always did all my work. Every day I would have my homework done, and if I did get anything wrong, I would make sure that I went back and corrected it.

5.2. Outside Circumstance

When students walk through the doors of our classrooms, there are a multitude of different situations that they are coming from. This could be anything from home life to relationships with friends; encounters they have at work/extracurricular activities and many more. These life events that happen outside the classroom have the potential to influence students' relationship with mathematics in the class.

For Carla, these external circumstances showed up in a variety of ways. During her first two years of high school, Carla was enrolled in the soccer program at her school. This allowed her and a group of peers to participate in special training with high level soccer coaches. However, as these coaches were not teachers, morning practices would often run late due to the coaches not being cognisant of the bell schedule. This resulted in Carla being late to her mathematics class. Carla, being someone who dislikes being late, would often start classes feeling rushed, a situation that sometimes would leave her feeling flustered and anxious. She took great pride in her academic work and disliked when her tardiness, due to soccer practices, implied that she had a lack of care about her academics.

C: And then, sometimes we would be on the field and we would hear the first bell. And then you are like oh my gosh, I am supposed to run into the school, get ready and then I have to go to mathematics class. And then every single day I would be late for mathematics class.

C: Yeah and then our teachers like hated us because they would think that we do not care about school. All we care about is sports. And we are like no.

C: I did not want to be late. It really stressed me out that I was late every day.... I remember near the end I purposefully put a spare by my soccer, so it did not affect my school as much.

The most influential contributors to Carla's shift in experience in the mathematics class were the five concussions she endured during her grade 11 and grade 12 year. These concussions were the major contributor because they played a significant influence in her experience in the classroom. This was seen through the impact on Carla's short-term memory. Due to Carla suffering with her short-term memory, she inquired with her teachers to see if she could receive any time extensions for writing her final exams. Carla was granted these time extensions; however, the side effects of the concussions were greater than she was originally aware, and the extra time granted was not a solution to Carla's short-term memory struggle.

C: I had a brain bleed, and my nose was bleeding every day and I was just a mess from all the concussions. So, I think is the number one problem because I got forced to take a bunch of finals. Grade 11 mathematics was okay, but grade 12 mathematics I got another concussion, and I kept asking for extensions so I would not bomb them. But I knew no information was going in, so it was not going to help.

Carla's concussions had the greatest impact on mathematics, out of all her courses in grade 11 and grade 12.

Although Maureen's experience in the mathematics class was also influenced by an outside circumstance, the outside influence in which she experienced was drastically different than Carla's. Maureen had the same mathematics teacher for grade 10 and grade 11, however, she did not begin to struggle with mathematics until her grade 12 year. During the summer before her grade 12 year, Maureen and her family moved to Alberta. This is when Maureen noticed a significant switch with her experience in the mathematics class.

M: I remember distinctly the teacher I had in grade 11, he was the same teacher I had in grade 10. But even in grade 11 I was struggling, and he was the teacher who I had for grade 10. And then in grade 12, I moved to a different school. I came from small town Christian school to big city school. I was like in over my head. It was a difference province. I moved from BC to Alberta in grade 12.

For Maureen, her struggle with mathematics in grade 12 not only came from being in a new school and a new environment, a change in curriculum, but also the change in her teacher.

M: That and I did not like the mathematics teacher at all. She was, she was awful- nobody liked her. I think she was like trying to be helpful, but because I did not like her either, (which sounds awful to say. I was just a snobby teenager), I was not listening, I guess. It was awful.

During this period, Maureen's disaffection with mathematics began, stemming from a culmination of external events that left her feeling overwhelmed and unable to catch up.

5.3. Not able to catch up

After these outside circumstances have occurred, the effects of these events can be seen in a variety of areas. This can lead to a situation and environment where students perceive it difficult to catch up.

Prior to Carla's concussions, she already felt behind in her mathematics courses due to the soccer program and the friend group she had in her classes. She would find herself talking too much in class and missing valuable information. Although she had, as she describes "pretty good teachers", she found that she was not retaining the

information being taught. On top of this was the influence of the soccer program and missing the beginning of the lessons due to being late for class. After experiencing this, Carla started to feel disaffection towards mathematics. She was often frustrated and found that “mathematics was the only subject where she could not, not care”. This shift in attitude reflected the challenging environment that had been created, making it difficult for her to maintain a positive connection with the subject. Despite her desire to keep up with her schoolwork, post concussions, Carla struggled to retain information which influenced her mathematics courses most significantly, especially when it came to her finals.

C: So, I think is the number one problem because I got forced to take a bunch of finals. Grade 11 mathematics was okay, but grade 12 mathematics I got another concussion, and I kept asking for extensions so I would not bomb them. But I knew no information was going in, so it was not going to help.

In Maureen’s past school, she perceived herself as a confident and intelligent student, reflecting a positive sense of self-assurance in her academic abilities. As she went to a smaller school for grades 9-11, she knew the expectations set upon her as she had the same teacher for multiple grades. When she moved to her new school in Alberta, everything was new. She felt as though she was not prepared from the beginning of her class, so no matter how much she tried to catch up, she felt as though she was always behind.

M: I think that because it was new school, new teacher, new province, probably a different curriculum even, umm like it was different curriculum. I do not think I was prepared from the get-go. I was like I do not know what I am doing. And I was a new student to the school and thought of myself as quite smart and that is how I identified in my previous school. So, it was like I do not know what to do with this.

Maureen worked with a friend in her new school who knew how to ask the right questions, but despite this helpful friendship in the class, Maureen still felt like she was unable to understand what was being expected of her and what she was supposed to do with the material being taught.

M: She was not super great at mathematics, but she was a super helpful personality. We would sit beside each other in class, and she would, she would ask all the questions and help us figure it out. But in the end, I was not getting it, but I was getting the answer. And I remember thinking that being like this is like Greek to me, and I wanted to drop out, but I could not.

Maureen's anxiety about coming to mathematics class and working on the material led to significant frustration. Eventually, this resulted in Maureen not wanting to be present for class because, no matter how hard she tried, she felt unable to catch up. This cycle of anxiety and frustration further contributed to her disaffection with the subject.

M: I would just blow it off and not do it, or not go to class. I would skip class a lot because when I went there, I would not know what I was doing. I cannot do it anyway, and I am failing anyway. I was that high school student.

5.4. Role of the peers

When students are having a challenging time grasping the topics being taught in class, it is often encouraged that they use their peers as resources. Peers can be a fantastic support and can provide assistance, however, they can also be disruptive and have the tendency to draw attention away from the task at hand.

When Carla began high school, she found that she had many peers that were also part of the soccer program and the accelerated mathematics program, just as she was. Carla had positive feelings about being in class with her peers, creating a conducive environment for socializing, however she often found herself distracted by them. Unfortunately, her peers did not contribute to fostering a productive learning atmosphere.

C: My peer group was all in the accelerated program with me. All the soccer girls. We talked way too much and got into too much trouble for talking. We probably had so much potential, but we just wasted it talking and flirting with boys.

Like Carla, Sydney also had many of her friend in her applications mathematics class in grade 9, however, when asked why her and her friends were talking and socializing, it was because they were done their work. Sydney and her friend were often found chatting during class time, but when their teacher checked in with them, they were able to produce work that was completed and correct.

S: Me and my three girlfriends, we would always be finished early. And our teacher would be so confused why we were just always sitting there chatting, and we always kept saying we are done. We actually had finished out work. But we still had a lot of fun.

For Maureen, it was perceived that the school she attended from grade 8-11 had two different pathways or tracks. One for students who were planning on going to post-secondary, and one for students who were not. Her school was quite small and therefore Maureen knew majority of the other students in her courses and often had many of the same classes together. Maureen enrolled in the courses that aided in post-secondary preparation, and so did her peers.

M: It was a real natural divide in the class. There were us who were smart, and then there were those who were not. There were only two tracks in the school. There was not even course selection, it was just your smart take these, or you are not, and you take these.

At her school in Alberta in grade 12, this was not the case as the school was larger and structured differently than her previous school. Due to Maureen starting her new school in grade 12, she did not know any of her peers and did not have any awareness of which students were the “smart kids” or not. In Maureen’s mathematics 12 class, she had one friend in particular who was helpful and assisted Maureen with her course work. Despite this new friend not being a strong student in mathematics, Maureen still worked with her as she was able to provide help. Maureen learnt that this peer knew what questions to ask and how to ask for help from their teacher and she would then relay that information to Maureen. In the moment, both the friend and Maureen would either work towards the answer or receive the answer from their teacher. However, Maureen found herself still confused and unsure of the question as a whole after receiving the help.

M: I had this one friend, she was not great at mathematics, but she was a super helpful personality. We would sit beside each other, and she would ask all the right questions. The teacher would help her out, and then she would help me out, and then we would get the answer, but I still did not understand it.”

5.5. Impact on Career Choices

The experiences we have in our past are known to have the potential to influence what our future looks like. Despite having unique past stories, Carla’s, Sydney’s, and Lily’s past experiences influenced their current career path.

Despite Carla’s negative experience with mathematics in her past, Carla has now completed her bookkeeping course and is a certified bookkeeper. For her, bookkeeping

is unlike mathematics as its concepts are concrete and gives guidance on what to do each step of the way.

C: Bookkeeping is very much like this comes in, this goes out. I like things that are predictable, I do not even know what the means. I do not like when they mathematics tries to confuse you. Like when you have to understand what each formula does. With bookkeeping, they just tell you what to do, and you do it.

Despite genuinely enjoying her current career, Carla still experiences some of the same symptoms now as when she was in high school. One of the similarities is that when she reads information, she feels as though she is not able to retain it.

C: I still notice somethings now. If I reread, like especially if I have to reread someone's name, and then I go to write their name, I have to double check like fifteen times. If I read a number, I have to go back go back go back. Especially if I have to read a business number. I cannot memorize big number or anything like a chain of numbers.

Contrary to Carla's story, Sydney's experience with mathematics negatively and significantly changed the trajectory of her future. When Sydney was in high school and was course planning with her counsellors, she found out that she was not able to get into the teaching program she wanted with the essentials mathematics course she was currently taking. It was due to this, that Sydney switched to a principles (mid-stream) mathematics course. Once Sydney graduated, she went into the teaching program, only to find out that she had to take a mathematics for elementary teachers. Unfortunately, her experience in this course mirrored her negative encounters with mathematics from her grade 11 year, further solidifying her distaste for the subject matter.

S: And I hated it. And my mathematics in elementary school did not have tens. And then all the sudden I was learning about tens. And I actually had to take mathematics for elementary school teacher twice. And the second time I had to go to Sylvan twice a week for them to teach to figure out, I had to get them to teach me how to do it. I thought it would be easy because elementary mathematics, that is the mathematics I liked.

This was extremely frustrating to Sydney as she loved mathematics in elementary school when she was a student and was thoroughly looking forward to this course as part of her education program.

S: I think just the stress from before makes me not want to do it now, which kind of sucks. And then I felt even worse because I could not even do the mathematics that I used to like.

After this experience, Sydney made the decision to not move forward with pursuing a career in teaching and did not continue in the education program.

Lily's experience was not as dominant of a response as Sydney's experience, however, Lily's experiences in high school did lead to a shift in plans for Lily in her post-secondary schooling. Lily did not receive any grades-based scholarship as her average was not as high as it needed to be, and she contributes this to her low mathematics mark. After high school, Lily undertook post-secondary education to become a teacher, however, her experience in the mathematics class influenced the degree in which she strived for.

L: After that, I just avoided mathematics as much as possible. I had the option of getting like, my degree was in English, and I had the option of getting like education as a second degree. But I would have had to take a mathematics class. And if I failed the mathematics class, I would have not gotten the teacher certificate. I am not going to risk failing a mathematics class and not getting my certification.

Lily describes this experience as ironic, because in the first two years of her teaching career, Lily taught a few junior mathematics classes. However, instead of having her past experience negatively influence her teaching negatively, Lily chose to be genuine and her use experience as a way to connect with her students. She openly shared her previous struggles with her students, using her own journey as a means to connect with them. Lily discovered that her ability to empathize with students who faced challenges in mathematics allowed her to come alongside them, offering encouragement and presenting alternative approaches to specific topics. This approach not only demonstrated a growth mindset but also fostered a supportive and understanding learning environment.

5.6. Impact on Present Life

Maureen's past did not lead to a change in career plans; however, her negative experience is still very prevalent in her everyday life. Anytime Maureen is placed in a situation where she must interact with mathematics, besides the basic operations

(adding, subtracting, and multiplying), she physically feels the memories of her experiences from the past.

M: It makes me physically uncomfortable, just the thought of physically having to do any mathematics

Maureen's present outlook on mathematics is tainted with a belief that she is incapable of completing any mathematics related task. This stems from her past experiences of feeling so behind in her courses and feeling as though she is unable to catch up. The impact of this fixed mindset is the most pronounced when she is interacting with her high school aged children. These interactions trigger noticeable physical affects that are associated with mathematics anxiety.

M: Every time [my kids] come home with mathematics homework, I can feel, I can literally feel anxiety in my chest when I look at their stuff. Even when they show me their pages. I literally have to leave the room

Even though Maureen is not the one who is enrolled in the mathematics course or doing the questions herself, the simplest question from her children bring back the fear and the feeling of "I do not know how to solve this" that she felt in high school.

M: I would not even know where to begin. When they talk about things, like I do not know, bedmas. I feel like I am so far behind, that I could never possibly learn it. Which is probably not true, but it is my attitude towards it

Sydney's interaction with mathematics currently does not stir up as dominant of a response as Maureen's does, she still notices some influences in her current job. Sydney's job as an office receptionist requires her to be able to complete basic calculations. Sydney often finds herself disheartened that she is not able to do these basic calculations in her head, using mental mathematics, like she used to be able to do. She attributes much of this to her experience in high school where she felt as though teachers pushed the use of calculators on their students.

S: It sucks. I wish I could do what I know I used to be able to do. I hate that they always just shoved a calculator at us and said here use this. I used to be so good at mental mathematics- like when I could do long division no problem

Sydney does not experience the physical emotions that Maureen does, however, she has the desire and longing to be able to complete the mathematics with ease like she has memories of before her relationship with mathematics shifted in high school.

Chapter 6.

Disaffection Themes

6.1. Effort/work ethic

As seen above, peers can provide a strong support network and come alongside to help ask questions. Be as that may, the work ethic and drive is ultimately up to the individual themselves.

Despite being frustrated with not grasping the material being taught in her grade 11 mathematics class, Carla carried forward a strong work ethic and continued to put in the work required.

C: Mathematics was the only subject where I was not able to not care about it.

After class, Carla would come home and diligently work on her schoolwork, but she was faced with the disheartening thought that her work ethic might not be sufficient. Despite her best efforts, she found herself unable to fully grasp the material, leading to a sense of frustration as she struggled to successfully complete the assigned problems. This struggle with understanding the material contributed to a growing sense of disaffection and challenged her self-efficacy in overcoming the material she was learning in mathematics 11.

C: I just remember coming home and trying to work on it, and it just was not clicking.

C: I got chunks of my dad's overachiever personality where we work hard and do not give up.

In a similar way, keeping up in mathematics was not a problem for Lily – until grade 12. Lily was the type of student who strived to understand what was being taught in class. As mentioned before, during her elementary school years, this had come very easy to her. She would listen in class and then would be able to complete the work assigned with ease.

L: Even though it was easy, I still made sure I always did all my work. Every day I would have my homework done, and if I did get anything wrong, I would make sure that I went back and corrected it.

L: I would constantly look back at my notes and my work and go back to my answers to see if they are right- and if they were wrong, I would fix them. I put in the effort because it was not something that came super naturally to me.

This carried on into the first few years of high school, and then in grade 12, this took a dramatic turn. Lily found herself struggling to be able to follow along in class. Despite Lily's consistent efforts to seek clarification by asking questions and seeking help, she frequently encountered discouraging responses such as "think harder" or "work harder" from her teacher. Lily worked extremely hard at utilizing available tools like class time, tutorials, and extra help sessions, but the consistent frustration she faced in navigating the material further fueled negative emotions and contributed to a growing sense of disaffection with the material she was studying in mathematics 12.

L: I would go to the tutorials, but those were completely student run, and the teacher was not even there. And it came to a point where I felt like I had done everything I could possibly do to within my power to do. And then I just went screw it. I could not do it. And I just kind of gave up.

Lily felt as though she had tried to reach out and ask for help in every way that she could think of. At some point, she felt defeated and gave up- feeling as if there was no pathway that would offer her the help that she was needing.

L: I was there every day and still trying. But I just accepted the fact that it was not going to go well. And sure enough, I think I got like 51% or 52%. Which is unreal because everything had been a B or higher. So, to get a 52% was pretty upsetting especially because then I missed out on scholarships and stuff like that. It was frustrating that I did so poorly when I was actually doing the things that I was supposed to do, and I was not getting the help that I needed.

6.2. Self-Efficacy

After experiencing moments and experiences when events do not go as expected or take a sudden shift in the negative direction, it is this shift that can influence

how students view themselves and negatively challenge their self-belief as they go into different circumstances.

When Sydney was researching the program requirements for her desired education program, she learned that she was required to take mathematics 11. The first time Sydney took mathematics 11, she did not pass. Through this experience, her self-efficacy “took a hit”. Sydney’s beliefs about her capabilities decreased as she knew she would have to retake this course if she wanted to continue pursuing her goal of becoming an elementary school teacher. One of the specific aspects of the course which Sydney mainly struggled with was quadratic equations. When Sydney redid the course in grade 12, her mom hired a tutor which helped support her outside the classroom.

S: And that was such, like a really big hit on my self-esteem too, because I failed mathematics eleven. And I needed at least mathematics eleven to get into the program I wanted. So when I redid it in grade twelve, the tutor had to really focus on explaining quadratic equations to me, and then I was a little bit easier for me. But I still did not do like super well.

With a similar career goal to Sydney, Lily also had a dream of going into education. Lily’s program of choice offered two degrees- Bachelor of Art and Bachelor of Education. However, due to her low mathematics 12 mark, of 52%, her overall percentage was lowered and this influenced her future career path. Lily was faced with the reality that this course had the potential to influence her future.

L: I accepted the fact that I just could not get where I wanted. I ended up with 52% which was unreal. Everything before had been a B or higher.

If Lily wanted to pursue her Bachelor of Education, she would be required to enroll in a mathematics course during her first year. After Lily’s past experience in mathematics 12, she could not imagine having to sit through another mathematics class and did not believe as though she would be able to be successful in it.

L: I guess that one year in grade twelve just rocked my confidence and I just could not face the idea of doing worse in it. And I was like nope.

For Maureen, it was much less about her level of self-efficacy, rather the type of student she identified as. Up until grade 12, Maureen thought of herself as a smart student. When she moved schools and was all the sudden faced with the new experience and emotions of not being one of the best in her class, it shook her identity.

M: I thought of myself as quite smart because that is how I identified with myself from earlier.

For the first time in her schooling experience, she began to experience the feeling of failure and was not sure of what to do with these new thoughts.

M: That was me when I failed mathematics in grade twelve. I was like well I do not fail. I do not fail anything.

Maureen's belief about her abilities in school and her confidence in being able to understand the material that was taught was all the sudden altered by the experience she had in grade 12.

6.3. Frustration with ability

It is common for students to experience fluctuations in understanding in the classroom. Specifically in the realm of mathematics, concepts that were previously approached with confidence and ease can now suddenly become sources of frustration and confusion.

For Carla, this frustration with grappling with the reality that she was not grasping the concept with such ease as before caused a great deal of stress. In her grade 12 year, when she was retaking mathematics 12, she had to wrestle with knowing that her ability to comprehend the concepts she had already learnt last year was not as strong as it used to be.

C: It was frustrating because it stressed me out because I took school seriously

C: I still really struggled that first year in grade 12. I obviously retook the course because I thought I got it.

Maureen was also deeply frustrated by her inability to reach the high grades that she has consistently attained in her previous mathematics courses. When this was not the case in her grade 12 year, Maureen's frustration reached a peak and she disheartened that her grades were not as good.

M: All the sudden I was like oh, I do not know what to do with this failure.

The contrast between her past academic success and her current struggles exacerbated her frustration which in turn left her feeling ashamed.

M: I thought of myself as quite smart, but it was like this is how I identified in my previous school, so all the sudden I was like ohh. I do not know what to do with this

M: I feel like I am so far that I could never possibly learn it until I went back to grade 9

Similarly to Maureen, Sydney's experience of switching to regular mathematics 10 stirred new negative feelings that she had not experienced before. Mathematics had always been a subject Sydney excelled in and one which came naturally to her. However, in mathematics 10, she grappled with unfamiliar feelings of confusion and uncertainty.

S: Going into regular mathematics just completely ruined me

S: Essentials 9 just kind of felt the same because everything else was also easy so this just stayed easy. It was not until I switched to grade 10 regular mathematics and I was like wow.

This sense of frustration persisted not only throughout Sydney's high school years, but also into her post-secondary studies- particularly while she was enrolled in her mathematics for elementary teachers course.

S: I did not even understand. It was like so different from what I thought. I was frustrated because I used to be able to do this stuff and I enjoyed it

6.4. Negative emotions where they had not been there previously

In all four stories we see mathematics being a subject that was once tackled with confidence, shift into a course that caused frustration, confusion, and even anxiety. For Lily and Maureen, this shift happened in their grade 12 year.

As noted earlier, Maureen's perspective on mathematics had always been positive until her senior year when she relocated to Alberta. The culmination of adjusting to a new school, unfamiliar curriculum, and difficulties connecting with her new teacher contributed to her newfound disaffection to mathematics.

M: ...I would not know what I was doing. I ca not do it anyway, and I am failing anyway. I was that high school student.

Lily also experienced a noticeable transformation in her attitude towards mathematics. The origin of these negative feelings are able to be traced back to her experiences in mathematics 12. Before enrolling in mathematics 12, Lily had always approached the subject of mathematics without any negative emotions or disaffection towards the subject. She had never encountered any significant difficulties or frustrations with mathematics prior to this experience.

L: I hit a point where I felt like I had done everything I could possibly do....I just gave up a little bit

L:...its unreal because everything up to that had been so well.

For Sydney, it was a slower progression over two or more years. What was once clear and straightforward became a course of stress. Sydney's journey differed from that of Lily and Maureen, as it was marked by a gradual realization rather than a sudden shift towards disaffection. Upon entering mathematics 10, she began to recognize the gaps in her understanding, stemming from her previous enrollment in the essentials 9 stream, which left her lacking in many foundational concepts from mathematics 9.

S: That is where everything went down hill

S: Going into regular mathematics just completely ruined me

Chapter 7.

Conclusion

When I am in the classroom teaching, it is not uncommon to be teaching 100-120 students per semester. In one year, I often will teach around 200 students in total. That means that in one year, I am learning roughly 200 student stories about their experiences in mathematics and what their past experiences have been. Something I have realized throughout this process is that when I am in the thick of it with teaching, sometimes the small details regarding students' stories get missed or forgotten. While interviewing my participants, my focus and attention was solely on them during each conversation. Throughout the process of writing their stories and through the analysis of each story, it was eye opening to me the multitude of factors that go into each person's past. For each participant, there was no one event or one thing that led to their shift in relationship with mathematics. There were major events, life altering events you could say, but there were still many minute moments during those major events that came together to change the trajectory of their relationship with mathematics moving forward.

7.1. Responding to research questions:

Throughout kindergarten to grade 12, when do students experience a shift in relationship in mathematics from positive to negative? What are the influences behind this shift?

When I initially began pondering the potential reasons behind students' shift in relationship from positive to negative, I initially thought there might be a single situation or circumstance that caused this shift. However, as I embarked on this research study, it became evident that the causes were more complex than one single moment. There were several factors that contributed to the shifts for all four participants. A commonality between Carla, Sydney, Maureen, and Lily is that each of them experienced a shift in relationship during their high school years. All four individuals had positive interactions, memories, and experiences in their mathematics classrooms leading up to high school. They fondly recalled engaging in lessons, willingly completing the homework assigned, supportive teachers, and moments of understanding and success. These early

experiences instilled in them a sense of confidence and enjoyment in learning mathematics and shaping their attitudes towards mathematics in a positive way.

Carla's turn towards disaffection was heavily influenced by her involvement in the soccer program which ultimately led her to receiving concussions during her grade 11 and grade 12 year while she was enrolled in mathematics 12. These concussions were pivotal and resulted in Carla suffering from many lasting side effects which negatively influenced her interaction with mathematics both in the classroom and at home. Struggling with memory retention, Carla found it difficult to retain the information necessary for her mathematics 12 provincial exam. Although Carla believed that taking the course would lead to an improvement from her initial mark of 74%, it unexpectedly led to even greater struggles the second time around, resulting in a lower grade. This outcome was a stark contrast to her expectations and left her feeling disheartened and defeated. Carla's shift in her attitude toward mathematics was primarily influenced by external circumstances, such as her experience with multiple concussions and their impact on her ability to focus and retain information. These challenges compounded her difficulties in the course and contributed to her disaffection with mathematics.

Similarly, Sydney's disaffection began with a lack of information about the courses required for her desired post-secondary program. While taking mathematics essentials 9, she discovered she needed to switch to the regular mathematics 10 stream, which presented challenges as the essentials course had not covered the necessary material needed for mathematics 10. Despite persevering through mathematics 10, Sydney continued to struggle in mathematics 11, and her disaffection for the subject deepened after failing the course and struggling again when she retook mathematics 11.

Maureen never experienced negative emotions or dislike towards mathematics up until her grade 12 year. She had been enrolled in the academic stream at her previous school, where she encountered minimal struggle aside from the occasional need to put in extra effort to maintain her high level of success (as seen in mathematics 11). However, the move to Alberta in grade 12 brought about significant change. With a new teacher, difference curriculum, and unfamiliar classmates, Maureen found herself navigating a completely different academic environment. Right from the start of the year, Maureen felt ill-prepared for the mathematics course. This abrupt shift in her academic

surroundings ultimately led to a change in Maureen's relationship with mathematics, as she grappled with feelings of frustration and inadequacy.

Similarly to Maureen, Lily had experienced lots of success throughout her school years leading up to grade 12. Despite her consistent work ethic and dedication to her school work, Lily found herself facing unexpected challenges in mathematics 12. She actively sought out additional support, attended help sessions and tutorials, and collaborated with her classmates in hopes to better understand the material. However, despite her diligent efforts, she was unable to achieve the level of success she had previously achieved. Lily received her lowest grade ever which marks her distinct shift in relationship with mathematics. Lily attributes her lack of success in mathematics 12 to the teacher she had in this course.

How do these influences lead to disaffection with mathematics?

Each of these four individuals prided themselves on their strong work ethic and their history of achieving high levels of success, both prior to and during high school. However, their shifts towards disaffection with mathematics were not due to lack of effort or a choice to give up easily. Maureen and Lily encountered significant frustration while working with their mathematics 12 teachers, which ultimately led them to reduce their effort and commitment to their studies out of a sense of defeat. It was not a random decision to stop working hard; rather, they realized that their efforts were not yielding the marks and understanding they had come to expect based on their previous experiences in mathematics classrooms.

On the other hand, Carla and Sydney's disaffection stemmed from external circumstances rather than frustrations with their teachers. Carla's involvement in the soccer program led to her being perceived as less committed to her studies, and the effects of her concussion's future hindered her academic success. This resulted in loss of self-efficacy and faith in her abilities.

Sydney's perception of not being adequately prepared for mathematics 10 became a significant factor in her aversion to the subject. Her lowered sense of self belief was compounded when she failed mathematics 11, causing her confidence in her mathematics abilities to waver. What was once a source of enjoyment and success for Sydney, now seemed distant and unattainable, leading to feelings of frustration and a

decline in her belief in herself. Although she passed mathematics 11, when she retook it in her grade 12 year, Sydney's negative experiences continued to influence her attitude towards mathematics. The lingering impact of these negative experiences resulted in disaffection with the subject as she struggled to overcome the doubts and insecurities instilled by her past failures.

How does this relationship from positive to negative influence their interaction with mathematics today as an adult?

The repercussions of each individual's disaffection with mathematics have had a profound impact on their interactions with the subject, both immediately after high school and throughout their careers. For Carla, Maureen, Sydney, and Lily, their negative experiences with mathematics during their formative years have shaped their attitudes and approaches towards the subject in various ways. Lily and Sydney chose to avoid mathematics-related courses altogether, while Carla and Maureen did not change their desired career path but still have a lingering sense of insecurity.

Lily's disaffection with mathematics significantly impacted her choices in post-secondary education, ultimately leading her to forego pursuing a Bachelor of Education due to her avoidance of the required mathematics class. The fear of failure had a powerful grasp over Lily, leading to her escape the possibility of struggle or failing a mathematics course. In contrast, Sydney did enroll in a mathematics course during her post-secondary studies, specifically mathematics for elementary teachers, but faced challenges. While she did manage to pass the course the second time she took it, she required external support from a tutoring company. Presently, Sydney's primary source of frustration lies in her perception of lower ability to complete mental mathematics, which reiterates her disparity between the mathematics skills she gained in elementary school and the practical application in her current job. As for Carla, despite regularly utilizing mathematics in her role as a bookkeeper, she struggles with confidence, feeling unable to reach the same level of proficiency she once did. Maureen's disaffection with mathematics is the most distinct and her history and experiences with traditional academic mathematics has left a lasting impact. When she interacts with mathematics today- particularly topics that resembled the challenges she encountered in school, she experiences physical symptoms of anxiety. While she feels competent in everyday

mathematics and basic operations, Maureen experiences significant distress when faced with situations reminiscent of her previous struggles with mathematics.

7.2. Further Research

Within the field of research, there exists the possibility for continuous growth and progress. The outcomes of this study have the potential to spark further opportunities for exploration and investigation. One of the primary concerns that arise following this study, is that now that some of the factors that influence and contribute to disaffection are known, how can educators intervene to prevent this phenomenon? Are there proactive steps that can be implemented to help eliminate or stop disaffection before it causes lasting effects? Further areas that can be studied are as follows:

- In this research study, each participant was an adult who had already completed their K-12 education and could reflect on their experiences and how those experiences influenced their post-secondary decisions and journey. How might the findings be different if current high school students who were beginning to perceive this shift in relationship with mathematics or those who have already experienced it were to be interviewed?
- How can educators assist students in recognizing when this shift towards disaffection is occurring and encourage them to seek support?
- Is it possible for educators to completely prevent disaffection with mathematics from occurring or is it an inevitable part of the education journey? Is it possible to experience some negative emotions towards mathematics but not complete high school with a sense of disaffection towards the subject area?

7.3. Avoiding future disaffection in the classroom

The research has illuminated the understanding that a single negative experience with mathematics does not necessarily define a student's entire journey. Through the stories of Carla, Maureen, Sydney, and Lily, it becomes evident that their resilience and perseverance played a significant role in navigating through frustrations. Rather than being shaped by isolated moments, their disaffection with mathematics evolved over time and were influenced by a series of events and encounters.

From my perspective, it is refreshing and reassuring to recognize that disaffection is not solely attributed to the teaching methods a teacher may use. There are so many unknown external factors that influence students' experiences and journeys

in school. Personally, I find reassurance in knowing that I am not solely responsible for a student's relationship with mathematics. For myself, this is a comforting fact knowing that I am single handily responsible for a student's relationship with mathematics. As educators, we are part of the conversation and part of the experience, but the pressure does not rest solely on our shoulders. This research suggests that there are multiple influences and factors contributing to student disaffection. To prevent and avoid disaffection, educators can implement several strategies to create a supportive and inclusive learning environment.

In considering these strategies, I draw not only from my research, but also from my own experience as a teacher. One important aspect that emerges from both is the need for open communication with students. By fostering an atmosphere of trust and transparency, educators can encourage students to voice their concerns and seek assistance when needed. Additionally, connecting with students individually allows for a deeper understanding of their unique challenges and helps tailor support accordingly. For example, this could be taking a few minutes into lunch to have a conversation with a struggling student about where some of their struggles and frustration are stemming from. It is possible that the external circumstance they are facing is presenting as difficulties in mathematics. However, upon discussion, it becomes apparent that there struggles with mathematics stem from those external circumstances rather than the subject itself. There are going to be situations where students may already harbour feelings of disaffection towards mathematics upon entering the classroom. Even so, it is important to adapt teaching practices to create a welcoming environment that encourages all students to engage with mathematics. By understanding and addressing students' pre-existing attitudes towards mathematics, educators can work towards fostering a positive learning environment where every student feels valued and supported in their mathematical journey.

The research has illuminated the understanding that a single negative experience with mathematics does not necessarily define a student's entire journey. Through the stories of Carla, Maureen, Sydney, and Lily, it becomes evident that their resilience and perseverance played a significant role in navigating through frustrations. Rather than being shaped by isolated moments, their disaffection with mathematics evolved over time and were influenced by a series of events and encounters.

7.4. How I have changed as a researcher

In my journey as a researcher, I have learned to appreciate the value of diving into the nitty-gritty details. Listening to the audio recordings time and time again has been an eye-opening experience. Each playback revealed new layers of understanding and insight. It has been about thinking outside the box and exploring unconventional ways to uncover a fresh perspective. Taking on a project of this magnitude, one unlike anything I have ever tackled before, has been both exhilarating and very challenging. Despite my initial uncertainty, I found myself rising to the occasion, and honing in my ability to uncover hidden nuggets of information when I did not know exactly what I was searching for. I have been repeatedly reminded of how much support my supervisor has provided and hope to be able to pass this along one day in whatever context that may be. This journey has been transformative, shaping me into a more versatile and resilient researcher with each new discovery. It is worth noting that when I started this process, I had very limited experience and awareness of how educational research was typically conducted. This made each milestone that much more significant in my growth as a researcher. Though I am aware there is always more to offer, I feel like I have gained a much clearer understanding of the ins and outs of educational research, from navigating literature searches to constructing research papers.

7.5. How I have changed as a teacher

Reflecting on the perspective above in section 7.3, I am prompted to consider how it can inform my teaching approach. As an educator, acknowledging that a student's current struggle may not be their first encounter with difficulty in mathematics opens up new avenues to support them. It allows me the opportunity to open the conversation for inquiring more information if this is not a student's first time struggling. I hope to learn about where their previous struggles have stemmed from. If they are carrying past frustrations into this new circumstance. How and if their self-efficacy has been negatively impacted through these experiences. Instead of viewing these challenges in isolation, I can explore the broader context of a student's mathematical journey.

This approach allows for a more detailed understanding of student disaffection and provides opportunities to tailor support accordingly. By pausing to inquire whether a student's current difficulty is part of a larger pattern of frustration, I can better address

underlying issues and provide a more supportive learning environment. This shift in my perspective emphasizes the importance of looking at the students experiences as whole and not just in isolation in my classroom.

Throughout this researching and writing journey, I have evolved as a teacher and have been shaped by this realization. I have come to feel relief knowing that one bad experience is not the end-all-be-all for a student's relationship with mathematics. While I do not take the seriousness of responsibility of my role as an educator lightly, these stories have provided me with a sense of reassurance. Understanding that there was not one instance in time that changed everything has encouraged me to take the time to delve deeper into why there might be frustration. It has prompted me to look beyond the confines of my classroom and consider what other factors may be influences a student's experience outside of school. It is easy to become absorbed in the day-to-day activities of the classroom, but it is essential to remember that the 80 minutes that students spend with me each day is just one piece of the larger puzzle of their lives. By adopting a more holistic approach to teaching, I strive to create an environment where every student feels valued, supported, and empowered on their educational journey.

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