A Teacher's Journey to Transform her Math Identity

by

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A Thesis submitted to the Faculty of Graduate Studies of

The University of Manitoba

in partial fulfilment of the requirements of the degree of

MASTER OF EDUCATION

Department of Curriculum, Teaching, and Learning

University of Manitoba

Winnipeg

Abstract

This study explored the transformation of a teacher's math identity. The researcher used narrative inquiry to live alongside the participant (Clandinin, 2013) as she experienced teaching in a pedagogically courageous way to make math meaningful to her students. Along the way the participant experienced cognitive dissonance but through intense collaborative professional reflection she persevered and evolved. The study addressed the questions: What factors influence a teacher's motivation to grow and to make math meaningful to their students? What factors influence a teacher to commit to lifelong learning in math? Four themes emerged through the observations, journals, and reflective conversations including sharing of interim texts and the final narrative. The importance of the *relationship* with the researcher/coach, the *trust* that the participant had in the coach, the process, and herself, her desire for *balance* in her teaching life, and her improved sense *efficacy* led to her transformed math identity.

Acknowledgements

There are many people who have supported and encouraged me along this journey. I would like to acknowledge the support of my advisor Dr. Ralph Mason for pushing me, advising me, and letting me be me. As Lily experienced an evolving sense of trust in herself as a math teacher I too experienced an evolving sense of trust in my identity as a researcher and a writer with the support of my advisor. I would also like to acknowledge the support of my other committee members. To Dr. Jerry Ameis for taking a risk on me and encouraging me to begin this new educational journey. He helped me to view math in a different way that opened up endless possibilities. To Dr. Frank Deer for being a member of my committee and providing his insight. Each member of my committee brought with them welcomed expertise.

I want to thank my family and friends, who have been extremely understanding and supportive. I want to acknowledge my brother for always being ready with a pep talk and encouraging me along the way. I would also like to thank my mother-in-law for all her encouragement and my Mom for all the love, support, and help she has given me my entire life. There are many friends who engaged in conversation and encouraged me along the way and I thank them from the bottom of my heart. I also want to thank Kelsey for taking the time to provide me with meaningful feedback. I want to express my gratitude to my immediate family, John, Jesse, Jake, and our dog Poppy. I want to thank Jesse and Jake for their energy, love and happy dispositions. They have grown up so much over the past four years. It is hard to believe they were two and four when this journey began. Most of all I thank my loving husband, John, for allowing me the space and time to pursue my Master's. Without John's encouragement, patience, and support this thesis would not have been what it is today. Finally, thank you to Lily for wholeheartedly participating in this study and making this a powerful experience.

Dedication

To my Dad

Dad always encouraged me to work hard and strive for more. He loved me unconditionally and was always there for me. He really listened and asked me the tough questions to help me work through moments in my life. After a conversation with Dad I always felt much better and felt ready for whatever came next. I have missed him every day since he died. I know he would be proud that I completed my Master's and persevered.

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Chapter 1: Narrative beginnings

[Note to readers: *As a whole, this thesis describes a research story twice. This chapter and the two that follow it were originally written as a proposal, looking forward toward an as-yet-unlived research story. The future tense used in the proposal is preserved here, to preserve my positioning as an author looking forward. My positioning changes in the final four chapters. Because these chapters construct a retrospective narrative of the research story as lived, I have shifted to past tense verbs, reflecting the shift in temporality* (Clandinin & Connelly, 2000) *of the author (me) in relation to the story as lived.*]

Mathematics has always been a passion for me. I knew that I wanted my career to revolve around math. I think I became a high school math teacher so I could do math every day, all day. I have been met with many different reactions when I tell someone I am a math teacher, often, "oh, I hate math" or "I was never good at math" or "how do you do it?" It is very seldom, if ever, that someone says "I love math", or "I was really good at math". Unfortunately these negative reactions include students, preservice teachers, and even practicing teachers. The following chapter will take a look at my history with mathematics as part of this narrative inquiry. "Narrative Inquirers must begin, then, with inquiring into our own stories of experience" (Clandinin, 2013, p. 82). Here I will begin the process of "engaging in an autobiographical narrative inquiry in order to set a research puzzle, to justify the study, and to position" (p. 86) myself in the study". The importance of engaging in a process that provides my history with

mathematics and my experiences teaching mathematics illuminates the starting point to this narrative inquiry and my journey towards exploring my research puzzle.

My Current Role as a Math Educator

I work at a university in the Faculty of Education teaching Curriculum, Instruction and Assessment Mathematics courses for Kindergarten – Grade 12 preservice teachers. I work in the ACCESS Education program and on main campus. The ACCESS Education programs are an off campus extension that provides academic opportunities for people with inner city experience, as well as single parents, mature students, and immigrants. I have had the opportunity to work with amazing people over the last four years that have overcome many barriers to become contributing members of our education system. The ACCESS program was developed to provide opportunities for Aboriginal people, minorities, and other inner-city residents to become teachers.

> It has long been recognized that there is an under-representation of Aboriginal people, minorities and other inner-city residents in the teaching profession. Often students who are representative of this population are struggling with circumstances and obstacles not experienced by the traditional "right out of high school" university student. Since this under-represented population brings with them a wealth of experience, wisdom and challenges, a program that is uniquely for them is necessary for long term growth and success. (The University of Winnipeg, 2015)

Our students are in need of academic, personal, or financial supports in order to pursue a university degree.

My interest in my students' math history did not just begin with the ACCESS program. I have always been interested in the relationship my students had with mathematics. In my

experience teaching Grade 8 to 12 math and teaching preservice Kindergarten to Grade 12 math teachers, I always had them explain their math history to me which over time evolved into stories that took place over their lifetime. I collected their math history in different ways, a math autobiography detailing their past with math, a Math and Me survey, and most recently I have my preservice teachers reflect in their journals on their experiences with math. The journal experience was a rewarding journey for my preservice students and for me. The first entry that described their experience with math was very telling. This was, for many of them, a description of the beginning of math for them in grade school. Many of them had negative experiences that tainted their future experiences with math, so much so that they reflected on how the class they were about to take was not one they were looking forward to at all. Some even expressed a fear or anxiety associated with math, one that they were hoping to lessen. In Burns' (1998) book, *Math: Facing an American Phobia*, she too had encountered scores of people that had told her about their aversion to math, "about their fear, dismay, anxiety, avoidance, dislike, inadequacy, incapacity, and more" (p. 142). She described it as an American phobia. The very same is experienced here in Canada too.

I felt it was important for my students to reflect on their experiences with math. In their reflections they used the words anxiety and phobia. They expressed their feelings of inadequacy and self-doubt in regards to teaching mathematics. Hardy (2009) recognized these feelings and explained that: "what we know of the problem and its explanation reemerges as a truth: that 'teachers are not confident with mathematics and not confident with teaching mathematics'" (Hardy, 2009, p. 192). This truth was reflected in my preservice students' journals. They had doubts about their ability to learn and teach mathematics. However, it was clear in their journal entries that they felt empowered telling their story; they knew they had a captive audience. They

expressed their goals and a glimpse of what their future math teaching would look like ideally. I intentionally left the journal entry's topic open, it allowed them to go in whatever direction they wanted. They gave me a picture of what their past with math looked like and what they were willing to share with me.

I believe the journal entries resulted in a more descriptive and helpful picture of their lived experiences. I believe that some of the important information that was shared with me would not have been shared if I had only had them respond to a set of questions. As we journeyed through the course and we continued to journal, I could see their growth as they reflected on the topics and prompts I provided them. Through their reflective writings they were evolving and coming up with their own solutions to problems and new ideas to explore. "We write to know. We write to learn. We write to discover" (Ely, 2007, p. 507). Journaling was helping my preservice teachers become more knowledgeable, learn, and discover. It seemed natural for most of them to use this mode to record their growth through the course and by the end even if they didn't feel quite prepared to teach math they felt they were closer to feeling prepared.

Near the end of the course, the students used their journal entries to reflect back and look at their growth. It was natural for them to reflect on what they felt was important even if I did not expect that topic to turn up in the entry it fit for them and their experiences. They were allowing me to see into their lives as experienced through math. Their journals were certainly an example of how their past was affecting their present and surely their future in regards to how they teach math to their students. "It is also important that we return to those earlier landscapes to inquire into the stories we are living and telling of who we are and are becoming, as we begin our narrative inquiries with participants" (Clandinin, 2013, p. 82).

Past Dissonance with Mathematics

As a child I too had experiences that could have led me to fear and be anxious about math. Fortunately, my brother and I had parents that were always there for us and they placed an emphasis on the importance of school. Dad was the strong, silent type; he worked hard, always helped his family and friends and had a calm and patient presence. He led by example, he didn't need to talk about it. Dad loved us unconditionally and, most of all, wanted us to have a better childhood than he had. Mom is loving and a hard worker, she won't sit down if there's work to be done, and would do anything to help us. She cannot be described as quiet – she could make a rock talk! Our parents taught us to value life, to do our best and to work hard.

When I was a young child my parents, especially Dad, encouraged us to practice our math skills. I would beg Dad to give me more questions to try. He would always give me a list of questions, which, as I look back on it, were very traditional fact-type questions, but still I enjoyed doing them. My brother instead would reply with groans and, "Do I have to?" It was from very early on that I displayed this enthusiasm for math. So, it came as a big surprise to Mom when I was in Grade 4 and she went to parent teacher interviews and was told that I was terrible in math and that I would never be good in math. To this day, I ask my Mom, "Did she really say that?" It seems a bit much for someone to say, but she swears she did. I feel similar to how Marilyn Huber (in Clandinin, 2013) explained her feelings:

> at least in my memory of this experience, of who I was and who I was becoming, was coherent neither with the student stories I held of myself nor with friend, peer, and family stories told about me and to me. (p. 63)

The words spoken by my Grade 4 teacher did not ring true for me. To say that my parents were shocked was a bit of an understatement. Mom was irate at this teacher but I remember Dad being so calm about the whole thing, saying okay let's see what work needs to be done. Dad was an optimist, my Mom is and always has been a pessimist and a constant worrier; they balanced each other. We continued our math fun together. However, for now he didn't make up the questions; we used questions from the teacher. Still I enjoyed it and had fun. There was no trace of the child the teacher had described as "terrible in math".

This memory brings forward many important pieces that have shaped my mathematics identity. Growth in math is so important. We know how damaging comments to a nine year old can be and we teachers know that we need to be encouraging. Math is a subject, it seems, that people can become discouraged easily. I have often heard, "I loved math until grade ___ and then I had ___ as a teacher and I have hated it ever since." I am lucky that when I was in Grade 4 my dad and mom took the time and worked on math with me, and allowed me to continue living out the story that I had come to believe, that I was good in math, I certainly enjoyed it. As I look back on Grade 4, the teacher probably was seeing this lack of confidence in general from being bullied at school all the time transfer over, even into math, a subject I loved. Dad and Mom really turned that math experience in Grade 4 into a positive one; unfortunately, children

don't always have someone at home that will do that for them in the same way. Support from home is so important! Without my parents' support, I could be telling about why I hate and fear math, but fortunately the story of my parents' support makes up part of my math identity, my growth and even my transformation. It is so important for students to have positive, confident, knowledgeable math teachers, but how do the teachers arrive at that point if they identify themselves as someone who isn't good at math or hates math?

Math in My Preservice Teachers' Lives

As teachers, we sometimes don't realize the impact one comment or one incident can have on our students, we can have a negative or positive influence on our students' lives. We need to be cognizant of our influence and help our students instead of hindering them. That comment my Grade 4 teacher made 30 years ago has probably long ago disappeared from her memory. Yet for me it helped shape my life, and shows "how the memories I carry of myself in this world have shaped and continue to shape, who I am and who I am becoming as a teacher" (Clandinin, 2013, p. 61). There are so many different background stories to our students and so much going on in their lives that affect their ability to learn and to communicate.

Teachers too have these background stories regarding math and need an opportunity to reflect and create counterstories for themselves. Counterstories "take what has (for the moment

at least) been determined, undo it, and reconfigure it with a new moral significance" (Lindemann Nelson, 1995, p. 34). Taking the opportunity to reflect and making new meaning from experiences resulting in greater growth and more meaningful connections to the past, present and future allows teachers to envision themselves through a lens that is reflective of how they want to view themselves.

Three qualities of narrative inquiry are described by Clandinin and Connelly (2000) using three sets of terms:

> *personal* and *social* (interaction); *past, present,* and *future* (continuity); combined with the notion of *place* (situation). This set of terms creates a metaphorical *three dimensional narrative inquiry space,* with temporality along one dimension, the personal and the social along a second dimension, and place along a third. (p. 50)

As an instructor for preservice teachers the temporality component is significant. As I reflect back on my experiences and my preservice teachers' experiences with math what resonates with me is the importance of looking at our past experiences, present experiences, and how these can shape our future experiences.

It is important to think about how we can improve our future, move forward, and reimagine. Math as part of my students' past, present and future needs to be explored. To allow my students to reflect on their past with math helps them to not only express their uncertainty regarding their math knowledge and their fear or dislike of math but also to hear others express their past. Our feelings play a huge role in our experiences and certainly our stories of our math

history. The more information I have about my preservice teachers' experiences and descriptions of their feelings the more I can help them alleviate their anxiety towards math. Their environment and those surrounding them make their story, who was there and what influence they had on their experience plays a role. The behaviours and attitudes they may be expressing in the present are often a result of their past experiences with math and without knowing what their past was it is difficult to move forward in a meaningful way. Their future as a math teacher depends on their present action and motivation to improve their relationship with math. All of these pieces influence their future decisions in regards to their choice to grow in math or to remain stagnant. For many of them to stay as they are in regards to math would result in a classroom void of connections, of real life problem solving and include only memorizing. This rote style of learning was never the true intention of mathematics. "This follow the rules, computation-dominated, answer oriented view of mathematics is a gross distortion of what mathematics is really about. It cannot be very exciting" (Van de Walle, Folk, Karp, & Bay-Williams, 2011, p. 16).

Preservice teachers must recognize that math "relies on logical structures. On relationships. On connections between and among ideas" (Burns, 1992, p. 72). Growth is paramount to their success as a teacher. As teachers we need to foster the importance of lifelong learning with a focus on mathematics. There are so many outside influences beyond math teaching awaiting them in their futures as math teachers in their environment. For example they have many subjects to attend to, school goals, professional learning communities, extracurricular

activities, policies to learn, and administrators' initiatives. My goal as a teacher educator is to increase my preservice teachers' mathematical content knowledge, establish a problem solving climate (Ameis, 2016) for learning, find ways to make math meaningful for them, and give them opportunities to reflect on math and how to teach math, in an engaging and meaningful way. By giving them the opportunity to grow and learn during their daily classroom interactions I will help ease the worry of outside influences causing their transformation to be delayed due to lack of time to work on their math identity. In the Principles of Standards for School Mathematics the National Council of Teachers of Mathematics (NCTM) support this positioning with The Teaching Principle:

> To provide high-quality mathematics education, teachers must (1) understand deeply the mathematics they are teaching; (2) understand how children learn mathematics, including having a keen awareness of the individual mathematical development of their own students; and (3) select instructional tasks and strategies that will enhance learning. (Van de Walle, Folk, Karp, & Bay-Williams, 2011, p. 3)

Unfortunately for many of my preservice teachers, their learning experiences in math did not reflect this type of instruction, and as a result their confidence is low in regards to teaching and even learning mathematics. I believe for Kindergarten – Grade 8 preservice teachers and practicing teachers increasing their confidence starts with making math meaningful for them and in turn their students. Decision makers need to support their teachers and give them time to focus on improving their craft. The desire is often there, the time is limited. According to Burns (1992),

> It's said that you know something best when you teach it. That's because teaching it requires figuring out why something makes sense and then thinking about how to present the idea so that someone else can make sense of it, too. Making sense is the very act of learning, and the source for that understanding is inside our head. (p. 72)

It is important that teachers improve and grow throughout their career.

The Impact of Storytelling

When I hear "walking into the midst of stories" (Clandinin & Connelly, 2000, p. 63), it sounds poetic. In the image that phrase triggers for me, I am walking out in the bush; all is quiet, and I have just my thoughts and my dog to keep me company. For me, the bush is where I do my best thinking and reflecting on my experiences. So, when I think about walking in the midst I think about what it would be like to be a part of someone else's experience and how it would fit in with my own. When I was teaching high school mathematics I could see that each student had a story, but I don't think that I always made the effort (or had the time) to hear their stories. I had over 200 students a year and sometimes when I had large classes I didn't even have enough desks. However, I always felt that their stories and experiences were important and through different experiences in my life I know that I was able to empathize with them more. Now, with fewer students and no set curriculum exactly, I can take the time to see how their experiences and stories have affected them and let those stories help guide my teaching. I think from having heard some of their stories that they now feel like a part of me as well.

One of the ways that I make math meaningful as a teacher educator is through storytelling. Stories can be used in mathematics to provide a frame or background, to introduce, accompany or intertwine, ask a question, or explain (Zazkis & Liljedahl, 2009). I told these types of stories to my preservice teachers. They were a way of making mathematics more accessible and more engaging. "Establishing meaning should be, we believe, a central thread in teaching mathematics – a subject too often perceived as the manipulations of symbols, the meaning of which is often far from clear to students" (p. 3). Making math meaningful is vital. As math is made more meaningful for preservice teachers they will be better equipped to make connections and recognize best practice. Storytelling made a connection with my students, one that I am positive they will continue to use in their teaching. I know this because they told me in their journals.

The power of storytelling, whether it was the stories in their journals or the math stories I told them, were part of my journey that led me to appreciate how important narrative inquiry could be as research. As an inquirer there will be a lot of responsibility for me and my participant. As an instructor of preservice teachers, I could feel this when responding to my students in their journals. "The inquirer needs to be aware of the details of place, of the nuanced warps in time, and of the complex shifts between personal and social observations and their relations" (Clandinin & Connelly, 2000, p. 91). I can imagine there is so much that makes up a teacher's lived experiences when growing in math.

As I explore my narrative beginnings I will "attend through the three-dimensional inquiry space to our experiences" (Clandinin, 2013, p. 83). I have so many memories that come to mind. "Attending in this way also means that we attend to the places in which our stories have unfolded, and we make visible the events that shaped our understandings and our emotional, moral, and spiritual responses to these events" (Clandinin, 2013, p. 83).

I remember when I was teaching at an urban high school as a department head, one of my responsibilities was keeping my department up to date on any changes or innovative ways to make math meaningful. My department was happy to learn new strategies, and excited to try out the new activities and ideas. They were particularly happy when the ideas resulted in the students making a connection with math, coming to a greater understanding and/or enjoyment for their students. The desire for growth as a math teacher exists and needs to be nurtured and encouraged.

As our Grade 9 students arrived each year they were filled with many different feelings towards math. Somehow, math more than any other subject seems to come with a lot of baggage. Somehow, MATH is a new four letter word that causes people to wince as if you just cursed. It has always been a goal of mine to help people move past their ingrained fear of math. The Grade 9 students were filled with memorized facts and rules regarding math, their problem solving was very limited in many cases and virtually nil in a few. We would review fractions and they would call upon their memorized rules, "okay so for multiplying fractions I cross

multiply", and were shocked to learn that this was incorrect. "But I swear that's what my teacher last year told me". Never mind. Now I have fifth year education students that give me that same explanation. Next we might move on to talking about integers. Here they have a whole pile of rules, believing that "if I could just write the rules down correctly I know I could do this again." Yet again they are saying "if I add a positive and a negative I will always get a negative", mixing up the rules for multiplying and adding. In the case of both fractions and integers (which by the way are integral to their success as students in Grade 9), they have memorized rules with no connections made; rules that they can't quite remember anymore without understanding. Instead, they do each procedure the way their teacher told them to do it.

Without making math meaningful and having the students make connections through experience, discovery, or real life, they do not take any ownership over the math. Nor do they have a true understanding of what they are doing. This has resulted in math learning becoming rote with no connections made. So, as a Grade 9 teacher, I would spend time making connections and fostering the understanding piece. Otherwise they would be plagued with this one way of learning math for the rest of their high school math career. As Burns (1998) describes, "learning means to understand, not to recite back what has been said to you. Learning mathematics means to grasp relationships, see connections among ideas, and be able to use new concepts and skills in new situations" (p. 70). The support I provided to my Grade 9 students I

now provide to many of my preservice teachers who, in some unfortunate cases, can remember only rote experiences learning math.

Transformation

Early on when I was teaching high school math, I wanted to talk with some of the middle school teachers at the time to try and ensure that as a group we were teaching for understanding and not just memorizing rules. At that time however, administration, the math coordinator and maybe even the middle school teachers were not open to a meeting of this nature. They felt that the math coordinator could handle this type of professional development. They also did not want it to turn into a blame type situation, which I can understand. However, I still believe that opening up the lines of communication and sharing our ideas, experiences and stories could only have been a good thing. Fortunately, 10 years later they are finally having those meetings in my former school division and openly discussing what they can do to increase the students' mathematical understanding. I am not part of those meetings however, with my new position.

When I saw the opportunity to teach preservice teachers math at a University, I thought, well here is my chance to make sure that when they start teaching they will see the value of making connections and not just repeat how they were taught. Here is my chance to make math meaningful to them. The class I first taught was a small ACCESS group of 12 students. They had some negative feelings towards math, but they were eager to change this. They didn't want to fear math anymore, and they also did not want to make their students' experience even remotely close to theirs. This was a good start. Unfortunately, some teachers who experienced success in math want to teach it the same way they were taught, by requiring students to

memorize rules and follow procedures, even though this does not lead to true understanding or develop the capability to solve problems in real-life applications. "Teacher education that is conducted in a setting that promotes investigation and inquiry into the problems of mathematics teaching seems to hold promise for assisting preservice teachers in becoming inquiring, reflective mathematics teachers" (Mewborn, 1999, p. 339).

More opportunities must be given to hear others' stories, share experiences, and to reflect on possible counterstories. Hopefully then teachers can see all the range of possibilities for teaching for understanding. As teachers we need to move our students forward. So, for now I will continue teaching preservice teachers in the hopes of making 'math' a happy word for them, a subject they can enjoy, value and pass on this positive relationship with mathematics to their students. As future teachers they have a responsibility to enable their "students to become confident, skilled, independent doers of mathematics beyond our classrooms" (Fillingim & Barlow, 2010, p. 81).

I am interested in math education at all levels, specifically how to promote growth in critical thinking and problem solving. I want to encourage teachers and students to move away from solely memorizing and using rules to solve problems. I want people to be able to solve problems and make meaning out of what the numbers are saying instead of just saying this is the answer. As a teacher educator I want to support other teachers during their mathematical journey to encourage them to take a few risks in their teaching that will help motivate their students to

really think. I realize that this often means increasing the teacher's confidence first and making sure they are comfortable with the content. Preservice teachers need to be exposed to more meaningful ways of teaching so that they can learn to teach in a meaningful way, modelling hopefully what they are exposed to in their university class versus some of their experiences in their past. As Bishop (2012) explains,

> Identities are important because they affect whether and how we engage in activities, both mathematical and otherwise, and also because they play a fundamental role in enhancing (or detracting from) our attitudes, dispositions, emotional development, and general sense of self. (pp. 34-35)

Past experiences, their current fears and their plans for the future weigh heavily on their willingness to grow and change their math identity. Many of my preservice teachers were given a math education consisting of a steady diet of pencil-and-paper practice and weren't given a chance to see the purpose and usefulness of arithmetic in real life. They were encouraged to be successful in arithmetic by learning by rote. Thinking and reasoning weren't required (Burns, 1992).

Success in school mathematics today depends on thinking and reasoning (Manitoba Education, 2013). Personal stories of learning and teaching math fits within the three dimensional narrative inquiry space. Recognizing the lived experience involved in this growth is a story worth telling. When people can read and see themselves, or relate in some way to another person's story or experience, the story was worth telling. As more narrative inquiry is

done, the more stories will be available for people to read and become, vicariously, a part of their own experience. As these stories are told the possibility that someone might think that another person's story sounds like what they have been going through increases. Such a story can help that person think through their own issues with their math identity. Math can be a very isolating subject when you don't have the confidence to teach it; many of my preservice teachers express their life long struggle of feeling inadequate in math. So, telling individual stories about experiences where their journey with math is similar to others' could be encouraging and empowering. This is what I hope to do, they are not alone in their journey, their stories are worth telling and recording, maybe by seeing others' stories told they will feel more confident in sharing theirs. The feedback from telling their story can be very helpful and more importantly help them move their story forward in a positive way. I hope to be a part of this movement.

My goal when I made the decision to become a math teacher was to teach high school math. After 12 years as a math teacher (seven as department head), I still loved teaching high school math, but I felt like I was not growing as much, sure I was making improvements each year, but I needed "more depth". When I was hired on to teach at the university that is exactly the words used by the Professor who was part of the hiring committee, he felt I had potential but I needed "more depth".

The choice to take my Master's was a hopeful decision, that I could grow more in regards to teaching math in ways that could help preservice teachers become more confident. I wanted

the preservice teachers to develop more meaningful ways of teaching math, other than teaching rules and requiring memorizing.

I would not have characterized becoming a teacher of preservice teachers as a shift in culture as described in *Keeping Hope Alive* (Yi, Mitton-Kukner, & Yeom, 2008), but the description did fit. It was a shift from teaching high school students to university students, which required me to slowly shift my teaching practice in my classroom. I wanted to make connections with my students, including many Aboriginal students, in meaningful ways. This was where storytelling came in for me. I started to see my students making connections, journaling about the stories, and making their own stories. They started to feel more hopeful about their future as a math teacher; a future they had once described as a scary one for them, they lacked confidence, couldn't make connections, and felt incompetent. By the end of the course the vision they had about what a math teacher looked like was very different from their original notion, it was new to them but more comfortable than what they had experienced in school. I think they would identify with:

> Threads of teaching knowledge which belonged to and were shaped by contexts far removed from the ones we found ourselves in subsequently caused us to question not only who we were in these new places but who we were as teachers as well. (p. 250)

Their new vision of math and how they could conduct themselves as a math teacher was hopeful. They could now imagine a practice they could see themselves achieving. The "writing of the new stories that followed these discussions which conveyed how we countered the hopelessness we initially felt" (p. 253) describes the journey of many of my students. They still have to begin

their bigger journey as teachers but hopefully their experiences as undergraduates will help them to continue to write new stories.

Hope is such a small word but filled with so much meaning. "Hope is complex and elusive and to try to pin down its characteristics" (Yi, Mitton-Kukner, & Yeom, 2008, p. 253) is very difficult. There are times in life where hope does seem to fade, hope is disrupted and restorying needs to take place and taking the time to sit and wonder what that might look like is so important. Educators need:

> to think how a narrative notion of hope might shape and shift their own teaching practices. Considering the ... shifting world in which we are situated, we encourage hopeful reflective practice and its fluidity: backwards, forwards, and purposeful. (p. 254)

With purpose as educators we question our way, we foster hope, and that's when we continue to hold the faith and trust of our students. As educators we need to be hopeful to foster hope in our students.

I have taught many students in the ACCESS program who were very passionate about teaching, about inner city students, and they have a keen desire to improve, to grow and to pass on their story of success. Our students need these types of teachers. These teachers should not be marginalized.

> One way in which we might attend to present and future responsibilities … is by not losing sight of the new possible intergenerational narrative reverberations that their stories foreground, reverberations holding significant potential for supporting the present and future lives of Aboriginal teachers and the present and future lives of Aboriginal children, youth, families, and communities. (Young, et al., 2010, p. 299)

Their stories need to be told and heard.

I want to tell the lived experience of a teacher and their growth in math. By telling their stories narrative inquirers show:

> that tensions can only emerge from relationships. Without living in relation in wide-awake ways, that is, by engaging in narrative inquiry as relational inquiry, we cannot know, feel, understand, and recognize tensions between an individual's storied life and his or her landscapes. (Clandinin, Murphy, Huber, & Murray Orr, 2010, p. 83)

The idea that tension is a central component in understanding the experience of people in relationship is paramount. Recognizing that lives continue after we leave must play a role in research and the impact that research can have positively or negatively cannot be forgotten.

Research Decision: Math Identity

Stories have always fascinated and engaged me, whether oral or written, I have always felt drawn to narrative methodologies. I, like Cardinal (2011), "find myself very drawn to stories. I live them; I read them and I always find myself telling them" (p. 1). All of my life

experiences surrounding math, listening, and reading stories about math experiences has led me to the narrative. I hope to be able to study experience in a meaningful way. The idea that our voices as researchers and the participants' voices can both be heard was enlightening. I can see how important it is to really be a part of the experience, and be able to ask the right questions at the right times, to read the situation and reflect on it in a meaningful way. The idea that lively conversation will take place as a result of the shared lived experiences is no truer anywhere else than here. The results of these lively conversations will only enhance our ability to study the experience. Clandinin and Connelly (2000) explain "that in the construction of narratives of experience, there is a reflexive relationship between living a life story, telling a life story, retelling a life story and reliving a life story" (p. 71). The idea of studying lived experiences became a reality as I read and responded to my students' journals allowing me to learn so much about lived experiences and I can only imagine if I invest more time and a more concentrated effort on only one teacher how much I could learn about their experience. I knew narrative inquiry was the right choice for me to study a math teacher's lived experience as they grew as math educators.

My Research Puzzle

I want to tell a story that is "crafted painstakingly from all the data with great attention to faithfully representing participants' points of view. The story is the heart of the matter" (Ely, 2007, p. 574). I can "imagine who [I] will be alongside, in relation with, participants" (Clandinin, 2013, p. 89) as they journey towards creating for themselves a more positive math

identity, as they grow as a math educator, and as they become more aware of their mathematical identities, empowering them to make that relationship more meaningful. What happens to the students whose parents didn't help and support them in their math education? Some of them become teachers and in my experience some of them continue to hate math. This is what has brought me to where I am today. I want to study a teacher's experiences with math, their growth, transformation, and goals. My research puzzle will surround the questions:

1. What factors influence a teacher's motivation to grow and to make math meaningful to their students?
2. What factors influence a teacher to commit to lifelong learning in math?

My hope is that by narratively inquiring into these lived experiences that others will be motivated to grow as math teachers, to provide support to others, and to share their stories with others.

> "We have to start somewhere. We need to change how we think about and relate to mathematics. Our children deserve nothing less." (Burns, 1992, p. 145)

Chapter 2: Transforming Our Math Identity

Demand for Growth

There is a demand for change and growth in mathematics education. This demand is not new. In school mathematics, that demand for change and growth was focused on the New Math, which was driven by a broadly shared belief that school mathematics required a change in both method and content (Adler, 1965), the difference was in the purpose, approach, and attitude. "The modern program of mathematics regards mathematics as a system of thinking rather than a set of arbitrary rules, as a system better learned by understanding the structure and principles of mathematics than by memorization of facts" (Petronia, 1966, p. 1).

Those responsible for the mathematical readiness of teachers recognized that they needed to achieve different goals that now included the importance of understanding mathematics in a relational way.

> It is the urgent responsibility of college and university departments of mathematics to provide prospective and practicing teachers with experiences that enable them to acquire mathematical knowledge, to understand the concepts and processes inherent in mathematics, to see the interrelations among the various branches of mathematics, to recognize the relationships of mathematics to other disciplines, to feel confident in their ability to do mathematics, and to have an appreciation of the power, beauty, and fascination of mathematics. This is the call for change, a vital, important, and necessary change that will benefit us all. (Leitzel, 1991, p. 41)

All of these pieces need to be reflected in their preparation to become math teachers. The program needs to provide these experiences to allow them to continue to grow as a math teacher as their career progresses.

The National Council of Teachers of Mathematics (NCTM) in their *Principles and Standards* publication (2000) concluded that the quality of mathematics teaching at the time was highly variable. "There is no question that the effectiveness of mathematics education in the United States and Canada can be improved substantially" (p. 5). In order to be successful at improving the quality of mathematics teaching, "teachers, students, and parents need to recognize the relationship between the affective and cognitive domains, and attempt to nurture those aspects of the affective domain that contribute to positive attitudes" (Manitoba Education, 2013, pp. 4-5). Committing to a positive attitude as a teacher of math is an important step to fostering mathematical thinkers and making math meaningful.

The Requirements for Teaching Mathematics

In *Principles to Action,* (National Council of Teachers of Mathematics, 2014) it discusses effective teaching and learning and emphasizes a set of eight research-informed teaching practices that support the mathematics learning of all students. Teachers are required to be "skilled at teaching in ways that support the mathematics learning of all students" (p. 7). They acknowledge progress but detail that there is still a lot of work to be done to improve the teaching of mathematics.

For instance, in an investigation of the relationship between elementary teacher's knowledge, attitudes, beliefs, and practices, Wilkins (2008) discovered that:

> Teachers' attitude was found to positively affect teachers' beliefs, ultimately adding to the total effect of attitudes on instructional practice. However, content knowledge was found to be negatively related to teachers' beliefs thus increasing the overall negative effect of content knowledge on instructional practice. Thus, not only were beliefs found to have the strongest direct effect on instructional practice but they also played a role in mediating the effects of teachers' knowledge and attitudes. (p. 156)

The content knowledge, attitude and disposition toward mathematics has to be nurtured.

The effects of teachers' mathematical knowledge on their students' learning in mathematics is an important topic to examine and study. When examining this phenomenon, a conclusion made was "that teachers' mathematical knowledge for teaching positively predicted student gains in mathematics achievement during the first and third grades" (Hill, Rowan, & Loewenberg Ball, 2005, p. 399). Even as young as Grade 1 they determined that the teachers' content knowledge plays a role. They concluded that an important feature of their analysis was that they measured mathematical knowledge for teaching, not simply teachers' computational facility or course taking. The role of the teacher cannot be underemphasized; teaching is the key

here. Whether it be attitudes, beliefs, or knowledge, improvements to teaching will increase student learning.

Examining the solutions suggested by Stigler and Hiebert in *The Teaching Gap* (1999) helped to emphasize the importance of improving classroom teaching to result in improved student learning. Their solution was lesson study. Stigler and Hiebert acknowledge the lengthy process involved for improving one lesson but they also discuss being deterred by the length of time needed to form change "by being in a hurry and taking the short-term view, we undermine the kinds of gradual long-term improvements that can add up to real change" (p. 120). They emphasize the importance of attending to teaching as it occurs because teaching is complex, and improvements in teaching will be most successful if they are developed in the classrooms where teachers teach and students learn. Allowing teachers to contribute to the knowledge base that defines the teaching profession enables the teachers to take ownership over the work, leading to gradual but continuous improvements to teaching. The study I hope to conduct does not include a lesson study, but it does include many of the qualities emphasized above such as: intellectual in nature; the teacher will think deeply about the options available to them and how they lead to student understanding of mathematics; it takes place in the classroom; it includes the teacher's point of view including their reflective wonderings; and it is gradual, starting small but with the potential to be expanded. In my research I would like to provide an environment where a teacher early on in her career would have the support of an individual that could help her move her learning forward in mathematics, to support her while her math identity transforms instead of turning to survival mode to make it through the year.

Teachers are encouraged to teach for understanding and beyond memorized rules and algorithms. Many teachers were taught by memorization and fall back to this type of teaching, or reading directly out of a textbook especially when they lack confidence in themselves. Reform recommendations:

> ask teachers to teach in a more adventurous, ambitious way. Rather than demonstrating procedures for solving problems and then giving students worksheets of problems to practice, they are asked to present challenging problems to students and encourage students to develop their own methods of solution. (Stigler & Hiebert, 1999, p. 155)

However, this can be a challenging way to teach and involves anticipating student contributions and using them in a meaningful way to develop mathematical understanding. I want to be able to support my participant while she explores teaching math for understanding and provide her with the space to be open to new ideas, grow and to develop the skills to facilitate a positive learning environment where the students are valued, contributing members of the classroom. By participating I hope that she will provide support for another teacher one day or someone reading her story will try something similar. In order for this to be possible, the story of her journey must be told and the teacher's voice must be heard. "Teachers must be at the heart of the solution" (p. 174). The future of education depends on teachers and their work towards improving teaching. "The star teachers of the twenty-first century will be teachers who work every day to improve teaching – not only their own but that of the whole profession" (p. 179).

NCTM (2014) is in agreement with the importance of teaching; teachers "know and use the cultural and linguistic resources of their students to create learning environments that build on and extend these resources, ensuring that learning is connected with students' sense of mathematical identity" (p. 114). NCTM has been at the forefront of improving math education as indicated by their vision:

> The National Council of Teachers of Mathematics is the global leader and foremost authority in mathematics education, ensuring that all students have access to the highest quality mathematics teaching and learning. We envision a world where everyone is enthused about mathematics, sees the value and beauty of mathematics, and is empowered by the opportunities mathematics affords. (National Council of Teachers of Mathematics, 2015)

To support the mathematics learning of all students, NCTM asks that teachers implement tasks that promote student reasoning and problem solving while facilitating meaningful mathematical discourse.

Disequilibrium to Transformation

The NCTM *Principles and Standards* for School Mathematics (2000) includes a teaching principle that describes effective teaching as continually seeking improvement:

> Effective teaching involves observing students, listening carefully to their ideas and explanations, having mathematical goals, and using the information to make instructional decisions. Teachers who employ such practices motivate students to engage in

> mathematical thinking and reasoning and provide learning opportunities that challenge students at all levels of understanding. Effective teaching requires continuing efforts to learn and improve. These efforts include learning about mathematics and pedagogy, benefiting from interactions with students and colleagues, and engaging in ongoing professional development and self-reflection. (p. 19)

The NCTM recognizes that reflection and analysis are often individual activities, but they can be greatly enhanced by teaming with an experienced and respected colleague.

As part of my research I will provide my participant with strategic support that will help them continue to grow in their efforts to learn about mathematics and pedagogy even when they feel frustration. The participant may not have a positive math identity due to various experiences during their schooling. The important piece lies within Piaget's theory of cognitive development (Piaget, 1969), where the participant has accepted her dissonance but also can see the possibility of growth, and embraces the idea, even if she feels uncomfortable at first. I want to use this as an interpretive frame for my research where my participant is at a place of disequilibrium and needs to push forward to grow. Piaget (2001) stated:

> if intelligence is adaptation . . . adaptation must be described as an equilibrium between the action of the organism on the environment and vice versa . . . we can define adaptation as an equilibrium between assimilation and accommodation, which amounts to the same as an equilibrium of interaction between subject and object. (pp. 8-9)

The participant, through previous experiences and action will have constructed her own schemas that she will use to interpret, understand and respond to the environment around her. This set of perceptions or ideas that drive the resulting action can be reconstructed, but they will affect how

the participant makes sense of the world. In order to reconstruct these existing schemas when disequilibrium is reached the new information must be assimilated into the existing schema, which often means distorting, transforming and imposing meaning on the information, possibly just added on or accommodation must occur where the existing schema is modified, transformed and reconstructed to change the schema and the resulting view of herself according to Piaget. This idea of dissonance can cause frustration and even cause people to give up, but in the case of my participant I want to provide the support to help her move her learning forward.

Applying Vygotsky's Zone of Proximal Development, (Smith, Dockrell, & Tomlinson, 1997, p. 61) to my study, my participant can already perform her teaching duties at a certain level alone, but in order to reach her zone of proximal development (ZPD) she requires help and support, and this will be part of my role in her classroom as a researcher. "This image of the child developing through their interaction with adults or peers with greater expertise has had a powerful impact in psychological and educational thinking" (p. 61). In the case of my study, the participant will be developing as our time together progresses. So that she can feel safe taking risks, our relationship will allow me the opportunity to provide scaffolding and strategic support that will include reflective conversations, intuitive questioning and providing a safety net. The ZPD is where learning and growth occur. Without providing this strategic support she may not be able to grow and reach equilibrium again when faced with frustrating tasks or problems in regards to teaching. I want to give back to my participant as part of this narrative inquiry; I know that just being part of her classroom world already affects her narrative story.

Teacher's Motivation

When I think about motivation, Daniel Pink's book *Drive: The Surprising Truth About What Motivates Us* (2009) came to mind first. His book describes that

> When it comes to motivation, there's a gap between what science knows and what business does . . . We need an upgrade. And the science shows the way. This new approach has three essential elements: (1) Autonomy – the desire to direct our own lives; (2) Mastery – the urge to make progress and get better at something that matters; and (3) Purpose – the yearning to do what we do in the service of something larger than ourselves. (pp. 218-219)

Autonomy, mastery, and purpose: these are three important ideas to keep in mind in regards to motivation. I must leave space for all three in my study for myself and my participant.

We need to consider the motivation behind students' mathematical actions. Fillingim and Barlow (2010) discovered three student-initiated behaviours: "making a connection to previous material, responses beyond the original question, and conjectures or predictions with relevance to mathematical discussions" (pp. 82-83). Their recommendation was to pay specific attention to promoting these behaviours to create an environment that is conducive to enabling students to succeed.

A study by Thanheiser and colleagues (Thanheiser, Philipp, Fasteen, Strand, & Mills, 2013) provides an illustrated example about motivating preservice teachers to engage with their

math learning. They conducted research using preservice interviews as part of their study to use them as a tool to motivate mathematics learning. They discovered that many of the preservice teachers felt they knew enough to teach math already at the start of the math content course. The interview helped them to realize that they needed to re-evaluate their beliefs and improve their understandings about the math content. Their study urges mathematics teacher educators to motivate preservice teachers to change the beliefs the preservice teachers hold about "what mathematics they need to know and how they need to know it" (p. 138). Their study included three principles that the preservice teachers needed to internalize to help motivate them:

> Principle 1: Underlying concepts serve as the foundation for mathematical procedures.
>
> Principle 2: Knowing the foundations for the procedures has value (including knowing why each procedure yields correct answers)
>
> Principle 3: Until they themselves learn to make sense of mathematics, Preservice teachers will be unprepared to support their future students beyond learning procedures. (p. 138)

These principles ended up providing the preservice teachers with a reason for improving their teaching in regards to mathematics. Exposing their lack of understandings and the important role they play as a teacher of math motivated them to improve.

The motivation to understand mathematics and value the power of mathematics is important for teachers and for students. Examining what motivates preservice teachers to do mathematics is an important part of the progression:

> In mathematics classrooms, students co-construct their knowledge through collaboration on meaningful tasks. When they do so, they make connections to previous mathematical

> understandings and refine their thinking; they are not empty vessels waiting for information deposits and accumulation. If teachers focus their instruction on meaningful mathematics, use real-world problems, and let students reconsider their own understanding in light of new experiences, the students will be motivated. (Sheats Harkness, D'Ambrosio, & Morrone, 2007, p. 237)

In their study they concluded that if "we want future teachers to have a positive disposition toward mathematics and to be motivated by it, then we must consider the goal orientations of our students and how we make different goals salient in our classrooms" (p. 252).

In my study I hope to be able to see what motivates the teacher I am working with to grow in mathematics. Many of my current students want their future students to have a more positive math experience than they had; this motivates them greatly. Will it be the same once they are in their own classroom, and how can they be supported to keep that goal in mind? The discussion of a positive disposition weighs heavily on my mind in terms of math identity. Their motivation to grow in mathematics is deeply connected to their math identity.

Mathematics Identity

Identity is a word heavy with meaning, and different meanings for different people for different reasons. I want to use identity to point to something that is personal and fluid. Edmund Metatawabin (2014) used a fluid sense of identity to tell his life story, I see it as illustration of how I want to view identity in this study.

Throughout his life Metatawabin (2014) defined his identity as his family and the connection he felt to them. "My identity is other people" (p. 200). He felt lost without contact with them. The first time this happened was in residential school where he was not allowed to interact with his family; much later in life the same thing happened in rehabilitation. He tried to explain that the healing for him involved contact with his family, his relations. As in residential school his feelings toward identity were disregarded and not valued. Metatawabin had to confront his past in order to move his life forward, he had many demons that followed him. His addiction to alcohol, his betrayal, and subsequent loss of his family made him confront his past. This could not be done in a way that didn't respect his culture and his beliefs. He, and the institution he originally attended, tried to make his rehabilitation fit a certain set of guidelines but his beliefs did not fit this prescribed path.

The path Metatawabin (2014) did find included his culture, all his relations, and reflected his feelings surrounding identity. He had to confront a past that included being forced from his family, being banned from using his language, being dehumanized by having his name replaced by a number, malnutrition, being silenced, major psychological damage, emotional abuse, physical abuse, and sexual abuse including rape. The path that he found to put his life back together included others that had survived residential schools and it matched his way of thinking. This process included traditional healing groups, rewiring his brain with culture, following the Red Road and finding his true path.

Metatawabin (2014) did find his true path and his identity, but it was a lot of hard work. This transformation enabled him to help others that were victims of residential schools. He

stated "We suffered greatly in the residential schools, but finding a worthwhile response to my past has become my life's mission, and led to my own search for meaning" (p. 299).

When I think about his idea of finding a worthwhile response to his past, I believe it connects with the idea of counterstories. In the context of this study I intend Metatawabin's (2014) story to illustrate the new meanings we can glean from re-storying our past and move forward. I hope to use the idea of identity in an all-encompassing way to help move learning forward, not in any limiting or close minded way. My participant will be making connections for herself and searching for her own meaning that will include dealing with her past.

In my narrative inquiry I will be looking at a teacher's mathematical identity, which often is connected to other identities we embody as Bishop (2012) states:

> Identities are important because they affect whether and how we engage in activities, both mathematical and otherwise, and also because they play a fundamental role in enhancing (or detracting from) our attitudes, dispositions, emotional development, and general sense of self. One goal of mathematics education is to help students develop positive dispositions toward mathematics – to become persistent, agentic, and confident (National Research Council, 2001). These traits are the cornerstone of powerful and productive mathematics identities that help learners handle frustrations and struggles not only in mathematics but also in all areas of learning and, for that matter, life. For this

> reason and despite the difficulty of studying them, identities are an important area of research and deserve increased attention in our mathematics classrooms. (pp. 34-35)

The idea that the power of identity is often overlooked in mathematics learning is highlighted by Bishop and is one that I want to explore. She offers her own definition:

> An identity is the set of beliefs that one has about who one is with respect to mathematics and its corresponding activities. An identity is dependent on what it means to do mathematics in a given context; as such, it is individually and collectively defined. Identities include ways of talking/acting/being as well as how others position one with respect to mathematics. (p. 41)

The conclusions from Bishop's study emphasized the importance of "the words we use can help others, and ourselves, to enact certain identities. Thus, the ways in which we talk and interact with each other are powerful because they affect who we are and who we can become with respect to mathematics" (p. 70). My study has a place here, helping to talk through and interact with another teacher as they navigate their way through teaching math with a positive, productive disposition. I can provide support and a sounding board to work through and transform their beginning thoughts about teaching mathematics.

Martin (2009) believes that it is important to uncover, study, and understand the simultaneous development of learners' racial identities and mathematics identities. He defines mathematics identity as

> the dispositions and deeply held beliefs that individuals develop about their ability to participate and perform effectively in mathematical contexts and to use mathematics to change the conditions of their lives. A mathematics identity encompasses a person's self-understanding and how others see him or her in the context of doing mathematics. Typically, a mathematics identity is expressed in narrative form as a negotiated self and results from the ongoing negotiations of our own assertions and the external ascriptions of others. (pp. 136-137)

He wants to ensure that all students are seen as intellectually capable, competent doers of mathematics. Math identities need to be examined and reflected on in order to move forward and make room for growth.

Part of the responsibility of teachers includes ensuring that our students explore their math identity. Leatham and Hill (2010) define "mathematical identity as an individual's relationship with mathematics. That is, the ways a person learns, does, thinks about, retains, or chooses to associate with the subject" (p. 226). They describe mathematical identities as complex and diverse, they believe that by "helping our students become more aware of their mathematical identities can empower them to make that relationship more meaningful, thus motivating them to engage in mathematics in our classrooms and beyond" (p. 231). As I work with my participant I hope to help her see her own mathematics identity and to empower her to transform her identity to ensure that she portrays math in a positive way so she in turn can empower her own students.

One way that she can examine her math identity is by looking at the three reflective tasks for students of all levels developed by Leatham and Hill (2010) to help her become more aware of her beliefs about mathematics and as a result her mathematical identities. They encourage teachers to gain a greater awareness of their own beliefs about math, and of the range of different beliefs their students may have, which "can significantly influence classroom interactions and help . . . motivate students" (p. 226). This can help move not only students forward in regards to their growth in math but teachers too.

In The Impact of Identity in K – 8 Mathematics Rethinking Equity-Based Practices (Aguirre, Mayfield-Ingram, & Martin, 2013) mathematics identity is defined as:

> the dispositions and deeply held beliefs that students develop about their ability to participate and perform effectively in mathematical contexts and to use mathematics in powerful ways across the context of their lives. Depending on the context, a mathematics identity may reflect a sense of oneself as a competent performer who is able to do mathematics or as the kind of person who is unable to do mathematics. Mathematics identities can be expressed in story form. These stories reflect not only what we say and believe about ourselves as mathematics learners but also how others see us in relation to mathematics. Teachers, peers, and parents can all exert an influence on the mathematics identities that students develop. A key consideration about mathematics identities is that they are strongly connected with the other identities that students construct and view as important in their lives, including their racial, gender, language, cultural, ethnic, family, faith, and academic identities. (p. 14)

Many factors including other identities play into the development of a mathematics identity. These will be explored as part of my study; they will come up regardless of my intentions, and so they should.

The book, *Mathematical Relationships in Education Identities and Participation* (Black, Mendick, & Solomon, 2009) was the result of a seminar series that "brought together a number of researchers and practitioners working in the areas of mathematics education and in education and identity to discuss how we can better understand patterns of participation in mathematics" (p. 1). Discussed in this collection was the central idea that math identities are fluid and can be transformed:

> learners of mathematics at all ages and stages are likely to have their own unique ambivalent relationships with mathematics. The approach we have taken here might help develop teacher awareness of inevitable fluctuations and could provide justification for teachers to resist positioning learners too definitely – that is, to resist selecting as a result of assessment. (Black, Mendick, Rodd, Solomon, & Brown, 2009, p. 29)

In this collection Hodgen and Marks (2009) found when

> confronted by tensions between the different aspects of their identities, individuals are compelled to negotiate and reconcile these different forms of participation and meaning in order to construct an identity that encompasses the membership of different communities. This process of identity reconciliation is central to an individual's ability to make connections and transfer meaning and knowledge between practices. (p. 33)

They caution that "mathematical identities are not static" (p. 36). Part of my study is based on this idea, and the idea that a teacher can transform their math identity, even if they have a past full of negative experiences with math. Teachers' math identities have been constructed often by ability and assessment that

> creates a vicious circle, with teachers replicating and reproducing the inequitable mathematics that they themselves experienced. The analysis of primary teachers' experiences suggests that reconstructing relationships – both between teachers and pupils and with mathematics – potentially offers a way of breaking out of this cycle. (p. 40)

The idea that a teacher's past with mathematics could influence their teaching and that they may replicate and reproduce their experiences in their classroom with their students has long term effects.

The focus needs to be on relationships and identities in order to improve math education, including:

> how people's relationships with mathematics connect with their identities in various emotional ways, and that variations in these relationships are very likely to lead to different approaches to teaching. This suggests that when working with new mathematics teachers, we should take account of their emotional relationship with mathematics knowledge, as well as their intellectual grasp of it. (Drake, 2009, pp. 161-162)

Drake (2009) believes that the people that are involved in the preparation and development of mathematics teachers should focus not just on subject knowledge but also the emotional perspective. The list that follows describes how the emotional perspective can be developed and in turn I believe improve and allow math identities to grow and transform by examining:

- individuals' perception of their own performance in mathematics, and how this relates to their experience of learning
- relationships between teaching and learning mathematics
- enjoyment/pain of (un)successfully dealing with difficulties
- significant other people in learning mathematics
- competition and comparison
- self-motivation and extrinsic motivation
- auto-didacticism, self-control, and independence
- social class, gender, and opportunity (Drake, 2009, p. 171)

I feel like this will be a helpful list for me as I do my research and navigate through these emotional pieces while supporting my research participant as they work on their math identity.

In this collection of seminars the mathematical identity of the teacher is highlighted as having a great effect on their students. George (2009) when discussing teachers, states, "a marked proportion of them bring psychic baggage from their experiences as learners of

mathematics to bear on their teaching and other practices" (pp. 210-211). She goes on to say that students are influenced by this. "Many students form a relationship with mathematics mediated by the relationship they have formed with their mathematics teacher" (p. 211). Her concluding thoughts about identity are "that there is an inextricable connection between learning and identity-then considerations of identity ought to feature in any effort to foster mathematics learning" (p. 212). Armed with this suggestion in mind I plan to connect the improvement of my participant's mathematical identity to her growth in mathematics.

Making Math Meaningful

One of our roles as mathematics teachers is to make math meaningful and in turn to make learning math a positive experience so that a positive math identity is formed. Making math meaningful can be accomplished by

> as you plan and design instruction, you should constantly reflect on how to elicit prior knowledge by designing tasks that reflect the social and cultural backgrounds of students, to challenge students to think critically and creatively, and to include a comprehensive treatment of mathematics (Van de Walle, Folk, Karp, & Bay-Williams, 2011, p. 27)

Making connections between our students' prior knowledge and their experiences will make the development of mathematical ideas stronger and more meaningful for them.

To make math meaningful it has also been suggested to focus instruction on "key ideas and mathematical processes, and how problem solving and communication are essential processes to develop at any grade level to ensure that students really do learn mathematics with understanding" (Small, 2013, p. 13). The emphasis here is on understanding.

The Kindergarten to Grade 8 Mathematics: Manitoba Curriculum Framework of Outcomes (Manitoba Education, 2013) makes it clear how important making math meaningful is by including critical components that students must encounter in their mathematics classrooms. The components are the mathematical processes: communication, connections, mental math and estimation, problem solving, reasoning, technology, and visualization. The importance of establishing a problem solving climate is clear.

> Problem solving is a powerful teaching tool that fosters multiple creative and innovative solutions. Creating an environment where students openly look for and engage in finding a variety of strategies for solving problems empowers students to explore alternatives, and develops confident, cognitive, mathematical risk takers. (p. 13)

Actively involving students and attending to each of the mathematical processes will help "achieve the goals of mathematics education and encourage lifelong learning in mathematics" (p. 11). While teaching mathematics these seven interrelated mathematical processes must be included in a way "intended to permeate teaching and learning" (p. 11). The importance of engagement and teaching for understanding resonates throughout the processes.

In Burns' book *About Teaching Mathematics a K-8 Resource* (1992), she also emphasizes the importance of engaging students actively in their mathematics learning to teach for understanding. Her suggestions for teachers are:

- examine how children learn mathematics
- develop a positive attitude toward and an interest in mathematics
- teach mathematics with problem solving as the primary focus
- understand the elements of a comprehensive mathematics curriculum
- establish a classroom environment that supports children's learning of mathematics (p. 3)

These ideas about making math meaningful may be met with some apprehension by my participant but my hope is to offer support and a safe place for this cognitive dissonance to exist and to help them move past their discomfort and lack of confidence.

It is important for me to think about my role as a mathematics teacher educator and narrative inquirer. I need to be thinking about how I can support my participant as she struggles and requires support and a safety net. This state of disequilibrium my participant may find herself in will provide me with the opportunity to keep eight mathematics teaching principles from *Principles to Actions* (NCTM, 2014) in mind. See Figure 1.

Figure 1. Mathematics Teaching Practices

Mathematics Teaching Practices
Establish mathematics goals to focus learning. Effective teaching of mathematics establishes clear goals for the mathematics that students are learning, situates goals within learning progressions, and uses the goals to guide instructional decisions.
Implement tasks that promote reasoning and problem solving. Effective teaching of mathematics engages students in solving and discussing tasks that promote mathematical reasoning and problem solving and allow multiple entry points and varied solution strategies.
Use and connect mathematical representations. Effective teaching of mathematics engages students in making connections among mathematical representations to deepen understanding of mathematics concepts and procedures and as tools for problem solving.
Facilitate meaningful mathematical discourse. Effective teaching of mathematics facilitates discourse among students to build shared understanding of mathematical ideas by analyzing and comparing student approaches and arguments.
Pose purposeful questions. Effective teaching of mathematics uses purposeful questions to assess and advance students' reasoning and sense making about important mathematical ideas and relationships.
Build procedural fluency from conceptual understanding. Effective teaching of mathematics builds fluency with procedures on a foundation of conceptual understanding so that students, over time, become skillful in using procedures flexibly as they solve contextual and mathematical problems.
Support productive struggle in learning mathematics. Effective teaching of mathematics consistently provides students, individually and collectively, with opportunities and supports to engage in productive struggle as they grapple with mathematical ideas and relationships.
Elicit and use evidence of student thinking. Effective teaching of mathematics uses evidence of student thinking to assess progress toward mathematical understanding and to adjust instruction continually in ways that support and extend learning.

(NCTM, 2014, p. 10)

By keeping these principles in mind, I can have a set of guidelines that will help provide me with a starting point for a vision of my role. Intuitively I feel I know where I will be of the most help but these principles will help me stay grounded in my study as I help tell the story of her journey. As stated in Chapter 1, I want to study a teacher's experiences with teaching math, her growth, transformation, and her goals. My research puzzle using narrative inquiry will surround the questions: what factors influence a teacher's motivation to grow and to make math meaningful to her students? What factors influence a teacher to commit to lifelong learning in math?

Chapter 3 Narrative Inquiry: Methodology and Method

"Narrative is the best way of representing and understanding experience" (Clandinin & Connelly, 2000, p. 18). In my experience, stories have been an engaging way to communicate; you can learn a lot about the people in the story but you can also learn a lot about the storyteller. The story not only tells you about the people but it also describes the time and place that the story took place. Clandinin and Connelly refer to this as the three-dimensional space, pointing the narrative inquirer "backward and forward, inward and outward, and locating them in a place" (p. 54). I grew up surrounded by engaging storytellers. The stories helped me imagine their journey, dissonance, support, and their eventual equilibrium.

Life is filled with these stories and the disequilibrium that comes along with life. Bruner (2004) explained:

> life stories must mesh, so to speak, within a community of life stories; tellers and listeners must share some "deep structure" about the nature of a "life," for if the rules of life-telling are altogether arbitrary, tellers and listeners will surely be alienated by a failure to grasp what the other is saying or what he thinks the other is hearing. (p. 699)

This explanation leads to much reflection about the telling of stories and the audience. How we interpret a story and where that leads us is important. Bruner describes that he finds just as much information in how people tell their stories as he does with the content of their stories. The story itself is important but much can be said about how the story is told. In regards to the narrative

Bruner wants to "learn how people put their narratives together when they tell stories from life, considering as well how they *might* have proceeded, we might then have contributed something new to that great ideal" (p. 709).

In this chapter, I will describe my methodology and method. It will be evident why narrative inquiry is the natural fit for my study and for me as a researcher. I will describe what I imagine it will be like in the field and how I will use my field texts to create interim research texts and final research texts. I will emphasize the relational aspect of narrative research as well as ethical concerns. I believe narrative inquiry is a powerful and a vast research methodology that can offer a lot of insight to the many challenges faced in teaching mathematics and making math meaningful.

My Choice to Select Narrative Inquiry as My Research Methodology

My interests lie within the improvement of teaching mathematics. I believe there is a lot to learn by using narrative inquiry. Thinking about the daily decisions we make and the effect that they have on our lives and the lives of others is an important endeavour. Teachers make so many decisions every day that greatly affect our students and their ability to learn. Teaching is a reflective process, these decisions need to be examined and stories need to be told about the journey, the disequilibrium that may be caused, the restorying or the coming to equilibrium again, and the details behind the process that made it a calm, safe environment for teachers and students where a positive experience could be had with mathematics.

In Greene's *The Shapes of Childhood Recalled* (1995) she describes looking at "prereflective landscapes and primordial landscapes" (p. 73). I think about what it means to look back at childhood memories and interpret them as an adult. When you are young you are unable to interpret the events in the same way that you can when you are an adult, that does not mean that you are unaffected by the events; it just means that your ability to think about their meaning is limited. However, that does not mean that these daily decisions we make as teachers leave no mark on our students. We know the mark can be left forever; as teachers we navigate around these marks as we are making decisions about our teaching. Teachers reflect back on their experiences with mathematics as a child and wonder about the effect their pasts have on their ability to teach math. What are some of the choices they have made in regards to mathematics to ensure their teaching and facilitating has a positive effect on students? We make choices in our lives, as described by Greene, "looking back, I find myself seeing past experiences in new ways – and I realize what it means to say that I have lived one possible life among many – and that these are openings even today to untapped possibilities" (p. 77). We make so many decisions in our lives that change our narrative that even the smallest decision can make the biggest difference. Greene's description of literature "making visible what has sunk out of sight, of restoring a lost vision and a lost spontaneity" (p. 77) is powerful. The idea of reflecting more on what we read, practice, observe and react to it, and describe how it changes us. "To look through others' eyes more than I would have and to imagine being something more than I have

come to be" (p. 86). I think this sounds like an amazing way to really experience not only your own lived experiences but the lived experiences of others too.

As defined by Clandinin (2013), "narrative inquiry is an approach to the study of human lives conceived as a way of honoring lived experience as a source of important knowledge and understanding" (p. 17). Narrative inquiry is a character building, story changing, life altering endeavour with many rewards.

Narrative Research as a Research Methodology

As a teacher educator the feelings expressed by Craig (2013) resonate with me:

> We as teacher educators also would like to have a definitive answer to address our students' "tell us what to do" demands. But when we are brutally honest with ourselves and with them, we do not know exactly how things will unfurl until the teacher-student-subject-matter-milieu dynamic plays out. (p. 268)

I feel like narrative inquiry and being a part of their classroom dynamic in regards to mathematics teaching will help alleviate some of these issues, and be more helpful to them than being outside of their classroom. Craig's research about teaching surrounds her desire to assist teachers in moving closer to their best-loved selves.

When selecting my participant, I would like to recruit the participant from my prior ACCESS students. It could be any student from the last three years that is currently teaching. It is important to me that a prior relationship be established and positive before the narrative

inquiry starts. Having some information already about them in regards to their math identity and past experiences with math will be paramount to the process. There will already be a relationship of trust established and they will be familiar with my teaching methods, motives, and personality. So, when they agree to sharing such a reflective experience they will be able to choose knowing who they are agreeing to work with, learn and grow alongside in regards to teaching math. Open communication between the researcher and participant is an important part of narrative inquiry; there has to be a comfortable relationship where there is a certain level of trust established and earned. I want to ensure that it is a reciprocal relationship where she will benefit by becoming more confident, knowledgeable, and comfortable with teaching mathematics. Feminine pronouns are used in this document when referring to the participant for the ease of the reader and because I anticipate the participant will be a woman due to the fact that the majority of the students in ACCESS are women.

In the Curriculum, Instruction, and Assessment courses for Mathematics many of my students arrive with negative feelings about math and teaching math, I spend a lot of time working on their math identities. They take part in a lot of reflective undertakings including a math autobiography, journal entries, article reflections, portfolios, partner work, and sharing circles where their math identities evolve. As my narrative inquiry unfolds I anticipate that it will be natural and helpful for my participant to reflect back on her past experiences including the ones from my classes and share them as part of the narrative inquiry.

Teaching mathematics includes possessing a positive math identity, or transforming towards a positive math identity. In the book *Becoming a Mathematics Teacher: Identity and Identifications* Brown and McNamara (2011) discuss that

> individuals make sense of their world through talking about it. Successive sessions, and the perspectives they produce, are taken into the world to be tried out for size. In this sense, teachers sharing reflections as part of process of professional development are renewing their self identity. (p. 100)

It is important for teachers to participate in professional development that provides them with the opportunity to reflect on both their ongoing and past math classes, in regards to their confidence, pedagogy, math identity, and efficacy. My participant will be participating in individualized professional development by taking part in the study. The topics will be based on her needs and her reflections.

Clandinin and Connelly (2000) provide some characteristics of narrative inquiry:

> Narrative inquiry is a way of understanding experience. It is a collaboration between researcher and participants, over time, in a place or series of places, and in social interaction with milieus. An inquirer enters this matrix in the midst and progresses in this same spirit, concluding the inquiry still in the midst of living and telling, reliving and retelling, the stories of the experiences that make up people's lives, both individual and social. (p. 20)

Stories make up a person's life and I want to take the time to explore and reflect on their stories.

The underlying view of experience sets narrative inquiry apart from narrative analysis and narrative research. Clandinin (2013) describes three aspects of the view of experience that are vital to a narrative inquirer as relational, continuous, and social.

> Narrative inquiry begins and ends with a respect for ordinary lived experience . . . the focus of narrative inquiry is not only valorizing individuals' experience but is also an exploration of the social, cultural, familial, linguistic, and institutional narratives within which individuals' experiences were, and are, constituted, shaped, expressed, and enacted. Understood in this way, narrative inquires begin and end in the storied lives of the people involved. Narrative inquirers study the individual's experience in the world, an experience that is storied both in the living and telling and that can be studied by listening, observing, living alongside an other, and writing and interpreting texts. Through the inquiry, we seek ways of enriching and transforming that experience for themselves and others. (p. 18)

There is a commitment and respect that must be established and nurtured.

Being in the Field

There will be three phases to my study. The three phases will be: early conversations about her relationship with mathematics, classroom visits followed by conversations, and the sharing and co-composing of interim research texts. My study will take place over ten weeks. I will meet with my participant three times during the first phase to compose and discuss two retrospective aspects of her story. The first conversation would surround her story as a student of math in school. The second conversation would be the story surrounding her time as a math learner in teacher education. The third conversation would be to share and discuss an interim research text which shares my interpretation of her stories of learning math.

In the second phase, I intend to visit her classroom over eight weeks, one to two times a week. Each visit will include a classroom observation and time for a reflective conversation. In the conversation we will reflect on the class together as she describes it. I will provide support, using questions to help her to reflect deeply, to clarify her goals and to plan appropriately to enact them. Then I will prompt the participant to reflect on whether she felt she had learned anything about math or teaching math that day. To conclude the reflective conversation, we would discuss the next steps.

Overall there will be four types of conversations we will be having. Please see Appendix I for a list of each kind of conversation and the possible questions that might be part of the conversation.

There are many elements to be considered while maintaining a supportive relationship with a research participant:

> As participants' and researchers' lives meet in the midst of each of our unfolding complex and multiple experiences, we begin to shape time, places, and spaces where we come together and negotiate ways of being together and ways of giving accounts of our work together. What we need to think about here is the sense that it is not only the participants' and researchers' lives in the midst but also the nested set of lives in which each of us live. Further, we need to think about the ongoingness of institutional, social, cultural, familial, and linguistic narratives in which each of our lives is lived, and is being lived, which are also in the midst. (Clandinin, 2013, p. 44)

I will pay attention to these details of her life to try to help her transform her negative and static math experiences to a more positive and dynamic math identity where she can see the results of her hard work to improve her math identity.

The best time to start the narrative inquiry would likely be once she has established classroom routines and classroom management. I will need to pay attention to how I negotiate entry, "negotiate the relational living alongside" (Clandinin, 2013, p. 44) and how I tell her story. I will be actively supportive in whatever way she requires and I will be sympathetic to help her with her lived experience.

The experiences I have had listening or reading the stories of my preservice teachers has led me to narrative inquiry. It has a given me a glimpse of what it might be like to be alongside them as they are experiencing their transforming math identity. I hope to be able to study the experience in a meaningful way. "Negotiating relationships, negotiating purposes, negotiating transitions, and negotiating ways to be useful" (Clandinin & Connelly, 2000, p. 63) are so important. Knowing that by using narrative inquiry my voice as a researcher and the voice of my participant can both be heard is very important. Within my study I will need to use my skills of noticing and my intuition to be useful in the growth of my participant including being able to ask the right questions at the right times, to read the situation and reflect on it in a meaningful way. I want to provide the right support to foster the individualized professional growth that I feel will naturally evolve through the study. The idea that lively conversation will take place as a result of the shared lived experiences is something I am counting on as I navigate through her lived experiences. The results of these lively conversations will enhance my ability to study the lived

experience as she transforms her math identity. The relationships formed are intimate and as a researcher I need to be sensitive to this feeling of intimacy,

> the researcher needs to be there long enough and to be a sensitive reader of and questioner of situations in an effort to grasp the huge number of events and stories, the many twisting and turning narrative threads that pulse through every moment and show up in what appears to the new and inexperienced eyes of the researcher as mysterious code. (p. 77)

When I think about being in the field for my narrative inquiry I think that by working alongside one person I could learn so much about their experience. I know that when I have my students journal I learn a lot, and I can only imagine if I focused only on one person how the experience would lead to a meaningful and powerful learning environment. I will describe the field as a place where ongoing conversations take place where the participant will tell the stories that make up her math identity and living alongside my participant in her classroom early on in her teaching career (Clandinin, 2013). In my narrative inquiry I want to support my participant along her mathematical journey to encourage her to grow as a learner and as a teacher of mathematics and to make room for her students to grow in a positive way in regards to their math identity. Past experiences, her current fears and her plans for the future weigh heavily on her willingness to grow and change her math identity. Narrative inquiry will help me to learn about her growth and development in mathematics. During my study the participant will have the opportunity to participate in professional development as she reflects on both her ongoing and past math classes, in regards to her confidence, pedagogy, math identity, and efficacy.

Composing Field Texts

The composition of field text enables narrative researchers to come to terms with the inherent complexity of observing while interacting with a participant's "living stories" (Clandinin, 2013, p. 145). As a narrative inquirer there will be a lot of responsibility to my participant and myself. "The inquirer needs to be aware of the details of place, of the nuanced warps in time, and of the complex shifts between personal and social observations and their relations" (Clandinin & Connelly, 2000, p. 91). Much can be learned from many different sources, experiences, and relationships. The idea is important that, as a researcher, I am not just an observer but I am also someone having an experience at a time and place. Along with these experiences and relationships comes dealing with closeness and distance as field text is constructed. Clandinin (2013) describes this act of construction:

> There are multiple ways to gather, compose, and create *field texts* (our term for *data*) from studying experiences of participants and inquirers in a narrative inquiry. Field texts are the records, including, for example, field notes, transcripts of conversations, and artifacts, such as photographs and writings by participants and researchers. (p. 46)

The field texts themselves are very open and in fact there is still room for creativity in regards to the field texts in this narrative inquiry; however, without positioning with regards to the three dimensional space "the research texts ultimately constructed from them are endlessly open to unanswerable questions and criticisms about knowledge claims being made and meanings generated" (Clandinin & Connelly, 2000, p. 118). Attention to detail is as important as it is with

numbers, it is the interpretation that could be different depending on the researchers experience and how they reflect on what they are experiencing.

> It is important as researchers to stay awake to the multiple ways to tell and live experiences. Field texts allow us ways to see how others make meaning from experience and may also point us to possibilities of diverse final research texts – that is, the diverse ways we might represent the retold stories. (Clandinin, 2013, p. 46)

While in the classroom activity phase of data collection, my field texts will consist of field notes, transcripts of conversations with the teacher and journal writing. My field notes will include observations of the teacher including her instructional moves, pedagogic decisions, use of mathematical explanations and elaborations, strategies for sponsoring visualization, use of contextualized examples, examples of questioning techniques, and instructional management. Included in Appendix II is a guide for my observations of the teacher while I am in her classroom. Conversation with the teacher will be recorded, and I will create transcripts of the conversations. I anticipate that they will contain lively conversation that will show the teacher's learning, growth, evolving math identity, future goals, and my support. I plan to create a personal journal where I will reflect on the experiences, field notes taken, and conversations in a way that is meaningful to me. It is my belief that this journal will help me think through some of my observations, make connections, and develop the experiences to reflect the relational nature of my field notes and our conversations. A journal will also be kept by my participant to help her reflect on her experiences, growth and future goals; if she shares her journal with me, I will use my journal to reflect of what she has shared. During all field-text writing, keeping the three

dimensional space in mind at all times is vital. I will continually ask myself questions regarding time, place and the personal-social dimension. There is so much that makes up a teacher's lived experience as they grow in math and I will be depending heavily on my field notes, transcripts from conversations, and journal entries to create my field text.

Composing Interim Research Text

Making meaning of experience (Clandinin & Connelly, 2000), describes what I plan to do in my study as a narrative researcher. Transitions are often difficult. In the transition from field texts to research texts "the topics of justification, phenomena, method, analysis-interpretation, the place of theoretical literature, positioning, and the kind of text intended and composed rise again to the foreground of the inquiry" (p. 119). The questions of meaning, social significance, and purpose are important, and can be initiated by asking myself questions of "who, why, what, how, context and form" (p. 121). The 'why' is always strongly autobiographical, but as Clandinin and Connelly indicate their own interests and ways of thinking were not enough. The work needs to connect with larger questions of social significance.

Transitioning from the field texts to the research texts is filled with "tension and uncertainty" (Clandinin, 2013, p. 47) and my analysis and interpretation will include creating interim research texts from my field texts. I will write an interpretation based on the experiences and field texts. The drafting and co-composing of interim research texts will allow me to continue to engage in relational ways with my participant. I will take the time to share the

interim research text with my participant as a partial text that will be open to allow an opportunity for the participant and myself "to further co-compose storied interpretations and to negotiate the multiplicity of possible meanings" (p. 47). We will participate in the interpersonal relational act of sharing interim text to negotiate shared understanding. I will have the contemplative tools developed in Chapter 2 at the ready to use to interpret her story.

I will share the interim research text with my interpreting and have her respond to the narrative in order to ensure that what emerged reflected her lived experiences. My interim research texts will include narrative accounts of the experience as it relates to my research puzzle as a way to make sense of my multiple and diverse field texts (Clandinin, 2013). I will be looking to discover the factors that motivated her to grow, to make math more meaningful for her students, and the factors that made her commit to lifelong learning in mathematics. Taking the time to make this part of our journey will be vital to the final research text. The dialogue with my participant may lead back to the need for more intensive work with my participant if more field texts are needed to compose a final research text that is seen as "authentic and compelling" (p. 47) by myself and my participant. I will compose and co-compose interim research texts that will awaken us "to the interwovenness of life experience" (p. 50), new wonders may become visible, and we can look further into the discoveries together.

As I work with the interim texts, writing, co-composing, sharing, and negotiating I want to keep in mind the work of Bateson (1989) to help create meaningful, authentic and compelling pieces. While negotiating and having conversations, I want to refer back to the words expressed

by Bateson: "We grow in dialogue, not only in the rare intensity of passionate collaboration, but through a multiplicity of forms of friendship and collegiality" (p. 94). I believe that this growth will emerge as a result of the intensity involved in narrative inquiry and the relational nature of the type of research. Bateson's description of watching "interruptions reshaped into transitions as thread after thread from the past was picked up and woven in" (p. 236) will help me to imagine how my participant may transform her past including her fears and provide an opportunity to restory or provide a counterstory to help transform the teaching of math into a positive and meaningful experience for her that will continue to grow and change over time. My participant will make sense of her journey aligning it with her beliefs and her growth, she may see herself differently than she did a few months ago and as a result tell stories differently. She may feel like her stories even mean something different to her now. She may feel differently than she did before and align herself with the idea that "none of us follows a single vision; instead, our very visions are products of growth and adaptation, not fixed but emergent" (p. 237). I believe that the discoveries made in this journey with my participant will reflect an emergent and ever evolving math identity.

Composing Final Research Text

In creating my final research text, my intent is to:

> Attend simultaneously to all three dimensions that we can come to understand in deeper and more complex ways the experiences relevant to our research puzzles. Only through

> attending to all dimensions can we see the disruptions, interruptions, silences, gaps, and incoherences in participants' and our shared experiences. (Clandinin, 2013, p. 50)

The connection I make with my participant is a real relationship and I want to be sure to honour and represent her experience in a way that reflects her accurately and socially establishes meaning. My intent with my narrative text is to interpret the transformation, tend to my research puzzle, and show evidence using the narrative. The math history of this teacher is likely one that at one point was negative and static. There will be an opportunity to see how this transformation went from static to dynamic, which will likely include some of the participant's past experiences.

The narrative will include the retrospective piece and describe their transformation journey. I will interpret their ever-changing math identity, how the landscape has changed over time, and the factors that influenced the transformation. I intend to interpret how their pedagogy and efficacy has evolved in regards to math education. By tending to my research puzzle and by making meaning of experience, I hope to provide a text that others can imagine themselves in, wonder about others and their situations and to help people in numeracy or administrative roles make decisions regarding the best ways to offer support and professional development as their teachers try to transform their math identities. As described by Clandinin (2013), my hope is to create a research text that allows "audiences to engage in resonant remembering as they lay their experiences alongside the inquiry experiences, to wonder alongside participants and researchers who were part of the inquiry" (p. 51). This final text will be a narrative version of the research participant's lived experiences, finite but intense. "Final research texts do not have final answers,

because narrative inquirers do not come with questions. These texts are intended to engage audiences to rethink and reimagine the ways in which they practice and the ways in which they relate to others" (p. 51). The final research text will fit into the research process as interpretation that will address my research puzzle. Sharing this text with the research participant in a final conversation will be a tribute to her learning, her hard work, her growth and (perhaps) her transformation.

Ethical Considerations in Narrative Inquiry

I know in my own experience when I first started considering using narrative inquiry, many of my friends and family wanted a description of what narrative inquiry looked like and what it accomplished. For one of them, a friend who at the time was finishing his dissertation in microbiology, the idea of narrative research was unfamiliar to him and he had concerns. Clandinin and Connelly (2000) call them "persistent concerns" and the fact that "none of the questions have definitive answers" (p. 169) explains a lot regarding the use of the word persistent. The story that I as a narrative inquirer set out to tell regarding the growth of a math teacher may not be the story that I envisioned telling at the start of the study. This is a unique attribute of narrative inquiry. The relevant story that needs to be told, the experience that is described, cannot be laid out from the onset. Narrative research is reflective of the story that unfolds: that is what makes narrative inquiry so relevant. This is the first ethic concern: that we cannot tell people exactly what they are in for in advance.

There are so many people involved in small roles that play a part in one person's lived experience. The story itself is often one to be proud of and the participants are okay with people knowing who they are, but this goes against the ethics of research. The responsibility piece is huge; the trust that is formed has to be used carefully and caution must be used when representing the participants (Clandinin & Connelly, 2000). Their well-being and future must be considered as you tell their story. When using the narrative inquiry research method I must also be aware of any "smoothing" (p. 181) that takes place to have everything work out in the end. I know in my own research wonderings I would want my participant's math journey to end in a positive way. Accepting that it might not end positively is a tough thought. However, that is the reality: their lived experience may not be one of triumph with math; this does not mean that the story is not worth telling. It may, in fact, be worth telling even more, so that people can see others struggling. Because my goal is to support the participant to improve her math identity, I can see how it would be hard to live through a story that was not one that showed growth in regards to math. However, hopefully in some way their lived experience and the telling of their lived experience would still move them forward, and that would be the positive piece to focus on instead growth in math perhaps. "We need to be wakeful about what we are doing as narrative inquirers, so we can continue to learn what it means to do narrative inquiry" (p. 184). As Clandinin and Connelly explain, "narrative is the closest we can come to experience" (p. 188) and it is this study of experience that is so important. This may mean that inquirers "avoid

strategies, tactics, rules, and techniques that flow out of theoretical considerations of narrative" (p. 188) in order to represent the experience. The statement that "relationship is at the heart of thinking narratively" (p. 189) helps put narrative inquiry into perspective for me personally. I look forward to being involved in the lived experiences of another.

The commitment to anonymity will mean that at least some fictionalizing will be necessary. "Fictionalization, then, is a way to stay awake to complex stories and, through inquiry into the tensions shaped in the living and telling of these stories, to imagine new possibilities because of the educative potential of tensions" (Clandinin, Murphy, Huber, & Murray Orr, 2010, p. 85). Fictionalizing can protect a participant's anonymity. There may be job-related consequences for teachers who allow their stories to be told, such as job loss, positioning in school systems, and promotion. As a result a researcher might choose to fictionalize a text to protect anonymity, and by doing so make it possible without risking the participant's safety for me to "necessarily call into question and make problematic the dominant stories of school as places where lives meet in smooth, happy, successful, caring school environments" (p. 83). Fictionalizing allows the story to be told, inclusive of some of the institutional realities that would otherwise need to be excluded to the detriment of the research's validity and significance.

By creating fictionalized text locations, times and the particularities of individual teacher's lives, identifications can be blurred.

Narrative inquiry includes many decisions along the way. Each must be tended to with the utmost respect to the participant and the relational nature of the research.

Forging a New Path

I believe narrative inquiry will be the best way to attend to my research puzzle in regards to the growth of knowledge and confidence that is gained by a mathematics teacher over a period of time. I look forward to the work and challenge ahead in my study.

I have never considered myself a poet (still do not), but I wanted to write a found poem that would encompass what narrative inquiry looked like and felt like, a poem using word images. Young, et al. (2010) describe a found poem: "Word images often shape a kind of beat similar to what we experience in our hearts when we hear the drum" (p. 292), described as a found poem. What follows is a found poem written using M. Ely's (2007) chapter in the *Handbook of Narrative Inquiry: Mapping a Methodology entitled In-forming Representations* (pp. 570-596). It is meant to be read aloud. I wanted the poem to reflect narrative inquiry and what I think is important for me to keep in mind during my research study.

Narrative

We write to know
Learn
Discover

Version of reality

Narrative research
How other people experience life

Story
Crafted painstakingly

All the data
Faithfully representing participants' points of view

Heart of the matter

Attention
Power
Voice

Layered stories

Task worth undertaking
Worth practicing

Powerful

Understand our participants deeply
To be fair

Reflecting

Sufficient distance
Better understanding
Research direction

Often unforgettable

Captures
Wholeness
Speaks to the mind and heart

Cohesive, complex
Meaningful
Lived and relived experiences

Life

Figure 2. Chronological Plan

I have created an organized list for my research and anticipated timeline.

	Timeline in Weeks
Recruiting a research participant	1 – 2
Early conversations about her relationship with mathematics	2 – 4
Interim text 1 (create, share, participant response)	2 – 4
Classroom visits including classroom observations and time for a reflective conversation weeks 1-4	5 – 8
Interim text 2 (create, share, participant response)	9 – 10
Classroom visits including classroom observations and time for a reflective conversation weeks 5-8	11 – 14
Interim text 3 (create, share, participant response)	15 – 16
Final narrative text (create, share, participant response)	17 – 20
Constructing the research story (field notes, journals, and conversations)	21 – 25
From interim texts to the final narrative	21 – 25
Final narrative	21 – 25
Addressing the research puzzle	21 – 25

Chapter 4: The Narrative Inquiry

The narrative inquiry began as a partnership where I would act as a researcher and coach and Lily (pseudonym) would act as research participant, teacher and learner. The three phases in my study were: early conversations about her relationship with mathematics, classroom visits followed by conversations, and the sharing and co-composing of interim research texts. Chapter 4 will describe the experience including how the data was collected, an introduction to Lily, Lily's backstory as a student of math, narrative episodes that highlight how the themes emerged, and the sharing and co-composing of the interim texts. The chapter will also include the role the interim texts played in making potential themes explicit and Lily's opportunity to interact with and refine the themes.

The data was collected from a variety of sources all centered on Lily's experiences. The first phase of my study included two one-on-one reflective conversations about her lived experiences with mathematics as a student in school and a preservice teacher in university. The conversations were engaging and although the questions listed in Appendix I section i. and ii. were used during the conversation, many other thoughts and questions came from the lively and natural conversation. During these first two conversations I made detailed notes as we talked, although this didn't bother Lily it bothered me and I never did it again. I wanted to give Lily my full attention and worrying about writing the details down at the time took away from the experience. Having the conversations recorded gave me the opportunity to play them back and make the notes I needed to create the interim texts. I also transcribed all the conversations, so I had another opportunity to interact with the conversations. As a result I made only a few notes in subsequent conversations. That allowed me the opportunity to embrace the moment knowing

that I could play back the conversation later when needed. The transcripts from the first two conversations were used to create interim text 1 and 2.

The second phase of my study included classroom visits followed by conversations. I visited Lily's classroom 12 times. Each time I made detailed observations using the observation guide provided in Appendix II. These field notes contained observations of Lily including her instructional moves, pedagogic decisions, use of mathematical explanations and elaborations, strategies for sponsoring visualization, use of contextualized examples, examples of questioning techniques, and instructional management. Immediately after the classroom visit Lily and I had reflective conversations. These discussions revolved around notes I had made on the observation guide about the experience that day and from questions in Appendix I section iii. The discussions unearthed what Lily had learned about teaching mathematics; the different choices she could have made, her reactions and why she felt they happened, her confidence in her lesson and teaching mathematics, the meaningful connections she felt she made and what influenced her thinking. We explored her satisfaction with the decisions she made including pedagogical choices, her motivation to teach the way she did that day and what she would like to focus on in the future. We did end up having more conversations than originally intended but these evolved naturally as part of the experience and made the journey more reflective and meaningful for us both. The contemplative conversations we had after the classroom observations often included a planning component as it was natural to think about the next steps along her trajectory. In addition to these spontaneous planning conversations, we also had three intentional conversations surrounding planning. Lily often needed time to think about and interact with certain ideas that we had discussed and reflected on after the classroom visits and that is where these planning conversations became a necessary part of the study. Another important piece of

data during this phase was the journal writing that took place. I wrote 16 journal entries and Lily wrote 10. The journal entries became another way to reflect on the experiences and to think through the themes that were emerging during the study. Lily's journal entries often included diagrams that she created to try to understand what she was experiencing and how she felt the themes fit for her journey. These diagrams would reappear as an important tool we used and co-created during our interim text conversations.

The third phase of my study included the sharing and co-composing of interim research texts. I composed four interim texts to share with Lily that brought themes and sub themes forward for discussion. We had four lengthy conversations to discuss the interim texts. During these conversations we worked with many themes and tried to draw out a model that helped visually show how the themes and ideas interacted with each other as part of this experience. Lily often elaborated on some of the thoughts brought forward in the interim text with additional narrative information or suggestions she had based on her lived experience. This phase was vital to my narrative inquiry. Lily's contributions and elaborations increased the potency of the themes and connected them in valuable ways.

Lily is a second year Early Years teacher, in her thirties. Her position at the time of the study was a Grade 4 teacher in a school in Winnipeg with a diverse population. Lily was a university ACCESS student to whom I had taught Curriculum, Instruction and Assessment Early Years Math in year 4 and Curriculum, Instruction and Assessment Middle Years Math in year 5. As a student I recall that Lily was hardworking, open to learning from her mistakes, and enjoyed learning. I had the opportunity to look back at the portfolio she made as one of the final tasks in our year 5 class together where I found her personal goal: "I will take risks and try to keep an open mind while exploring mathematics" (Excerpt from Lily's portfolio, 2014). Math did not

always come easily to her. There were moments of frustration and confusion but Lily always persevered and moved her learning forward no matter the challenge. She liked order and took steps to help organize herself as a learner of math and a future planner of math lessons. Lily also provided me with feedback as her instructor knowing that reflective feedback was important to me as well.

The conversations we had about her early experiences with mathematics as a student and preservice teacher were vital to developing the beginnings of her narrative story and math identity. The struggles she had as a teenager made her math identity negative at times and later her lack of efficacy made her decision making surrounding math more rigid than she actually desired.

The opportunity to observe her teaching breathed life into the research. Being there as Lily made decisions in the moment and observing the results of her decisions was an important part of our journey together. The empathy and compassion Lily displayed for her students was evident in the way she interacted with them daily. There was a mutual respect and love that I could sense from day one, this would help drive her desire to cause learning and to ensure that her students were active, not passive, in their math experiences. I observed first hand her moments of doubt, stress, and discomfort that caused a disequilibrium that was not easily balanced in the moment. As time passed, and we were further into the eight weeks of classroom observation, the moments of disequilibrium were still occurring but the time it took to return to equilibrium and a place where she felt comfortable came faster. This was partly a result of the reflective conversations that took place immediately following the disequilibrium and the journaling and planning that took place as a result.

The reflective work that took place was important to Lily's growth. I was able to meet Lily in her zone of proximal development, and move her learning forward to help improve her pedagogy and her sense of efficacy. Being there in the moment as Lily interacted with her students while teaching math all played out, as introduced in chapter 2 (page 50), was vital to helping Lily move forward in her math identity. During our conversations afterward we would be specific about where she needed to improve and grow. We discussed how she could cause learning, and make math meaningful for her students. Being present helped me assist Lily in moving closer to her "best-loved self" (page 50). Before we started working together, she didn't feel true to herself and her beliefs about teaching math. The reflective conversations helped her express her beliefs.

The journaling that took place individually was an essential piece. For me it helped think through our next steps together and to interpret the journey so far. For Lily it helped her to plan her next steps, to think about the bigger picture for herself as a teacher and learner of math, and to clearly define her goals. Lily had individualized professional development that was based on her needs and her reflections during our conversations. It was relational, continuous, and social.

Backstory

Lily's backstory is her recollection of her time as a math learner and her thoughts about her math identity. The backstory was developed from interim text 1 and 2. As a child, Lily, felt the need to achieve in math for recognition in her home. Lily grew up in a home where she was not safe to make mistakes. Lily would protect herself by lying about her mistakes. She wanted to avoid pain. At this time in her life she was not able to learn or evolve from making mistakes. Lily recalls the heat of being caught in a mistake but she would keep up the lie and it became a habit; a part of her identity.

Lily remembers the struggles with algebra but she also remembers math being like a puzzle. The feeling she would get after she worked her way through a math problem was a good feeling, some kind of chemical release, almost euphoric. Lily reflected that:

> it became more of a puzzle. So I would get really frustrated but I would keep going because I knew that once I achieved or got it, I really liked that feeling; it was a good feeling, to go through what I can see now as the struggle of it, and come out getting it. (reflective conversation, April 10)

There were times when she gave up, felt frustrated or that she was not good at math anymore.

When Lily took Pre-calculus math she decided to walk away. She remembers internalizing at that time that she was not good at math. When I asked Lily about what she thought made her struggle through some of the math it became clear she had not yet determined that herself as she talked through her thoughts.

> I wonder… I'm not sure about my basics, like how my foundations in math were. I don't recall a lot of that, but I wonder if it was just that healthy struggle that happens when you are doing something new. Or if it was a conceptual struggle, or like I was saying a little bit earlier, it was stuff that was happening outside of the math classroom that made it hard for me to engage and focus and retain things. (reflective conversation, April 10)

There were times with certain topics, like polynomials, that Lily was very frustrated. But she also remembers when she did get it that she loved it.

Some of the topics in school math were without context, polynomials and algebra didn't seem to connect to real life and this made it more difficult to be motivated to keep going. If she could see things as a puzzle it helped to bring her back into wanting to learn and complete the task. Lily wanted to know "the why" and "the point" behind learning math. She cannot

remember anyone explaining these important pieces. Lily recognizes that some of the stories she has heard as an adult, for instance Pythagoras solving math in caves because it was illegal, would have motivated her had she learned these stories as a teenager. In high school when she eventually took a lower level math, Consumer math, she started to feel better about math again. Her choice to take the lower math was motivated by her feelings of inadequacy from her Pre-calculus math experience and she was not feeling good about math at that time. Some of the content was difficult for her to remember. She does, however, remember being able to relate to the math in Consumer math, for instance the buying and leasing of cars. This provided Lily with direction and connected to her life. When she felt like a course connected to her life she would work persistently at it. This was a time where she felt good at math again. These feelings of competency and comfort with math further increased with an accounting course Lily took. She really enjoyed that experience and felt motivated to work hard.

Math cannot be isolated for Lily, it cannot be separated from the life she was experiencing at the time of her feelings of success and struggles. Relationships and the context of her life always played a huge role in Lily's educational experiences. Things outside of math made it harder to succeed with math. When she was younger friends played a role. There were times when Lily struggled academically but had a positive peer group that helped her through. The peers all enjoyed school, and were in band together. So, even though Lily remembers struggling with math at this time, even failing at times, she did persevere. Lily moved a lot and the peer group she so valued was lost in one of her many moves. She moved 21 times before she was 21 years old. She was in foster care. These unstable times made it very difficult to remember the student she wanted to be and to actively pursue and buy into the educational experience. Most of the time as Lily moved from school to school she connected with

marginalized people. Most of these people did not like school. This became Lily's reality, even though as she reflects back she feels like she was just pretending not to like school as part of trying to fit in with her new peer groups. Her life reminded her of a pinball game, a very unstable existence. Socially, if she was not connecting with people, she would throw herself into school. The disconnect with school happened for Lily when she was socially successful.

There were teachers along the way that built relationships with Lily where she was at and this helped her. Lily would refer to these teachers as genuine, unconventional, pushing the boundaries, a side door approach to math, relationship first then the math. She can't necessarily remember the math but she remembers things like laughter and being able to relate to the topics. It still always came back to her outside circumstances, these were the real determinants.

Lily was often grappling with becoming balanced and stable in her life. As time passed the connection to her reality became a driving force for Lily to grow into a place where she could feel and experience equilibrium.

> I was here for this long, then here, then here, so it was a very unstable time in my life. But sometimes I don't know what would happen, but I'm thinking in particular when I got pregnant then I created some stability even if it was unstable stability, if that makes sense, and then I was able to yeah dig in and I really liked [the math], I really enjoyed it. (reflective conversation, April 10)

She needed to find stability for herself at 18 when she was pregnant with her daughter. She wanted more for her daughter and didn't want to be on welfare. This was a driving force for Lily and made her motivated to get back into math, to focus and get it done. Consumer math related to her realm at that time and became more relevant to her. It was hard work but she finished it quickly this time. Math was originally about puzzles and relationships for Lily before she lost

her way. Later finishing math became about survival; getting out of Manitoba housing and off welfare.

Working her way towards independence Lily had to grapple with making mistakes in the workforce. Lily had a few jobs where she would continue covering up her mistakes at this time with lies until she made a really big mistake, a financial mistake. She had no choice but to own up to it. It was then that she resolved to cut away from that way of living that included lying and unresolved mistakes and she started to admit to her mistakes. She remembers the visceral discomfort. At this time in her life she required small, scaffolded steps with guidance to help her develop what would eventually be her growth mindset. She needed to go through the discomfort of it, mentally and physically, to make those decisions on her own, but welcomed the guidance of mentors along the way. Lily thought a lot about balance and the importance of the context of her life and the relational aspects of life. Her next big decision was to become a teacher, a dream for her. She made a choice to make it her reality.

As Lily began her university journey in mathematics it was about her need to relearn and fill in the gaps. She felt immersed in mathematics in year 1 for two weeks. She remembered lots of good puzzles, stories and number systems that reawakened her desire to learn math. She explained:

> it was really intense. I don't know if that's the way that I just roll. Maybe it would be a different experience with someone else but it was like immersion. When I'm into something I'm all in, so it was intense and it was intimidating and I was relearning . . . it was like I re-activated that resilience in math. It was there, maybe it was dormant because of life or it came out in different ways, but it was reactivated and I was intrigued.

> I was intrigued by the professor as a person and I think he got me through the relationships and the puzzles. (reflective conversation, April 10)

The learning environment was something she remembers as very important to her success. She felt that the puzzles and problems provided were a manageable challenge. Stories made things more real for her and she was able to make connections. Lily was intrigued - not only with the math topics and stories - but the professor intrigued her. The content was intimidating and there were struggles but she now had ways to cope with her feelings of wanting to give up. She always came back and persevered.

Lily identified as having a shaky math identity at the time but also confident. She certainly felt more confident than many of the people in her cohort who had terrible experiences with math. Some topics Lily found easy while her peers found them hard. The reverse was also true. She struggled at times, the struggle was caused by gaps and hazy memories of the math content. She found the collaborative piece helpful. She felt she had a dual role to play as the cohort would teach each other and learn from one another when they collaborated. When Lily thinks back she believes her goal as a future teacher would have been to meet students where they were at, to be able use differentiation to help them succeed.

Lily reflected a lot about wanting to make the learning authentic and meaningful. For her, authentic meant:

> rooted in reality, the blood, sweat, and tears of being a human. It means there's not a veneer. To be an authentic person it means it's messy. To be an authentic experience . . . it's not sterile: there is a struggle, there's both a struggle and success hopefully. (reflective conversation, April 10)

She believed meaning came from this strange balance between struggle and success. That humans make a choice to make meaning followed by informed and related action. For her authentic meant making meaning from experience and living through it:

> I think authenticity in math is or as a human, maybe math and being a human aren't that separate, like maybe they shouldn't be two separate things . . . being authentic to me means being a reflective person, making meaning from our experiences; so that can happen in time, given space. (reflective conversation, April 10).

When she thought about veneers and having a closed mind, she believed they were driven by fear. With authentic learning she felt there needed to be a level of trust in the class, with the teacher and the community. Lily wondered about the real definition of "authentic" and this led her to wonder if she had been using the word incorrectly all this time; did she mean genuine and meaningful?

Lily felt that her math experience in university was like a garden, the seed was planted but it was the environment, the support and scaffolding that helped to nurture the seed and eventual grow and blossom. This environment and the context created by her first math professor and I gave her the safe space to work things through, struggle, discuss and collaborate to reach success. The content was a struggle, the language of math, the process of knowing where to start was hard but she was willing to take risks which helped her succeed. She questions, though, if in a different environment, a different soil if she would have succeeded.

Lily reflected on times where outside stability and instability weighed heavily on her, but her desire to succeed was much higher in university than at 15 years old. She was raising a child on her own with all the struggles that came along with that. She was also doing her own personal work that was intense and tiring. She felt a renewed love of math; it became engaging

and motivating again. She experienced the euphoric feelings that came with solving math puzzles again. She chose to make it meaningful by reflecting, taking risks and grappling with it.

> I'm a person who is willing to take risks and I think that that's what allowed me to be successful, but yeah the struggle again came from this outside stuff, instability, stability, this dance. And then these gaps and hazy parts and bits and pieces of the actual content, so context and content. (reflective conversation, April 10)

So Lily's success or lack of success hinged on the reality of her context; the stability or instability of her life and her ability to connect and understand the content. The fact that her sweat and tears went into her work was meaningful to her. She described the learning process as "your own sweat, your own tears, your own just wrestling … actually wrestling. It smells and it hurts, you know that's reality. Welcome to being a human" (reflective conversation, April 10).

The beauty of math was coming back to her, and making meaning out of these experiences. Lily felt safe in the environment, in the soil, but she always knew there was an edge, a fine line. She knew she was either going to do it or not. The experiences she had in math in her classes met her where she was at, her zone of proximal development was nurtured. She had to do more than just try, it was the doing. She knew I was always there supporting her as her fourth and fifth year instructor, listening, and noticing. This was all part of the environment that led to her eventual success and graduation.

It was her growth mindset and drive to succeed even when met with seemingly unsurmountable circumstances that led me to asking Lily to participate in my narrative inquiry. Visiting her class on the first day as she attempted to make a lesson from a workbook meet the needs of her diverse students was just another step in her ever evolving math identity and our journey together.

Episodic Narratives

There were many pivotal moments that I was fortunate enough to capture during my classroom observations that helped to highlight some of the themes of her journey. Many of these themes were hinted at during her backstory and not only connect to our time together but also to Lily's journey through her life as she navigated her way to becoming a teacher. The following are some of the stories that emerged from the field texts.

Episode 1. Worksheet world

When Lily and I had our first meeting she expressed that she really liked the particular workbook she had been using. She wanted to rely on this workbook and the accompanying worksheets to steer her teaching. I decided to purchase the workbooks so I could see exactly what it was that appealed to her. Lily had used the workbook to teach a unit on telling time and was satisfied with the results. I had the opportunity to observe her using the workbook in her class a few times.

The workbook took her students step-by-step through what was considered to be prerequisite knowledge for creating a pictograph. The worksheet Lily was using for several days was on pictographs including scales and symbols. She would have students provide answers and carry through with each question. She felt it was important to honor all answers even the ones that led them far away from the intention of the lesson. Lily reflected on the fact that she had indulged a student who was describing that what she saw from the triangle pictograph was a 3-D shape and drew it on the board. This was interesting but not relevant at the time; the diagram perhaps looked like a net for a tetrahedral shape but the topic was pictographs. As a result, time ran out and the lesson ended in an incomplete way. By allowing her student to carry on with unrelated thoughts, Lily missed the learning target for her lesson. Lily needed to re-evaluate

how she could still allow her students to explore some of their thoughts and still stay on target with the intended learning outcome. Students were skip counting, talking about 3-D shapes, fractions, and possible diagrams that could be used as symbols and why those symbols worked for a pictograph. At times students were so off track that Lily had a hard time making the topic fit. Students left Lily's lesson without knowing the right answer, even though the worksheets seemed straightforward.

Lily described her focus as scattered. She could feel the energy leave the room during worksheet lessons. She was working really hard to engage her students in the material but the interest was not there. She would pause and have them stretch or do a physical activity to regain their focus but it was not coming from the material it was coming from her. The relationship, the mutual love and respect between Lily and her students, was what kept them going. They knew that math was important to Lily so they would keep going.

Lily's students had made periscopes for a different discipline just prior to learning about pictographs. She eventually recognized the worksheets as micro steps that didn't need to be covered to move them from their periscope project where she had them collect data about what colours were pleasing and using that data to create a bar graph. This periscope context and her guidance could have caused learning and led them to pictographs. The step by step worksheet was not needed for this topic nor for most of the students in her class.

Lily recognized the worksheets as a safe way to do mathematics. She stated "I know it's fear-based but it's this balance between covering stuff and getting it done or discovering" (planning conversation, April 24). Lily struggled with her desire to honour all her students answers and realizing that in order to cause learning teachers need to be intentional about which students we choose to share, what order we select them, and the questions we use to steer the

learning forward in the discussion. It is about noticing and using what you notice to achieve your teaching goal. This was not part of the worksheet lesson. Each question was posed; she would cover the question by taking all answers and then move to the next. The line would be filled with the correct answer but Lily was unsure how to tackle wrong answers so sometimes she left them hanging.

Lily did have other activities, like using money to discuss many-to-one correspondence as a context for her students. She had turn and talk opportunities and group discussions. However, she was finding that sometimes her students weren't listening to each other, they weren't taking the time to process what their peers were saying, nor were they adding their own thought process to give the topic more depth or more accessibility. This just was not happening discussing questions from a workbook. Finally, after micro managing pictographs for a painstakingly long time, she recognized that "sitting here going through worksheets that's not cutting it so say we do one applied task with pictographs and then we're done and just let it go" (planning conversation, April 24).

Eventually, with my guidance, Lily came to the decision that she wanted to be a bigger part of the planning to cause learning and feel more ownership over her teaching. She recognized that if the energy was coming from the learning that she wouldn't have to fight for it, that energy, that spark; it would be there. She was struggling with "trying to find that balance between traditional ways of doing things and authentic, genuine" (planning conversation, April 24) ways. The worksheets were not working for her anymore, she now wanted more out of her math classes. She described one of the classes as "it's like there was no pulse in here" (reflective conversation, April 19). She expressed her feelings by describing that she knows in her "heart that we learn by doing, and we learn thematically and the learning will happen" (planning

conversation, April 24) but she also wanted to feel secure and safe when making decisions and she felt less confident in her content knowledge without following the worksheets.

Lily had not been ready until now to really take a risk and change the way she taught math, the way she caused learning in math. She needed my support to meet her in her zone of proximal development to feel safe to take a risk in her pedagogy, to be pedagogically courageous. Her request was "so if you can support me in this journey of me trying to be more vulnerable and teach to my beliefs my core beliefs" (planning conversation, April 24) and that she was ready to be pushed and find a balance where she was comfortable taking risks and to make math meaningful to her students. Really she had laid the groundwork for having a classroom where she caused learning. Her students loved her and they felt safe in her class. They knew she loved them back and she truly enjoyed teaching them and challenging them. They share their answers and thoughts easily, this was an environment that could foster a problem-solving climate, and a constructivist math class could reside here.

Episode 2. Thematic Teaching

One of the struggles Lily had was determining on her own what the big ideas were in Grade 4 math. She expressed "struggling with understanding what's most important" (planning conversation, April 24). Through conversations we decided that she needed to move to:

> 4.N.6. Demonstrate an understanding of multiplication (2- or 3- digit numerals by 1 digit numerals) to solve problems by using personal strategies for multiplication with and without concrete materials, using arrays to represent multiplication, connecting concrete representations to symbolic representations, and estimating products. (Manitoba Education, 2013, p. 91)

We decided to use a three-stages of teaching math approach (Ameis, 2016) that required a theme, a set scene that introduces the theme in an open and engaging way, activities used to develop the outcome including multiple modes and a problem solving climate. As the year progressed the third stage would include a maintain stage where they would do mini and rich tasks to help the students maintain their knowledge and connection to the material.

Lily's students were interested in gardening at the time so we decided that this would be our theme. I shared an investigative type article with Lily to try to help inspire some ideas for the theme and subsequent activities and materials. The article was entitled Mr. Greenthumb's Garden (Sweda, Knotts, & Moyer-Pakenham, 2004). The gardening theme provided the students with an opportunity "to explore the topic of multiplication using the array model and to motivate students to see the applications of school mathematics in their everyday life" (p. 217). Lily started out strong, she had the students use seeds to make arrays for a variety of two-digit numbers, referred to as gardens. She had them acting it out and then creating a diagram that represented the array on graph paper. The students were engaged and challenged finding the various arrangements. Lily was able to support her class in a positive way moving their learning forward as she circulated. Lily reflected in her journal

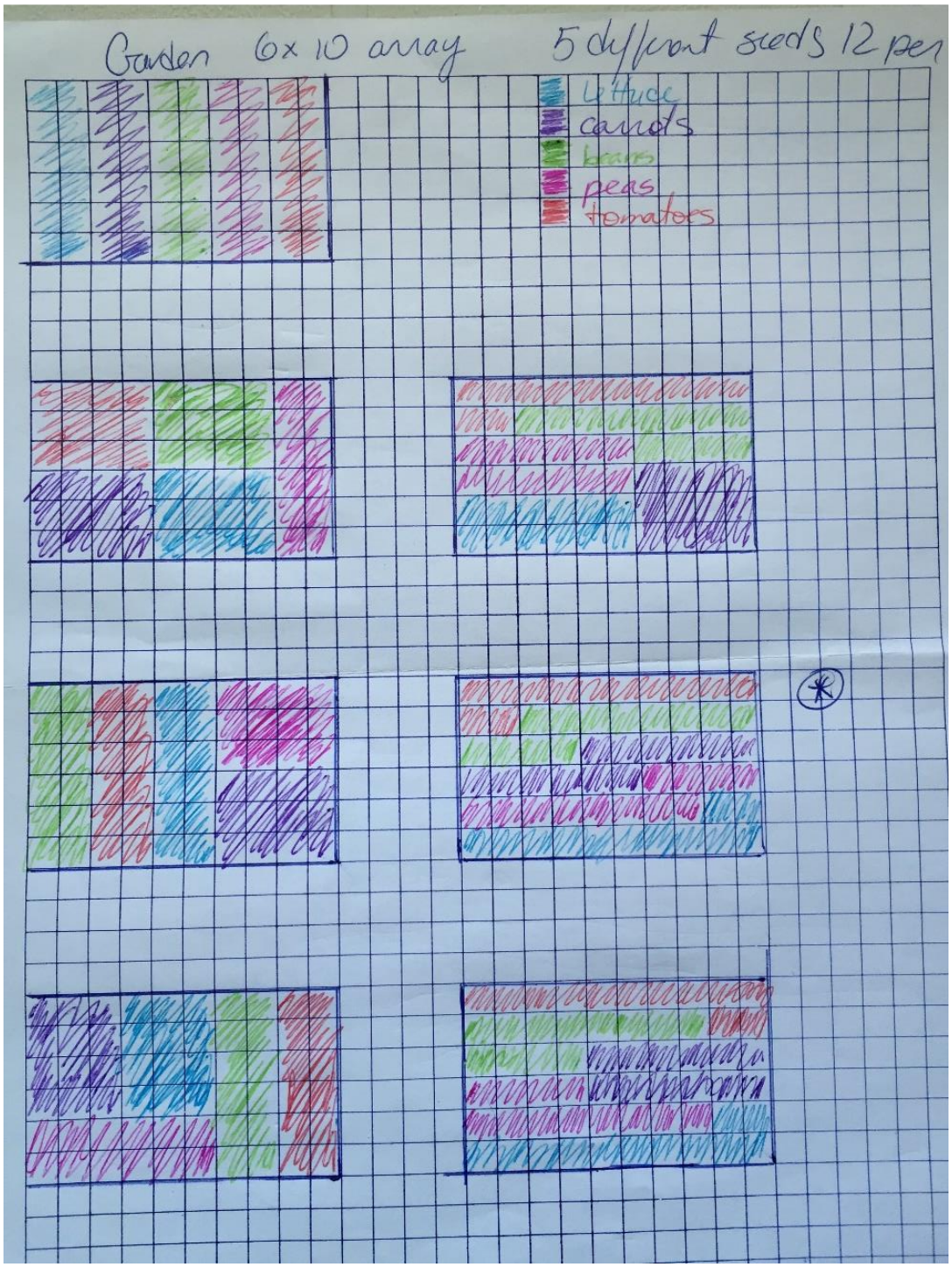
> I like having R to work through this with. She sees a conceptual progression that I don't, just yet, like seeing all of the repeated addition which can segue into place value. Sometimes I'm caught up in the doing and managing and I can't quite see what's happening. (Journal entry from Lily May 2)

She recognized her path as concrete, pictorial and then symbolic.

One of the activities that caused the greatest struggle for her was an open task. She posed: given a garden with 6 x 10 array, she wanted them to plant five different types of seeds,

12 of each kind. She gave them graph paper and five different colours of plasticine to represent the seeds. Figure 3 shows various arrangements that met the criteria. After the activity she reported that she "felt really tense. That was really uncomfortable" (reflective conversation, May 6). She was frustrated and felt like she was getting sharp with her students when they were either struggling with creating the 6 x 10 array or if they were making rectangles with 12 seeds that she didn't recognize as productive in her mind. Lily recognized that the concrete part was important for some of her students she just felt impatient with the seeds and plasticine balls. The drawings and models she reflected on as being efficient for example: five arrays of 2 x 6 fit the structure she had imagined but the 1 x 10, and 1 x 2 that made up the first set of seeds she just couldn't imagine how those could be right. When we reflected after and she really thought about their answer she then recognized that the sum of all of their rectangular arrays would still add up to 60. She felt bad that she had discouraged them. Her lack of personal knowledge of school math was evident here but it was a learning experience she will never forget. She recognized that she "was being narrow-minded about what" (reflective conversation, May 6) she felt an array should look like. This type of activity caused her stress, what she saw as unproductive and ineffective I saw as a meaningful opportunity to cause learning in math, to interact with peers, to think about how a garden could be arranged, and then to bring it to a place where the class would recognize that no matter what arrays you used inside your 6 x 10 array that you have used all 60 seeds and created a garden. When the students see the five – 6 x 2 arrays will they recognize it as the most uniform and organized, maybe, but it doesn't make their different arrangements wrong.

Figure 3. Garden Arrangements



> For Lily it was about her feeling vulnerable:
>
> and when people are vulnerable it's like walls go up, and I get kind of black and white you know. It's like a defense thing, or I don't know what it is, it's just a safety thing. When I feel vulnerable there are things I put in place consciously or unconsciously to seek safely and whether that's using a worksheet instead of doing something like this or whether it's being sharp or whether it's you know like having: this is what an array is. (reflective conversation, May 6).

When she was deliberating her next step she recognized that I helped her understand the process and how important it was to notice and to recognize the important thinking in her students work even when it doesn't match her vision. She explained that she "could see that if some teachers don't have that support or can't reach out for that support would say hello pre-done book" (reflective conversation, May 6) but we needed to work through the discomfort, she even described it as her body just felt sick. So, her next step was not to go to a safe and quiet worksheet as she described it but it was to pick up where she left off, repair some of the sharpness and recognize the math that was happening in all the pairs and allowing them to share their process. She had collected their work and decided a course of action for each pair to move their learning forward, she persevered and was very happy with her decision later to continue moving forward on that same path and have trust in the process. The process included the well thought out and intentional activities, the problem solving climate, the reflective conversation among her students, her prompts and questioning techniques, her ability to notice, and her use of multiple modes.

The gardening theme led to a day of planting gardens in the courtyard with laughter, engagement, purpose and enjoyment. The students were held accountable for their gardens with

journal entries and labels for their gardens detailing their process, number of seeds, arrangement of seeds (array), and type of seeds. Watching the gardens grow was a valuable experience for all of them as they learned about math and gardening. A photograph of one of the gardens is displayed in figure 4. Lily described the activity as "wonderful" and that she didn't "feel that chaos feeling like the other day" (reflective conversation, May 13) which was interesting because we were outside with major winds, soil and seed packages blowing around, kids still wearing toques, no gardening tools just our hands, turning storage buckets used during the year for their winter gear into gardens.

Figure 4. Gardens

The experience felt authentic it had "blood, sweat" and winds and also joy, laughter, and life. It had the pulse of genuine learning. It also really had a great balance of what Lily had expressed striving for the first day I observed her teaching in her classroom a balance between creativity, spontaneity, intentionality, and planning. The focus was on the connections the students were making and really playing an active role in their learning. People asked about the gardens and the fact that they hadn't labelled them yet became an important step in their learning and there was a reason for their labels to inform others. Lily wondered about whether she would be able to replicate this type of activity in the future with a different group of students. The classroom climate of trust and safety she had created and the mutual respect that had been established in her relationships with her students, through the connections she made with them all played into the success in the classroom. In my mind she will be able to do this again, it may not look the same or sound the same but the trajectory will be the same and her courageous pedagogy will triumph again.

Episode 3. Taking a Risk

The process of trying to change her teaching to match her real beliefs about how to teach mathematics was not an easy journey. As Lily progressed from pictorial to symbolic she struggled with the vision of how she should present the information to her class after a student had worked through an example in her own way. Lily wanted to use this particular sample to carry through the next part of her lesson, the sample had used an array model and broken the array up by place value, exactly in the direction Lily needed to proceed next. She asked if I would model it. I really felt like this was a pivotal moment for her on her journey so I responded by explaining to her how I would write it out pictorially and symbolically but I encouraged her to carry on as the facilitator. I recognized in my journal later that

> I could see that Lily was uncomfortable today but happy that she tried 9x17 but at one point she asked me if I would model it for them 9x7 + 9x10. I modelled it for her but I really believed she needed to take the risk and talk them through it. Part of me did want to take over and jump in, it would be fun for me to cause learning and work directly with them and interact with their ideas but the point is for her to experience it and reflect together on her experience with my support. She was happy that she did walk them through the student examples and really she did a good job. (Journal Entry, Rhonda, May 11)

After I had modelled it for her she carried on and was intentional about what contributions she asked for from her students, and she was able to use them to move the learning forward. She used good questioning techniques, prompts and her skills of noticing to cause learning and empower her students. She recognized that certain answers were not going to keep her on target, she described it as "that's a rabbit hole we could go there, but I'm not going to go there so I forced myself" (reflective conversation, May 11). In our conversation afterward she thanked me for not letting her "cop-out" (reflective, conversation, May 11). The activity could have benefited from some interaction with a partner about the work they had done instead of her telling them to grab a book while they waited. Some students were counting all 153 squares as their process at this point and others were ready to move forward. Lily recognized after that she needed to be prepared for both ends of the spectrum. Keeping them all focused on the task at hand was important.

Lily needed to determine her next step. She took the opportunity after class to look at all of her students' work from class and described what she noticed and how to move that individual student's learning forward from where they were. Lily saw patterns, misconceptions, counting

errors, alternative methods, number tricks, and students ready for the standard algorithm. She was intentional about the next steps she took for the next class, she based it on her trajectory and the individuals in her class not the next worksheet in the book. Her trajectory was based on a series of activities arranged to progress along the path to teach the specific learning outcome. She created a plan that sounded balanced and manageable to her. At the end of that week she reflected:

> I am beginning to see, to feel how things are fitting together. I feel like having a coach has given me that sense of safety that I seek, the nest or the soil. It's given me space to process my feelings, the experiences and I'm just noticing it's through relationship. Within the relatedness, I've taken risks, moved through the discomfort and what felt like tense, sharp, chaos to a deep knowing that I, we are on the right track. Without the safe context and relationship, I may have defaulted or stopped with the plasti-seeds and gone back to the security of a prescribed worksheet/textbook. (journal entry from Lily May 14)

Lily could feel her math identity evolving and her sense of efficacy was improving. Her experiences were not only having a positive effect on her but her students too.

Episode 4. The Art of Noticing

When it came time to explore bigger numbers that wouldn't fit on the grid paper Lily felt trepidation about the activity but she also felt empowered. Lily gathered her students around her and had them work with manipulatives and white boards with grids. She used bigger numbers, 7 x 23 and 7 x 43, to try to move the students past needing grid paper to create arrays for multiplication. The students made connections and were able develop a new, more efficient way to understand multiplication that came from their ideas. She was focused, encouraged students to take risks, used prompting techniques, and her skills of noticing to move the lesson forward.

Through her techniques she sponsored visualization and connected with her students. They were willing to take risks to determine how they would make an array without grid paper. It did not come from her, but she selected students' comments and moved the learning forward using suggestions that included using the side of the white board without the grid, just writing what the numbers were, and placing a line at the place value. Lily facilitated the learning by helping everyone to see how these ideas made their process more efficient and transferable. She described her teaching decisions like a puzzle, which was an interesting comparison. Lily felt like she was using all these pieces from her students to keep on her trajectory and empower them. She reflected that it "just happened, I wasn't sure how it was going to happen and that's maybe part of this too is trusting this is helping me trust the process" (reflective conversation, May 19). Lily trusted the process and trusted herself, her ability to connect with the process and the content to help her class arrive at the method as a result.

There were still moments where her lack of knowledge surrounding school math was highlighted, labelling the lengths of the sides inside the arrays led to some confusion but she corrected it with some prompting from me (that the students were unaware of) but she totally owned up to her mistake and made it part of the learning process. "And to be able to say in front of my kids, oops human and then here's why and we're going to go back and do that" (reflective conversation, May 19). That moment was authentic and modelled a growth mindset. Making mistakes is part of life, and Lily felt safe to model what it was like to work through a mistake in a realistic and genuine manner. From her past experiences as a child she knew what it was like to get in the habit of running from mistakes and even lying about them. To expect her students to display a growth mindset without her demonstrating one and sharing what it feels and looks like would be to her students' detriment. Boaler (2016) describes how important it is to "develop a

growth mindset in mathematics, to approach mathematics with confidence and enthusiasm and to pass that on to their students" (p. 9). She went on to describe that for teachers "appreciating the importance of mathematical mindsets and developing the perspective and strategies to change students' mindsets involves some careful thinking about our own learning and relationship with mathematics" (p. 9). This included embracing mistakes.

In the past Lily needed help to continue on the path that allowed her to move forward from her mistakes and this desire for help was present that day just as it is present with her students with her as the mentor. She felt that without my support:

> I wouldn't even get to experience this and go through the tension and coming back and saying and knowing that I wasn't labeling that right I felt really confused when I was writing 40 and then 7x40. There is so much in here that I felt confused so to have a coach come and say. (reflective conversation, May 19)

This was all part of a learning experience for her that she was embracing and growing as a result.

Lily's ability to plan and keep on her trajectory was improving. Her vision became clearer as time passed. Lily had her class outside drawing arrays with chalk on the concrete the day prior to this, it was a creative and spontaneous moment she had fostered. She expressed that it made what happened on this day much more meaningful. She expressed that it:

> was really cool to see that I did that. It was intentionality, I knew where we were going but I just trusted myself with it, I didn't have this plan. No, I had no idea what we were going to do today. I was thinking "oh I'm ashamed because I did this but then I thought ok easy it does it". (reflective conversation, May 19)

Lily had a certain way she pictured planning and what she had done to prepare for this class felt different. She tried to explain her process further later in the conversation:

> this morning when I was writing this I was like "oh yeah I know what I am going to do. I know which numbers I'm going to use", I felt empowered. So that's what I feel. Oh, I did have a plan, I knew my numbers, I knew how many boards I needed, I figured I wasn't winging it but yesterday I didn't, I was thinking "where are we going to go after this?" (reflective conversation, May 19)

So she really did have a plan and had no reason to feel ashamed. She really did feel more confident in her methods and strategies. That day it became about trusting her efficacy about teaching math.

A beautiful moment took place that she reflected on, one of her struggling students took a risk. She felt confident enough to do a question in front of the class and she nailed it. The student was very proud of herself and so was Lily. Lily did a mock interview with her about how she felt, whether it was an easy process, and how it had been a tough road, lots of hard work, doubt in herself along the way, but she did persevere and succeed. Lily supported her throughout her learning process. This process mirrors what this journey has been like for the two of us:

> I feel like some of how Lily reacted to her student's work is reflective of how she feels with her current work that the ability is there it's just she has to keep trying and taking risks to feel comfortable making some of the decisions that need to be made in that type of learning environment as a teacher and like her student had the support of Lily as her teacher Lily has my support as her coach as a safety net which Lily recognizes and feels comfortable with the relationship and the trust that comes along with it. (Rhonda's journal entry, June 1)

The learning environment was vital to her growth.

Lily had planned another activity that was outside of the gardening theme, Hit the Target (Burns, 2015). The game involved selecting a target range of numbers to try and hit through multiplication by selecting an initial number and then finding a second number to make the product within the range. Lily was unsure about the game, the instructions, and the tools needed to play. She went with it anyway, and made some pedagogical decisions along the way. When we reflected after, a lot of the changes she wanted to make were how the activity was originally supposed to be played. She recovered more so this day than on other days, she knew the intention of the game and the content which made it possible for her to make changes along the way. In her journal Lily expressed "today I felt confident and self-aware. I was like I knew I wasn't on the right track, but I did something about it in the moment. I observed specifically what a student was doing and used it" (Journal entry, Lily, May 30). She knew which methods to notice and share with the whole class and advised them to monitor and modify as they went along with the game.

The idea to continue to monitor and modify behaviour is a creed one of her mentors teaches. Lily lived by this creed and this was something she employed a lot in her classroom. It infused her teaching philosophy. She practiced monitor and modify herself and at times recognized the need for practice and the need for steps developed to help her students become more proficient. Lily used parts of two worksheets and sheets she created to help facilitate this. She also took time to use an idea from one of her students who had described one of the arrays as resembling a floor plan. She later took the idea to provide a context to the importance of labelling and the meaning behind the model as a model for area. She had them explore and discuss a variety of floorplans to connect to the relevant comparison. Lily was embracing the

real life connections. She now had the space to make room for and make the relevant connections to engage her students and as a result increase their desire to learn math.

Episode 5. Rebellious Moments

On my final visit to Lily's classroom I was looking forward to observing her initial lesson on division. Lily used a Three-act-task. Dan Meyer developed three-act tasks (2011). The

> students are shown an image or video that depicts an interesting situation… A good task will suggest some mathematical features or relationships that children may wonder about. After viewing the image or video, students are engaged in asking mathematical questions, identifying important information that is needed to answer those questions, constructing mathematical models of the situation, and comparing their models to the real world. (Kazemi & Lomax, 2016)

Lily showed her students a photograph of a Ferris wheel, it was supposed to be the start of division, an engaging set scene. She confided in me just before the class started that she was really nervous about how it was going to go and how it was going to lead to division. In retrospect, I wish we had discussed the content more thoroughly beforehand but when I asked her earlier in the week Lily was quite confident. As I observed the activity it was evident that she was not clear on her trajectory, the process of how to carry out a three-act-task was clear but not the content or how this activity fit along her path to teaching the concept of division. It was disappointing. Lily looked defeated, unsure, and frustrated.

We reflected afterwards that lots of good thinking came up that could have been steered into division but during the lesson Lily couldn't see it. The students had great questions, some mathematical and some not. They identified important information like how many baskets they thought there were and why. Students were brought back on track by a reminder from a student

that they were supposed to be making mathematical observations when they got off topic. They talked about how many people might fit in each basket and how many the Ferris wheel could hold in total. Instead of continuing that conversation, the task got steered by Lily to determining the number of people that could ride the Ferris wheel at one time if there were 24 baskets that fit six people each basket, a multiplication question. Lily's lack of content knowledge made it impossible for her to reach her goal in that moment and so she settled on this task.

The low point in the class came with only seven minutes remaining. Lily selected a student who was engaged in an unrelated task and asked him to share his answer with the rest of the class. This self-destructive choice worked against the progress Lily had made with using her noticing skills to move the learning of the class forward. The class ended on this note. She had been picking people intentionally before so when she explained her reasoning she said:

> yeah and it was totally something different and I kind of did it and then I went "why did I do that?" as I'm listening to him share and looking at the clock thinking "why did I do that?" I knew he had done the poles . . . Maybe part of me wanted to rebel against I don't know what and let him answer . . . and I knew I was doing it, it was intentional… as I chose him and then I thought . . . I was curious about his process but that doesn't matter right now because right now, what's our question actually? . . . and the class is sitting there going "what?" I totally saw myself doing it, it was weird. (reflective conversation, June 2).

She made a decision in that moment to have him share, it went against the work we had been doing but she did it anyway. As a result the work we had been doing, the purpose, became even clearer and more real to her in that moment.

I did feel responsible for her taking a risk and for her not succeeding but the experience led to even more growth than if she had executed everything perfectly. Although she was unhappy with the activity, after a couple minutes of reflecting she felt confident that she could still regain the intention of the activity the next day. The students ended up doing a rich task in multiplication, almost a review but she turned it around the next day. She could have abandoned the process but she persevered. When we spoke after she compared it to the day she used the plasticine, she felt uncomfortable, insecure and snippy with her students.

> It wasn't an investigation, in this case what I saw was everybody going to arrays because that's what they knew how to do. So I feel that was because, to be totally honest, my bad, was like if I'm assessing my own teaching here, I focused on the process and not on "what's the point?" and that's my bad and because of that it felt uncomfortable. It felt like I didn't know what I was looking for, I heard numbers so I went with that. I heard her say estimating so I brought that in but I didn't know where we were going. (reflective conversation, June 2)

The idea of doing this activity was exciting, part of her math identity involved being excited and passing on that excitement to her students but she didn't get there that day.

There were opportunities during the activity she was just unaware of what to notice and what to use to help her turn the activity into a discovery about division. She described:

> that through this work I'm confident but now this is a reminder and I'm grateful for it in a way, . . . the bottom line is knowing where I'm going to go, that's the bottom line and how we get there. I can trust now . . . and knowing what I'm supposed to notice. (reflective conversation, June 2)

When I asked her what she thought she accomplished that day, besides her students engaging in a real life connection multiplication, she responded "I took a risk, I noticed, felt the discomfort of it and I observed it rather than like I didn't necessarily act out on it you know I could've gotten…I can get sharp but I didn't so that was a good thing" (reflective conversation, June 2). Lily was evolving, she was trusting herself and her sense of efficacy while teaching mathematics had improved.

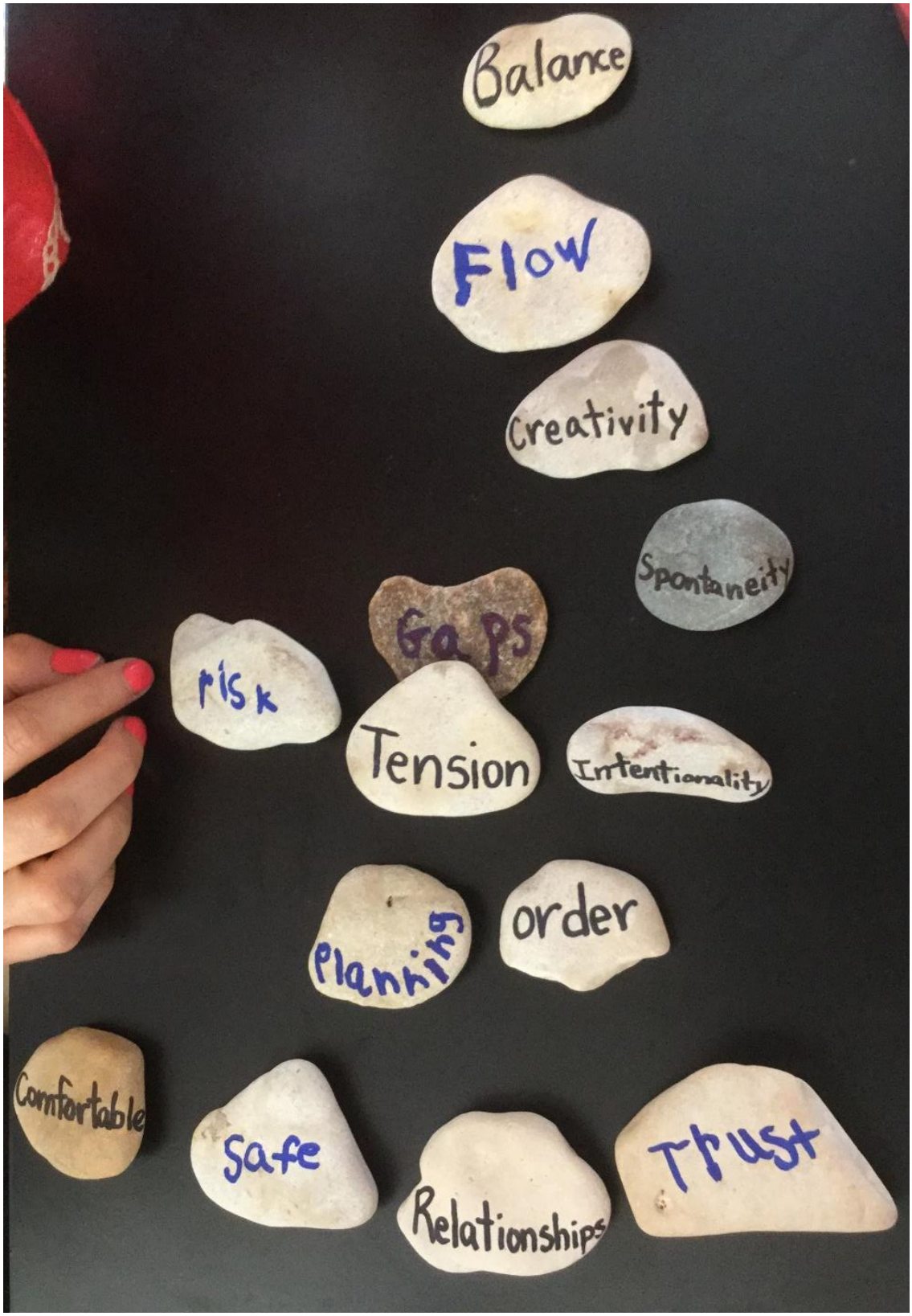
Lived Experience

Experiencing these episodes alongside Lily and reflecting on them afterwards through conversations and journal writing helped to prepare me to interpret the narrative accounts of the experience and to interpret the meanings. As I wrote the interim texts, themes emerged from the field texts as I relived the experiences and reflected on them. Lily had already done some important reflective work in her life on her inner struggle with power and her choice to make it productive or destructive. Through many of our reflective conversations this was underlying her thoughts and decisions. Her desire to remain aware, open-minded, and willing to make decisions that would lead to productive experiences for herself and her students was a driving force for Lily.

Many themes and subthemes reoccurred throughout the first four weeks. I took the time to embrace them and used them to help me write the third interim text. Once I completed it I wanted to give Lily the opportunity to work with a set of words that included possible themes. Lily is a visual person. She likes to draw pictures and diagrams to work through her thoughts and experiences and determine how they connect with her feelings and past experiences. So, at the end of our discussion on the third interim text, I gave her a bag of rocks with a word written on each rock, the words were what I saw as themes from her journey so far. I also included

blank rocks for her to add words that she felt were important. Figure 5 displays how she arranged them initially. She tried to explain why she felt they went that way. As she worked through her thoughts, she moved some rocks into different places. She felt like all of the rocks were part of the whole journey. She even resisted classifying them as positive or negative; she recognized them all being a part of a balance she was looking for, knowing that tension must be there to grow. Lily's desire to come up with a visual that helped her to examine how she was feeling and represent her journey was important to her. Lily used many metaphors throughout our conversations. When she saw the word flow she said that she "automatically thinks of water… if it flows past a tree it doesn't hold on for safety, it doesn't hang on to the plant for safety it just flows where it's going to somehow" (interim text 3 conversation, May 8). For her finding flow meant trusting in the process and this allowed her to have the room to make decisions to cause learning, to stay on her trajectory and as a result she met the needs of her students. While moving the rocks around she reflected on the process, the journey, the experiences so far she had relationships as the base explaining that:

Figure 5. Reflecting with Rocks



> without the safe, trusting, relationships whether it's with a coach or a mentor or with my students in the classroom it's not, there's nothing, I don't think and I think maybe sometimes I look at my life and when this stuff [comfortable, safe, relationships, trust] wasn't there that's when this became order and planning, they became a necessity because that's the control because of fear . . . but when that's [this base] dominant there's a place for this [risk] but when this [planning, order, gaps, fear] becomes the dominance it cuts off the energy of being willing to take a risk. It cuts off the energy of spontaneity, it cuts off creativity which comes through all of that. I think then it cuts off the flow because it's like an ice cube. It's frozen, when I'm in this place [planning/order] hard-core, that's fear, that's not feeling safe. Maybe I don't trust myself as a math teacher or teacher or human. (interim text 3 conversation, May 8)

The planning and order helped her feel in control but the planning she was taking part in was not helping her reach her students.

Lily believed that through our experience together she was an active part of changing her mindset surrounding her ability to plan and teach mathematics. She felt that this experience would become part of who she would become as a teacher:

Figure 6. Reflecting with More Rocks

> this process this will just become who I am but I have to go through the tension and the gaps and just understand that that's part of the process. Growth is inherently risky like it or not. If I look at all the little leaves, it's a very risky situation to be a little sprout growing in the grass. That's a very risky situation out of the shell. So for me it's finding the balance. I still want to keep my shell a little bit, but I just want to and this context that we have created, the context of the classroom with the people that I love like that [growth] can happen and it is happening. (interim text 3 conversation, May 8)

Lily is a learner who finds metaphors and visual representation an important part of her learning process. She took the rocks home and added the words in red and rearranged as shown in figure 6. She could reflect and think about her experiences and feelings in a meaningful way through images. The importance of being responsive to relationships and intentions stood out the most in this rearrangement. Lily believed in action, experiencing, moving forward, and feeling that break-through.

During our final conversation surrounding interim text 4, weeks 4-8, Lily and I spent a lot of time trying to build a model that would represent her journey and her experiences. In fact we were often drawing maps and diagrams that would represent the experience visually throughout our journey together. We tried to make the themes and subthemes fit together. As I explore the themes in chapter 5 the visual puzzle that we were presented with will come together, not in a static way but in way that has flow and interplay. The experiences, reflections and her growth over time are all part of a dynamic lifelong learning journey.

Lily reflected on trust often in our time together. She knew that there was more she could do to reach her students when teaching mathematics, she had wanted more for her students. She recognized that there was danger in striving for change and compared it to a seed growing:

> that is the seed that's been with me. I remember living in an apartment on First Street [pseudonym] and not living in a good way and I remember waking up and there were people all around sleeping and I was like, I must've been 17, I was living on independent living. I was like, this isn't it, there is something better in the end and this is the same thing. (interim text 4 conversation, June 11)

Through her own life experiences Lily knew she wanted to change, she knew certain pieces were choices and she knew she could do it. There were times in her life that she had to experience and then overcome dissonance.

> Sometimes it's continental collisions like where you just get shattered and what you believe in, what you know and your trusting yourself and everything is shattered, and sometimes it's this slow kind of osmosis like water seeping into a shell and it slowly gently dissolves. I don't think it's always a shattering; I think it's one of those two…that's nature sometimes. It's just unpredictable that moment of homeostasis needs to happen. (interim text 4 conversation, June 11)

Lily has lived through both types of experiences, continental collisions and osmosis. She has witnessed many other experiences that her friends and students have lived through.

Throughout our experience together many themes emerged. The major themes that emerged were the importance of relationships, trust, balance, and a trajectory. Throughout the experiences many subthemes developed as well that fit in with the major themes. I will now move to drawing meaning from the journey thematically.

Chapter 5 – The Themes

The major themes that emerged from this narrative inquiry were *relationships*, including: the context and connections; *trust*, including *trust* in herself, *trust* in me as her coach and mentor, *trust* in her students, and *trust* in the process; *balance* that led to flow; and *efficacy* that made the trajectory clearer. I believe Lily needed the same foundations that her students needed to feel comfortable taking risks: an environment built on *trust*, a *relationship* that she felt safe in its provision of support and collaboration, and a place to wonder safely so she could make some decisions that cause learning. These decisions would lead to a *balanced* classroom where flow and *efficacy* reside. Her growing sense of *efficacy* helped to provide vision and made the process of developing a trajectory more comfortable and resulted in a feeling of empowerment for both teacher and student. This particular theme worked in reverse as well–the success of developing a trajectory increased her feelings of *efficacy*.

In this chapter I will be addressing each of the four themes. I will explore each of the themes: *relationships* and *trust*, *balance*, and efficacy including the importance of a trajectory. As much as *relationships* and *trust* seemed like separate themes they could not be explored separately; they were interconnected throughout the journey so I ended up exploring them together. I will begin with an overview of the themes and then segue to how the themes were co-constructed by Lily and me during the coaching and researching. I will then go into greater detail about each of the themes. To conclude the chapter, I will present a visual representation of the themes that Lily and I developed and amended throughout our conversations as a way of interacting with the themes as a coherent whole.

Overview of the Themes

Relationships and *trust* came up often along our journey. When Lily reflected back on her math identity as a student it often elicited a conversation about *relationships*. These *relationships* with past teachers or professors helped develop connections for her and a context. Without these *relationships* and the efforts made by these people her math identity suffered. The opportunity to work with a mentor/coach was one Lily deeply believed would improve her pedagogy and her *efficacy*. According to Magnusson & Hopkins (2011), "A coach brings her presence, deep listening skills, powerful questions, and relevant tools and resources to support the individuals and challenge them to clarify and realize their goals." (2011). Lily believed that I could provide her with this type of support. Lily believed that with support she would transform her teaching. The importance of *trusting* me was part of this belief. Our *relationship* mattered to her; it was as important to her as it was to me.

Lily needed to take many risks to take part in this narrative inquiry and to truly honour her beliefs as an educator. To be able to take risks she needed to *trust* me as her coach and *trust* in the process we were experiencing together. Lily's use of worksheets was not reflective of her beliefs about effectively teaching math. The use of worksheets was without risk to herself. They were comfortable, but they lacked the ability to connect with students. She needed to feel uncomfortable, to feel that searing vulnerability as a teacher to really feel like she was part of the process. She needed to *trust* in the process, be open to the tension to allow herself to take ownership over the learning and to feel empowered. Lily believed in the work we were doing as integral to the process of transforming her math identity. This process required great vulnerability. The process included her being pedagogically courageous, evolving her planning process, allowing herself to be observed by me, reflecting on her teaching including her evolving

math identity and collaborating and reflecting with me. The feeling of safety would return with experience and success.

Lily desired *balance* within her teaching and her planning. Vision and flow were of utmost importance to her as part of this *balance*. She wanted to create an environment where she *balanced* planning with creativity, intentionality, and spontaneity. Lily wanted her math classroom to be a place where activities with multiple modes, problem solving, real life connections, authentic connections, themes, practice, and automaticity with facts existed together. Integration of these activities would be part of the flow. She wanted a place where mistakes were embraced and used in a positive way to move learning forward. Lily wanted to foster a growth mindset, "students with a growth mindset take on hard work, and they view mistakes as a challenge and a motivation to do more." (Boaler, 2016, p. 8). Lily too has a growth mindset she was just working on expanding it to include mathematics to achieve the *balance* she desired. Lily was ready to embrace her growth mindset in mathematics.

Lily had gaps in her school math knowledge that made it difficult to abandon the workbook. She needed to anticipate the responses in order to skillfully move to the next step in her activities. Her planning still had to have a trajectory but that trajectory relied on her *efficacy* for the activity including the individuals in her class and their needs. The activities that were part of her trajectory needed to actively involve her students and give them ownership over their learning. Part of this experience needed to end with empowering not only herself as a planner and teacher but her students too. For this she needed to improve her knowledge of school math and fill in the gaps. She needed to reconnect to the content and provide a context to make the math more meaningful.

The Development of Themes

The themes emerged from the many conversations we had, the observations made in class, and the journal entries. As the themes started to emerge I began writing interim texts to use my understanding of the lived experience to explore the themes further and to interpret Lily's experiences. A sample of an interim text is provided in the appendices. Appendix III is interim text 3. The interim texts were shared with Lily and she had the opportunity to contribute her thoughts and expand on how the interpretation fit her experience. The first two times Lily and I met to discuss interim texts Lily wanted to hear the entire text first and then she went back and added her input and interpretation after. Often she would add more to elaborate on how she felt or offer a metaphor that helped her relate to the experience. This was meaningful for both of us. For the sharing of the final interim text she interjected throughout after confirming that this change was fine with me first. This changed the experience, it was just as meaningful and made Lily a big part of the evolution of the final themes. It was through co-construction that the themes emerged.

During these moments Lily also tried to visually represent her experience as a way of making her journey accessible in a meaningful way for her. The rocks were presented to her during our meeting surrounding interim text 3 (see appendix III). The words that were originally printed on the rocks are located at the bottom of interim text 3. The rocks were created for Lily knowing that she would benefit from having the reoccurring words and themes in front of her to help make sense of her journey visually. The two photographs provided in figure 5 and figure 6 are two examples out of many. The first arrangement Lily made was shown in figure 5. The words chosen here were themes that had come up during our journey so far. Lily added the words in red in figure 6. *Trust*, *relationships*, safe, comfortable, tension, and risk were rocks that

were present from the onset and seemed to belong together. Lily, on her own, added sharp, soft, and clinging to highlight how she was feeling during these times of tension and risk taking. Lily wanted to feel *balanced* as a teacher. She wanted to feel flow. For Lily this *balance* included intentionality, spontaneity, and creativity where she could feel flow. This was all part of experiencing, another theme she added that fit the narrative inquiry. Planning, order, and gaps emerged as important pieces in her role as a competent teacher. Lily felt that she needed to be responsive, a word she added, to feel *efficacy*. These feelings of *efficacy* helped her feel like she had travelled and grown as a teacher, and she was flowering. She could feel herself transforming. Lily described it as a break-through.

Lily felt comfortable when she could visually organize her thoughts to model her experience. Her use of metaphors to describe her feelings about her experience and her use of visuals helped to explore the themes in a potent and succinct way. Appendix IV and Appendix V are examples of rough-drawn visuals that were created by Lily and me to make sense of the emerging themes during the narrative inquiry. In her rough drawings, she wrote that her identity was grouped with her beliefs. She believed her identity as a teacher underpinned all and that her intentions ran through it all. Lily believed that the emerging themes were permeable, evolving constantly but that there was a constancy to certain pieces. The themes themselves were emerging and part of our discussions throughout. During our meeting surrounding the fourth and final interim text, we co-constructed three themes: *trust*, planning (including a trajectory), and *balance* (including being authentic). These themes are included in the final narrative. As part of my interpretation that included that meeting the themes were expanded. The expansion resulted in relationships being part of the trust theme and planning became a subtheme of the much more descriptive and inclusive theme of efficacy.

Relationships and Trust

Lily had often found herself telling her students to take a risk and to trust the process. She often reflected that she was not just telling her students this but herself too. She described that initially this began with her trusting me. Then, as time passed, she began to trust the process which led finally to trusting herself. That did not mean that she felt like she trusted herself every moment and that every decision was the right one. Rather Lily now knows that even if she does grapple with some idea or response that her sense of efficacy will move her forward. She is now confident in her resilience. Her resilience did not come without taking many risks, many leaps of faith along the way. There were times along the way that without my support and coaching that she might have given up or chosen an easier path. She did, after all, have all the multiplication worksheets copied and ready as a fall back.

Lily recognized the importance of relationships, our relationship and the relationship she had with her students. It took courage to intentionally change some of her thinking and decisions. She felt vulnerable, she felt tension, she felt fear, and even anger. Lily expressed wanting to stay inside her "hard shell" where it was safe, but she knew she needed to sprout. She described that's where possibility lies and danger, she needed to allow herself to be vulnerable to experience the tension. She expressed that:

> the seed starts out hard in its shell it's protected it's safe and then it's given nourishment and then the shell starts to split open. I noticed this in my bean sprouts and then, it's not an aggressive process but as they absorb the water, as the inside transforms, then they split and the sprout comes out. But the sprout is very vulnerable and it seems like in my life, it's this dance between… it's this strange dance in here part of me knows what I'm

> doing and sees the success but part of me runs back here I want my shell back. (interim text 3 conversation, April 24)

Lily felt the danger. This feeling of danger came from the lack of control and searing vulnerability that she felt as she was first taking the risk to teach in a pedagogically courageous way. She intuitively felt that trusting me and trusting the process would be worth it in the end. This faith she grew to have in the process allowed her to feel confident and connected to the teaching. She expressed that she knew she would not have gotten there without my support. The support of scaffolding and meeting her in her zone of proximal development was needed. Her recognition of my role in her growth echoes the pieces brought forward in Chapter 2 (page 29) where I explained how I felt the zone of proximal development would play a part in my positioning as a researcher and as coach/mentor. The journey led to beautiful moments where Lily felt comfortable and confident. Even as she stumbled along the way, Lily knew I was there to support her. At first she felt great discomfort when she couldn't recognize where to take certain ideas but, over time, she knew she just needed to allow herself to be more open. To look deeper into her students work and look for the pieces that still fit the learning target to empower them was the key to her growing confidence and efficacy. The guidance I provided in a safe environment as part of collaborative conversations and reflections after classroom visits helped her improve her math identity. The ideas regarding math identity from Chapter 2 (page 34) surrounding the importance of reflective work and support resulting in an improved math identity occurred.

Now Lily knows she can find her way. No matter what happens, good math will happen and be discussed. She truly felt herself earning her desire to enact what it meant to have a growth mindset and to foster this in her students. This shift allowed Lily to not only trust the

process, but to trust herself too. She expressed that our experiences together in this relationship and context allowed her to shift quickly to trusting herself.

> In this process that we've explored I've, I was able to educe because I knew where I was going, because it was in a context where I was safe to grapple with this. If it had just been me in the classroom well guess what probably I don't know if it would've looked this way. I can say that maybe it would've gotten there years and years and years down the line but with this kind of coaching, mentorship it was like it happened. This is a very short period of time. (interim text 4 conversation, June 11)

As our time together drew to a close, Lily felt more confident and competent as a teacher of math. Trusting herself, she explained, had not come easy. It had not been easy going from where she had been to where she was as we parted company. That identity piece, whether that was in math or just as a woman to trust herself that her heart was in the right place, that she was doing the right thing. Lily's experiences led her to feel like a professional. Through the encouragement of myself Lily was learning to trust her judgment and intuition. Whether it was with how she interacted with her students, her planning process, or all of the decisions she made to cause learning during the day. Relationships and context flowed through everything. The context of Lily's outside life still affected her as a teacher. Recognizing this, and allowing it to be part of who she was as a teacher at that time, helped Lily to take a step back and trust herself. This knowledge allowed Lily to trust her intuition, to let emotions come and go as they needed to as a part of life. A transformation had occurred; Lily described it as a metamorphosis. She had built that trust in herself, in the process just like she trusted nature.

> That gives me hope because to know it is, it's trusting the process. Like I can look at nature and I can trust that the sun will, not the sun is going to come up, but the earth is

> going to rotate or whatever I can trust that. Night will come and day will come, when you can trust the birds are going to sing in the morning like I trust that but that trust I have to trust that this is part of that and this is pretty far out right now but this is where I'm at. I have to trust that this process of learning and of being, like I'm part of that nature. My students are part of that nature I have to trust that it's going to come out. It's trusting the process. It's funny I was saying that to the kids all last week but I was really saying it to myself. (planning conversation, May 29)

Lily had ownership over the process now, she could see the whole picture, how relationships, context, and trust fit in as a student of math and a teacher of math. The frustration that can evolve from lack of trust had dissipated now. The experience had allowed Lily to recognize the importance of being authentic to who she was and in the intentional decisions she made to make the learning genuine and balanced.

Balance

Lily was looking for balance. She liked order and she felt tension when order appeared to be lacking. At the beginning of the classroom observations it was difficult for Lily to see the flow, to see the big picture at times. In fact, at times, the flow did not feel there at all. The emergence of Lily's pedagogical curiosity occurred when she recognized the workbook had a sense of order but it lacked pedagogy that had flow. At times she felt that it dragged on and that the students were ready to move on before the book did. Really she was ready to try something new, to take that risk after a few of our meaningful and collaborative conversations. The support I offered included a safety net and that was what she needed to take the leap. The safety net discussed in Chapter 2 (page 31) was a vital part in allowing her to persevere and grow in such a short period of time. With support she was able to see that the steps along the way, including the

activities that used multiple modes, as part of the path she needed to take to help her students take ownership over their learning and to succeed. Balance could be achieved. Her students had a wide variety of needs, strengths and weaknesses. Engaging them and developing the learning objective through various activities, appealing to all the senses already appealed to her as a learner and a teacher. As time progressed she felt more at ease making these decisions while teaching mathematics. Although she still struggled, she felt more confident and comfortable along the way. Lily recognized her own transformation as the product of hard work. Striving for balance included improving her pedagogy and continuing to transform her teaching and, simultaneously, her math identity. She had spoken about using her creativity, her spontaneity and intentionality for her planning and looking for balance.

As she was experiencing the eight weeks, being genuine and authentic in her quest to make math meaningful for her students weighed heavily on Lily. She knew she wanted to cause learning through her activities, not just say this is how it is through transmission teaching or by direct instruction. Lily knows teaching isn't black and white. She referred to yin and yang, even in the white part there is black and in the black part there is white. Lily described:

> Yin and Yang is this interplay. So if I'm teaching in a yin way it's quiet, it's private, they're working on their own independent work. It's closed, it's more introverted, more contemplative. It's slower, it's softer like I can feel when we're in that zone but when we're here it's more noisy. These are all the yang qualities . . . so this is the balance that I seek . . . and then I was looking at a yin experience: there would be more cooperation. I would be circulating, giving, connecting, . . . it would be non-linear . . . Yang would be more competition, more concentration, more about goalsetting . . . performance based. It's like "wow this is OK this is the balance I seek". (planning conversation, May 29)

Lily strived for balance. Part of this balance included her desire to honour contributions but also keep her learners on task. This balance is still one she struggles with. She saw the importance of noticing and using ideas to move the learning forward on the trajectory but she wanted to find a balance where all ideas had a place. In the end she needed to find a way to do this in other ways as to not derail her trajectory. Lily respected her students, but at the same time, she wanted them to respect that they may need to learn a process and be open to other ways of learning and doing math in a meaningful way. She recognized the importance of balance in her activities and including multiple modes to include all learners and all of the multiple intelligences. The fact that math came alive for certain students when they were given the opportunity to use manipulatives as part of their process or that they could connect to the relevance of the math through the real life examples provided was a valuable recognition. Lily recognized that they were hungry for it and their feelings of success were long overdue. The worksheet process didn't do that. Her individual students and their needs remained untouched by the worksheets.

The balance Lily looked for was intentional and driven by her intuition. When she felt a lesson lacked the structure she provided structure, when the opportunity arose to be creative she embraced it, when students needed support she provided it. Lily was taking ownership over her teaching and planning. By leaving the worksheets behind she felt more autonomous. Lily connected with her students and her desire to cause learning but she had to ensure she had the content mastered. These pieces echo back to my discussion in Chapter 2 of the importance of individuals having autonomy, mastery, and purpose (page 39) to motivate them to grow and transform. Lily empowered her students by making them part of the learning process, by using their ideas and thoughts to spur her next moves, to educe. Lily could look back and see the whole experience and she reflected on how impactful it was; she could now see and feel the

flow. The liveliness of the class was evident, their connection to math had increased, and some were expressing loving math, including some she thought never would or even could love math.

Lily's desire to plan her next math topics using realistic and authentic pieces was again, indicative of the hard work she had done to get to a place where she recognized the balance she desired in teaching mathematics had to include these. There was no longer the need to have the worksheets photocopied "just in case". She saw the "aha" moments of her students in this experience and it made her want those situations to be fostered and facilitated by her teaching in their future even more. This balance still included vital practice and number tricks built upon the students understanding the math behind them. Even when the openness of some of the realistic and authentic tasks seemed like too much she helped them to persevere.

There were times when Lily wanted to go back to the predictability of the worksheets, to protect herself from the searing vulnerability she felt, but the connections she was making using a balanced approach to teaching along the way and the positive effects that her change in pedagogy had in her math identity and her students was undeniable. It was worth the initial pain, tension, and discomfort. Lily had lived through a productive struggle in her growth as a teacher. This was a productive struggle she wanted to emulate in many ways so her students too could experience the positive effects of increased confidence on their math identities. The importance of fostering perseverance in math and providing the safe balanced setting for them to do so was a great gift that she has given her students. Lily always had her students monitor and modify. This fit in so well many times over this experience and led to perseverance. Being able to trust the humanness and see that her students were now hungry for math and were innately curious about math has allowed Lily to continue to take risks and trust the process, to trust herself to reach a balance that she will continue to monitor and modify.

Efficacy

Lily's sense of efficacy was constantly revisited throughout the narrative inquiry. She wanted to improve her efficacy. Efficacy is the extent to which teachers feel confident they are capable of bringing about learning outcomes (Protheroe, 2008). Efficacy includes the notion that a teacher of math can learn to persist even when unsuccessful in that moment as a teacher. Lily was part of unsuccessful situations that provided her with the opportunity to learn to persist.

Part of causing learning is being able to notice how students' action can be part of the path to causing learning. Lily felt apprehensive when it came to recognizing her student's work as belonging on this path. She recognized that she had gaps that made her uncomfortable when she tried to move away from the paper pencil worksheet type math, it felt too risky, too chaotic. Her sense of efficacy was in need of improvement. The ability to notice in mathematics does come with having the knowledge to see how her student's current product would take them to the place she wanted them to go next. Part of noticing comes with experience. The confidence of knowing that next time a student does something similar she would already know what to do with their work, prompts that would help move their learning forward and make them an active part of their learning.

We had to start somewhere and part of improving her sense of efficacy was the types of activities chosen to cause learning. Part of this plan was seeing the end result and recognizing that she could still have a plan, she still could have order. The activities were picked intentionally to cause learning and from this Lily would start to feel flow and balance. During the first four weeks of classroom observations Lily felt like she was navigating through uncharted territory that caused her discomfort and even stress. She felt her gaps in knowledge played into a lack of confidence in the success of her activities. This lack of confidence weighed

heavily on her, that feeling of perceived chaos as she looked at the different directions students were taking with their work felt scary. Lily had a lower level of efficacy at this time. However, her desire to help support them and to help them make meaning out of their choices was a priority for Lily. She wanted to empower and encourage her students and she felt dissatisfied with herself when she lost patience with their seemingly inefficient work. She recognized her love for math and subsequently her desire to cause learning in a positive and meaningful way. Lily knew this meant being pedagogically courageous. Knowing that she was at the beginning of her teaching career some of these new ideas that she was trying seemed risky and that order, and workbooks made her feel safe and more comfortable. She needed to find a balance where she could use effective pedagogy that includes a constructivist approach but where she could also feel confident in her plan and her vision for how the learning will occur. She will always be navigating the difference between curriculum as planned and curriculum as experienced.

Lily's past experience with planning had included her "bank statements", as a former instructor used to call them. She had charts and lists that were meant to create a plan that equaled success and learning for her students. As a student in year 5 one of her portfolio reflections regarding her planning process was:

> Okay, I've stepped the heck out of this. Now for the reflection. Here's what I'm learning about myself. I over-plan, but I also am learning to let things go. I'm not teaching SLO's and strands. I'm teaching humans. And humans don't fit into 4 by 4 squares with rows and columns and codes. Still, I think that the planning process is very necessary. It gives me a sense of professional control in the classroom. It's like the bottom of the iceberg. If I'm well planned, I'm able to engage with, guide, and interact with my human

> students in the moment. I'm not worrying about what we're going to do today or how it connects to curriculum or the needs of the class, because I've already done that. That work is done. Now my focus and my work is folding that curriculum into a diverse classroom community. (Portfolio excerpt Lily 2014)

There was comfort and safety in these lists and charts. She even described them as a prescription. She was meticulous and perfectionistic which led to a feeling of control. However, she found that this really was not part of the reality of teaching on a daily basis. She turned to other sources for her planning, sources that helped her feel safe.

When we first met Lily felt a particular workbook worked for her and that she wanted to rely on that workbook. The workbook and the lessons within provided structure, it felt safe and not messy, comfortable. As time passed she could see that its structure lacked authenticity, it felt lifeless. She recalled times when her students were not saying anything during the worksheet driven lessons and she was trying to make them be alive. She felt that the blood, sweat, and tears of being a human, the smiles and joy were lacking. The opportunity to grapple and persevere was missing from these lessons for both teacher and students. The humanness seemed suppressed. Much of this was only truly recognized after she experienced a different type of experience, a different kind of planning.

Lily had talked about the importance of having a trajectory. Her planning process needed to include mapping out the trajectory, there were still steps, and these steps helped students get to a particular desired end point. This planning process included a theme (Ameis, 2016), with an introductory activity that piqued their interest. Next came a series of activities meant to expose students to learning experiences that helped them use their own ideas and thoughts to move their learning forward including a constructivist approach. These activities included multiple modes

to include all learners and to expose them to various methods and modes for interacting with the math involved. Lily did not feel like she had to re-invent the wheel; she was able to pull from various sources to plan and develop her activities. She felt like she was an active participant in the planning and simultaneously this improved her sense of efficacy. Making the decision to try these different activities felt tense and uncomfortable, but the rewards were big. Students were more engaged, they were asking to do math, they were even saying they loved math. Math was becoming more meaningful to her students through the various activities she had employed that allowed them to be more active in their learning. The work they had done gave them the opportunity to think creatively and critically. The math connected with her students and they understood the math. The importance of making math meaningful for learners was discussed in Chapter 2 (page 50) and it came alive here in Lily's classroom. Lily truly was able to educe and cause learning. This type of planning and teaching was exhausting at times; the importance of making intentional decisions to support her students' achievements and ideas was heightened. She now saw the importance of noticing her students' work and comments during small group discussion and using them to move her lesson in the direction she wanted based on her trajectory. This important step of listening and noticing, of giving students ownership over the ideas that led down her already mapped out path, gave the activities a natural feel and flow that allowed students to be an active part of the learning process while keeping to her target.

Lily needed to be active in the planning. She realized that the process involved in the lesson was important but equally important was the content and where she were headed, as she described: what is the point? These were two very vital parts of Lily's new planning. She was able to trust the process of developing activities that had the students active in the construction of their learning. When she relied on the workbook math she did not find herself worried about the

planning, the trajectory or what came next because it felt mapped out for her and her students. The difference now was Lily understood that looking for the progression of things and being a part of that planning process and thinking process was a vital part of teaching. The importance of posing intentional questions to start students thinking in a certain direction was vital as was her questioning techniques which she discovered along the way. She was planting certain ideas intentionally with her activities, her questions, the answers she prompted to be shared, all of this was part of the trajectory. This meant Lily had to ensure that the connections were made along the way, which sometimes made her go back and highlight some of the important pieces but it seemed natural and genuine. She described it as just happening, connections were made by students and she noticed and used them to move their learning forward and in the direction she had mapped out for them. Recognizing all the intentional decisions she made along the way, there was a purpose.

This new planning process was reflective of Lily's vision of herself as a competent and confident teacher. Lily recognized the messiness of this new planning process that included activities with multiple modes. By embracing this messiness she felt more true to who she was. Equally important who her students were and how she wanted to get them there, to that end point, it felt like she was on a roll. This planning and enacting in the classroom was truer to her vision than her bank statements, it fit for her, now having this trajectory felt safer. She even recognized the process as being holistic. When planning for division she expressed wanting to replicate the process we used for multiplication, even though she remembered that it started out uncomfortable she now felt she was ready to navigate this because she now trusted the process and trusted herself. Lily even recognized that her use of the word "replicate" still showed her desire for a formula, a recipe even though she recognized the openness of this process. When

she felt she had a trajectory she felt secure but also flexible and confident, like a true professional. Her sense of efficacy was improving, she felt confident in herself as a teacher of math.

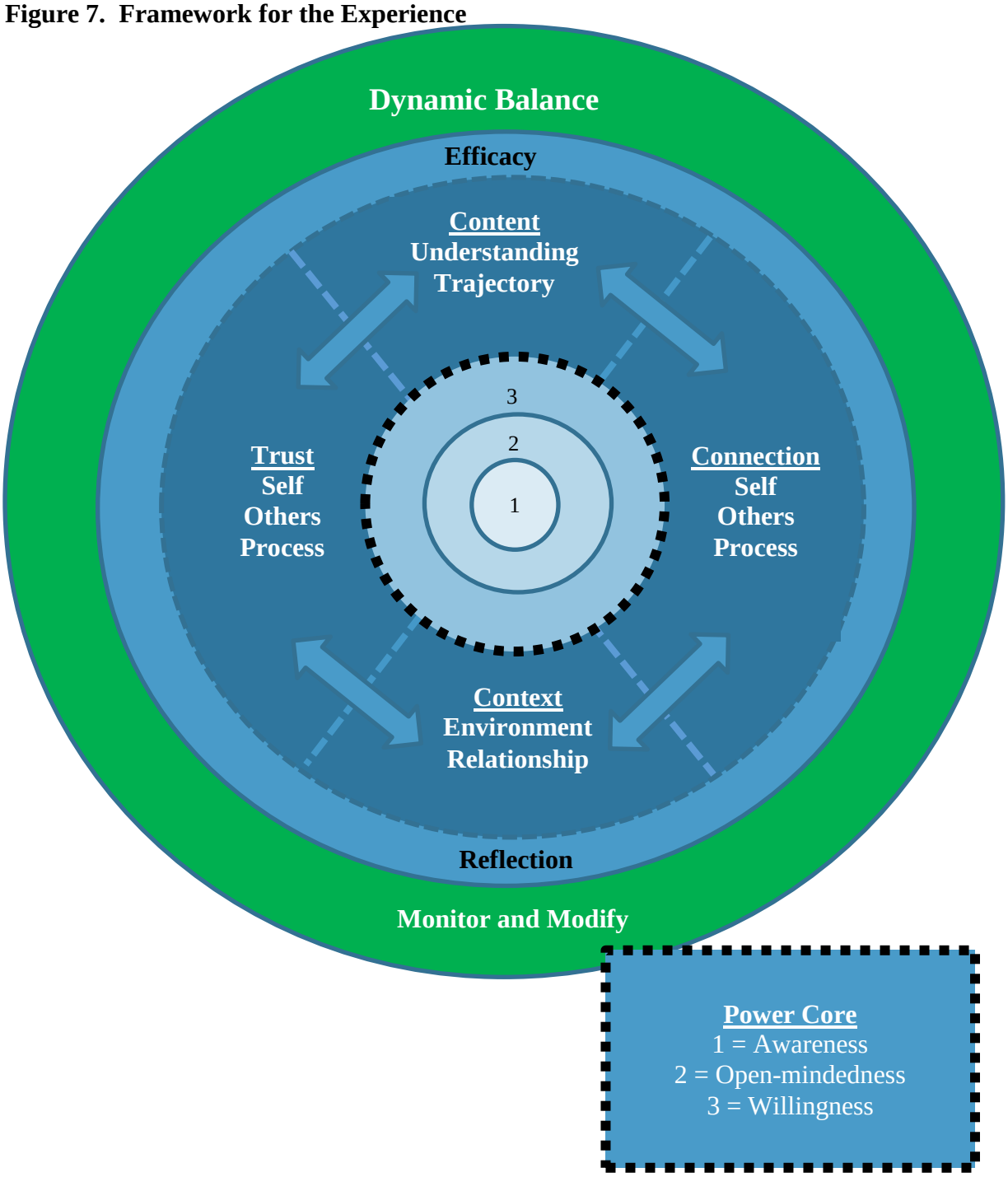
Reflective Work

The reflective work Lily and I did was a vital part to the discovery of the major themes of her journey. There were three valuable types of reflections that helped to interpret and make meaning from this experience. The construction occurred through spoken reflection, written reflection, and visual representation that were reflective of the work being done. The reflective work uncovered the transformation that was taking place, the commitment to growth, and the improvement of her sense of efficacy and math identity. The experience was dynamic and reflective of the human experience. The decisions made along the way and the choice to be hopeful emerged as a factor. Lily and I finalized the visual model of the experience and Lily put the final touches and created the visual in figure 7. Lily and I had many rough drafts (see Appendix IV and Appendix V) for the visual that would fit the experiences and help visually explain the themes that emerged and their relation to each other. The importance of the visual being dynamic and representative of the growth and learning that took place was vital. It was a process that we both grappled with and one that we had to trust would emerge as we came to the end of our journey together. Lily emphasized the importance of being aware of dissonance and then being open to try something new and willing to actually execute it. This was the starting point and will continue to be a starting point. The content, context, connection and trust emerged throughout the study as factors that contributed to her growth. Lily needed to understand the content in order to create a trajectory. The context provided her with a coach to help her to continue to grow and move her learning forward in a space that she felt comfortable to take risks

knowing she could reflect afterwards. The connection and trust she needed to feel to herself, to others, and to the process were all major parts of her improved math identity and sense of efficacy. Throughout this dynamic journey we were reflecting and monitoring and modifying as needed.

The model represents a part of the process and I shared it here to provide an illustrative example. The process of making the model was part of the journey, it does not represent the whole journey. The model does provide an illustration of how the interpretation of Lily's story as lived was part of the collaborative narrative inquiry and co-constructed. The model making was accompanied by coaching conversations, interim text authoring, and discussions. The model was also important to Lily and me as one part of the many layers that were part of her growth and transformation.

Figure 7. Framework for the Experience



Chapter 6 – Addressing the Research Puzzle

The time that I spent with Lily interpreting and writing about our lived experiences has afforded me the opportunity to craft a story that needed to be told. This was a story that drew from the data and that respected the importance of representing Lily's point of view and her reflections. I was living alongside of Lily as she journeyed towards creating a more positive math identity, as she grew as a math educator and became more aware of her mathematical identity thus empowering her. The relationship we had was meaningful and a vital part of her transformation. Her individual story is important and it allowed me to attend to my research questions.

The intention of my narrative inquiry was to study a teacher's experiences with math, her growth, transformation, and goals. My research puzzle using narrative inquiry surrounded the questions: what factors influence a teacher's motivation to grow and to make math meaningful to their students? What factors influence a teacher to commit to lifelong learning in math? My hope was that by narratively inquiring into these lived experiences that others would be motivated to grow as math teachers, to provide support to others, and to share their stories with others.

The Factors that Influence a Teacher's Motivation to Grow

The factors that influence a teacher's motivation to grow begin with a desire to improve efficacy. It includes the willingness to remain hopeful and make the choices necessary to move forward and grow as a math teacher. The importance of feeling confident, comfortable and competent while teaching math weighs heavily. The recognition that, as a teacher, the gaps in school math can be filled and feeling connected to the content will improve the way the math

classroom feels and how the teacher feels. A motivating factor was the desire to be a part of the planning process to ensure that the individual needs of each student were met and that it was part of a trajectory to cause learning in mathematics. The classroom climate needs to be a place where students are comfortable taking risks, using multiple modes, solving problems, and discovering. This classroom climate cannot occur without a willingness to take risks in teaching to cause learning. When confidence in school mathematics is lacking a workbook can seemingly provide all that one might need to ensure that all topics are covered in an efficient and step by step manner that any learner could succeed. The topics are covered but there is no discovery involved, the wondering, grappling, true problem solving, and processing is not there. The recognition of this does need to come first in order to be motivated to breathe life back into the math classroom.

The recognition that improvement is necessary comes along with cognitive dissonance. The feeling of disequilibrium is a factor and the choice to truly feel, and listen and decide to make a change. Some may choose to ignore the feeling of disequilibrium that comes along with teaching, ignore the cognitive dissonance but this results in complacency and lack of growth. The choice to take action, grow, and evolve is vital. It is not enough to just take a risk. There often needs to be a safety net to truly allow the teacher to take the steps necessary to be pedagogically courageous. The safety net, in the form of a coach, was an important factor in motivating growth. The relationship allowed there to be collaborative and reflective work done after the risk was taken. The reflective work came in the form of verbal, written, and visual efforts. The reflective work was uncomfortable at times. The feeling of vulnerability was not a welcome feeling. However, to persevere through that feeling a teacher needs a trusted coach to provide guidance. With the coach's participation, the teacher can engage in discussing the great

thinking that took place by the students that otherwise might go unnoticed due to a preoccupation with feelings of doubt. The coach needs to be a part of the teacher's classroom world to experience the cognitive dissonance first hand. The relationship with this coach needs to be one of trust and openness. The coach cannot be reporting to anyone but the teacher. Without the support that was provided in the context of the study teachers may quit earlier and not make the major strides that would occur with the focused involvement of a coach.

Other factors that made the growth possible included openness to a growth mindset in mathematics and a keen desire to teach math in a way that matches teaching beliefs. The factor that most influenced the desire to grow was the teacher's willingness to improve their math identity and to recognize that it can be improved.

The Factors that Influence a Teacher's Motivation to Make Math Meaningful to Their Students

The factors that influence a teacher's motivation to make math meaningful to their students begins with a recognition that more can be done to make connections with their students and math. A balance in math activities that includes multiple modes can create a feeling of equilibrium and can make math more accessible to the variety of learners that reside in a classroom. This desire to cause learning and to give students ownership and empowerment over their work is a factor that has a great influence over a teacher's motivation to make math meaningful. Empowerment from a coach for a teacher and empowerment from the teacher to her students are both important pieces to making math meaningful. Knowing that students can succeed in a classroom that makes math feel authentic (and still leave room for practice and automaticity) is a motivating factor to teach in a more pedagogically courageous way. When that moment occurs that it is clear that the math is more meaningful to the students due to the

decisions made by the teacher this too influences future decisions to teach and plan in a way that elicits improved math identities in the students.

Lifelong Learning in Mathematics

Lifelong learning in mathematics starts with a foundation that includes a trusting relationship in which one feels safe trying new ideas, tailoring your math activities to the responses given by your students, meeting the individuals in the classroom where they are and using multiple modes to reach them. The feeling of success from being involved in this intimate professional development then inspires the desire to continue on this path and to continue improving their math identity. Knowing that a teacher can cause learning and feeling that success with the support of a trusted coach present makes the teacher want to continue on this path, trust in their efficacy, their intuition and to continue growing and improving their pedagogy and knowledge of school math. Feeling both the disequilibrium and equilibrium, the dissonance and the resonance and to feel the difference helps to commit to a new way of planning and teaching math through experience. Seeing the results in the classroom that the needs of their students are being met; the students understand, connect with the material, think beyond the math presented, ask pertinent questions, and volunteer thoughtful answers all the while improving their math identity. The feeling of success with their students and hearing students express loving math when they never have, and have struggled wholeheartedly throughout their education in mathematics, is the greatest motivation to continue committing to lifelong learning in math as a teacher. This commitment includes optimism that improvements can and need to be made year after year. There is a recognition that math needs to be accessible and connected to all students and that, as a teacher of math, this can happen.

The many factors that are involved in this study of a teacher's experiences with math, her growth, transformation, and goals do connect heavily with the themes explored as an interpretation of Lily's story. There needs to be a trusting relationship with a coach to motivate a teacher to grow and make math meaningful for her students. Through this trusting relationship the desire to improve efficacy, to feel more confident and competent with the content of math, to improve the planning process including the importance of a trajectory, to teach with a growth mindset, to teach in a way that matches their beliefs for causing learning, and to improve their math identity can be accomplished. Knowing that success in all these areas, through risk taking and feeling vulnerable, can happen increases the commitment to lifelong learning in math. Just knowing it can happen will allow the teacher to continue on this path after the coach is gone.

Chapter 7 – Implications for the Future

I am glad that I went on this journey. The opportunity to experience Lily's lived experience as it transpired was meaningful and genuine. It was affirming for me to see a constructivist classroom in mathematics emerge through our conversations and her actions as a reflective teacher and facilitator. This affirmation does not happen in my day job as an instructor of preservice teachers, the setting for experimenting with activities and lessons is contrived and not reflective of the daily struggles and classroom management issues that are a part of an Early Years classroom. My hope was that by narratively inquiring into these lived experiences that other teachers would be motivated to grow as math teachers, to provide support to other teachers, and to share their stories with others. I believe this hope has come to fruition. I believe that this experience Lily was a part of and her feelings of increased efficacy as a result would motivate others to engage in a relationship with a trusted coach to improve their math identity. I know that Lily will continue on this path as she becomes a more experienced teacher. She has expressed that she would like to converse with others about math in the way that we did. I strongly believe that this journey improved Lily's math identity and sense of efficacy. I also believe that the incredible intimacy I developed to construct this narrative and the meaning I have drawn from it and shared will have some significant impact. This impact could potentially improve teacher education, classroom practice (specifically for beginning teachers), teacher learning journey (including an evolving math identity) and in the preparation of teacher education scholars.

Teacher Education

As a teacher educator I believe in the importance of modeling the teaching practice that I am instructing them to use as a future teacher. The importance of using multiple modes to reach

my students was always part of my planning process. The fact that I choose to teach this way is one of the comments that appears most often on my student evaluations. My students recognize and appreciate my commitment to teaching in a way that engages and empowers them. My narrative inquiry has infiltrated my thinking about preservice teaching. The success of this study and growth that Lily experienced encourages me to continue to emphasize the importance of efficacy and fostering confidence and competence in mathematics. The importance of developing preservice teacher's awareness of their math identity and the fluidness of it was abundantly clear in this study. Time must be spent tending to preservice teachers math identities. As teacher educators gain the trust of their students they will be more likely to be pedagogically courageous and take a risk when they feel comfortable in the climate the teacher educator has established. They can then hopefully replicate this feeling of safety in the future with their own students. Knowing what worked in this study will allow me to speak to the importance of relationships, trust, balance, and efficacy. Part of the preservice teachers' education needs to include the importance of a growth mindset and its necessity in improving the teacher's sense of efficacy. There needs to be a focus on trajectory and the importance of being involved in the planning in order to feel confident and competent as a future teacher. The trust that preservice teachers have in themselves will help them feel like taking a risk and reflecting in a meaningful way on the experience. Encouraging some type of reflective work as part of preservice classes will help them to continue being a reflective practitioner. The reflective pieces can be carried out in various ways, verbally, written, and visually to foster the importance in their future as teachers.

Classroom Practice

Classroom teachers, especially beginning teachers, need to be involved actively in making decisions to improve their efficacy. This means making choices to improve their school math knowledge and their pedagogy. Traditional ways of teaching mathematics are not sufficient enough. The importance of including intentionality, creativity, and spontaneity as part of their planning that keeps classroom teachers on their trajectory should be emphasized in their professional development. The idea that the students need to be active during well-orchestrated activities in order to be part of the learning process should be a part of classroom practice. Students should be actively involved in posing questions and providing responses, the responses should be used to move the lesson forward giving students ownership. The importance of becoming proficient at noticing what students are doing and using their ideas is vital. The selection of contributions and the order of contributions plays a huge role. Activities, questioning techniques and prompts need to be expertly used to ensure that the students feel involved and empowered. This takes time to master but it is well worth the effort as a teacher of math. Realizing that perseverance as a teacher is just as important as it is for the students is vital. Teachers should be actively talking to students about what it means to persevere and to take a risk to move their learning forward. There will be moments of tension but making reflection a part of the daily process will help work through some of the issues. If a coach or mentor can be involved in the reflective work and part of the experience then the classroom practice can improve even faster.

Teacher Learning Journey

This journey will help others on their own teacher learning journey transform their math identity, take ownership, increase confidence and increase awareness surrounding the choices

they make as math teachers. The opportunity to be coached in the classroom should be a part of all beginning teachers learning journey. The relationship formed provides a safety net to take a risk and grow as an educator. Taking the time to reflect on what was learned about teaching math that day, whether it is verbal, written or visual and collaborating with an experienced coach who has gained the trust of the teacher is vital to the teacher learning journey. The sharing of the experience also needs to be shared with others so that many teachers will want to be a part of a similar experience. After the journey with the coach and improved efficacy has occurred the teacher could take the role of a coach or a collaborator in small groups to discuss the importance of planning with a trajectory and the teacher's confidence in their math pedagogy and knowledge of school math.

Preparation of Teacher Education Scholars

Preparing teacher education scholars needs to include opportunities to read stories that include the lived experiences of teachers as they transform and evolve. The story told in this narrative inquiry allows people to hear about the pieces including my interpretation that made up the experience of a teacher coming to equilibrium and trusting in herself. It is a story of her increased efficacy and the positive effect it had on her math identity. The reading of Lily's story may inspire others to delve into similar narrative inquiries to learn more about the experiences that lead to growth and reflective teaching. Taking a closer look at what it feels like to be part of an experience that changes how a teacher thinks, acts and feels about teaching mathematics is important to education faculties. The importance of telling the lived experience of people through narrative inquiry is a valuable way of interpreting and drawing conclusions based on story. Narrative inquiry is like no other research. I was an integral part of the experience and without it I would never have had the opportunity to truly feel connected to the data.

Hopefully there will be others who inquire narratively into the lived experiences of teachers to really get a close look at what it means to be an effective teacher of math and how the transformation of a math identity can be fostered.

Appendix I. Questions for conversations

Sample questions for the four types of conversations

i. First conversation - surrounds her story as a student of math

What motivated you to do math?

How did you feel about learning math?

What made math meaningful to you?

ii. Second conversation - the story surrounding her time as a math learner in teacher education

What were your goals as a preservice teacher surrounding teaching mathematics?

What motivated you to engage in mathematics?

What made math meaningful to you as a preservice teacher?

iii. Reflective conversation after the classroom visits

Did you learn anything about teaching mathematics today?

Would you have done anything differently?

What were some of your reactions and why do you think they happened?

Do you feel more confident about your lesson and teaching mathematics?

Did your lesson make meaningful connections? What influenced you to make these meaningful connections?

If you reflect back on some of the decisions you made, pedagogical choices included, are you satisfied with them?

What motivated you to teach the way you did today?

What do you think we could focus on in the coming weeks?

iv. Interim research discussions

What did you think of paragraph 1? 2?...

Does the interim research text match your feelings and vision of the experience?

Do you have examples to share that could help make the text more meaningful and reflective of your lived experience?

Does the text reflect your vision of your math identity and feelings of transformation?

What factors influenced your motivation to grow and make math meaningful to your students?

Appendix II. Observation Guide

Observation Guide for Classroom Observations of the Teacher

Instructional moves	
Pedagogic decisions	
Use of mathematical explanations and elaborations	
The strategies for sponsoring visualization	
Use of contextualized examples	
Examples of questioning techniques	
Instructional Management	

Appendix III. Interim Text 3

Interim text after four weeks of observation

When I sit and reflect on our shared experiences and conversations and try to interpret meaning I am filled with so many thoughts. Really you have laid the groundwork for having a classroom where you cause learning. Your students love you and they feel safe in your class and they know you love them back and you truly enjoy teaching them and challenging them. They share their answers and thoughts easily, this is an environment that could foster a problem-solving climate, and a constructivist math class could reside here. You often tell your students that they should take a risk and now you are following your own advice and taking a risk. I believe you need the same things that your students need to feel comfortable taking risks, an environment built on trust, a relationship that you feel safe in that provides support and includes collaboration so you can make some decisions that cause learning. A place to wonder safely about how to cause learning in math. I read a quote the other day about what a coach can do "A coach brings her presence, deep listening skills, powerful questions, and relevant tools and resources to support the individuals and challenge them to clarify and realize their goals." (Magnusson & Hopkins, 2011). You do believe that with support you will transform your teaching, the importance of trusting me is part of this belief.

You are looking for balance, you still like order and you feel tension when order appears to be lacking. It is difficult for you to see the flow, to see the big picture at times. In fact the flow does not feel there at all at times. However, in mathematics the workbook you used provided step by step instructions but you felt unsure if that amounted to pedagogy that had flow. At times you felt that it dragged on and that the students were ready to move on before the book did. Really you were ready to try something new, to take that risk after a few of our meaningful and collaborative conversations and the support I offered that included a safety net that was what you needed to take the leap. With support you have been able to see that the steps along the way, the activities that use multiple modes, are part of the path you need to take to help your students take ownership over their learning and to succeed. Balance can be achieved. Your students have a wide variety of needs, strengths and weaknesses, engaging them and developing the learning objective through various activities, appealing to all the senses already appeals to you as a learner and a teacher. The next step is how to get to a place where you feel at ease making these decisions while teaching mathematics and to feel confident and comfortable along the way. This, as you have recognized, will not happen overnight but you still see the value in improving your pedagogy and continuing to transform your teaching and simultaneously your math identity.

Part of causing learning is being able to notice how what they are doing can be part of the path to causing learning. You feel apprehensive when it comes to recognizing their work as belonging on this path. You recognize that you have gaps that make you uncomfortable when you try to move away from the paper pencil worksheet type math, it feels too risky, too chaotic. The ability to notice in mathematics does come with having the knowledge to see how their current product takes them to the place you want them to go next. Part of noticing comes

with experience and knowing that next time when a student does this bit you will already know what to do with their work, prompts that will help move their learning forward. Right now you feel like you are navigating through uncharted territory that causes you discomfort and even stress. The gaps in knowledge that you feel you have are playing into a lack in confidence of the success of your activity. This weighs heavy on you, that feeling of what you perceive as chaos as you look at the different directions students take their work feels scary. Your desire to help support them and to help them make meaning out of their choices is a priority for you. You want to empower and encourage your students and you feel dissatisfied with yourself if you lose patience with their seemingly inefficient work. You recognize your love for math and your desire to cause learning in a positive and meaningful way. Knowing that you are at the beginning of your teaching career some of these new ideas that you are trying seem risky and that order, safety and comfort are what you desire. This brings us back to finding a balance where you can use effective pedagogy that includes a constructivist approach but where you can also feel confident in your plan, your vision for how the learning will occur. You will always be navigating the difference between curriculum as planned and curriculum as experienced. We have to start somewhere and part of this balance is the types of activities chosen to cause learning. Part of this plan is seeing the end result and recognizing that you still have a plan, you still can have order, the activities are picked intentionally to cause learning and from this you will start to feel flow and balance.

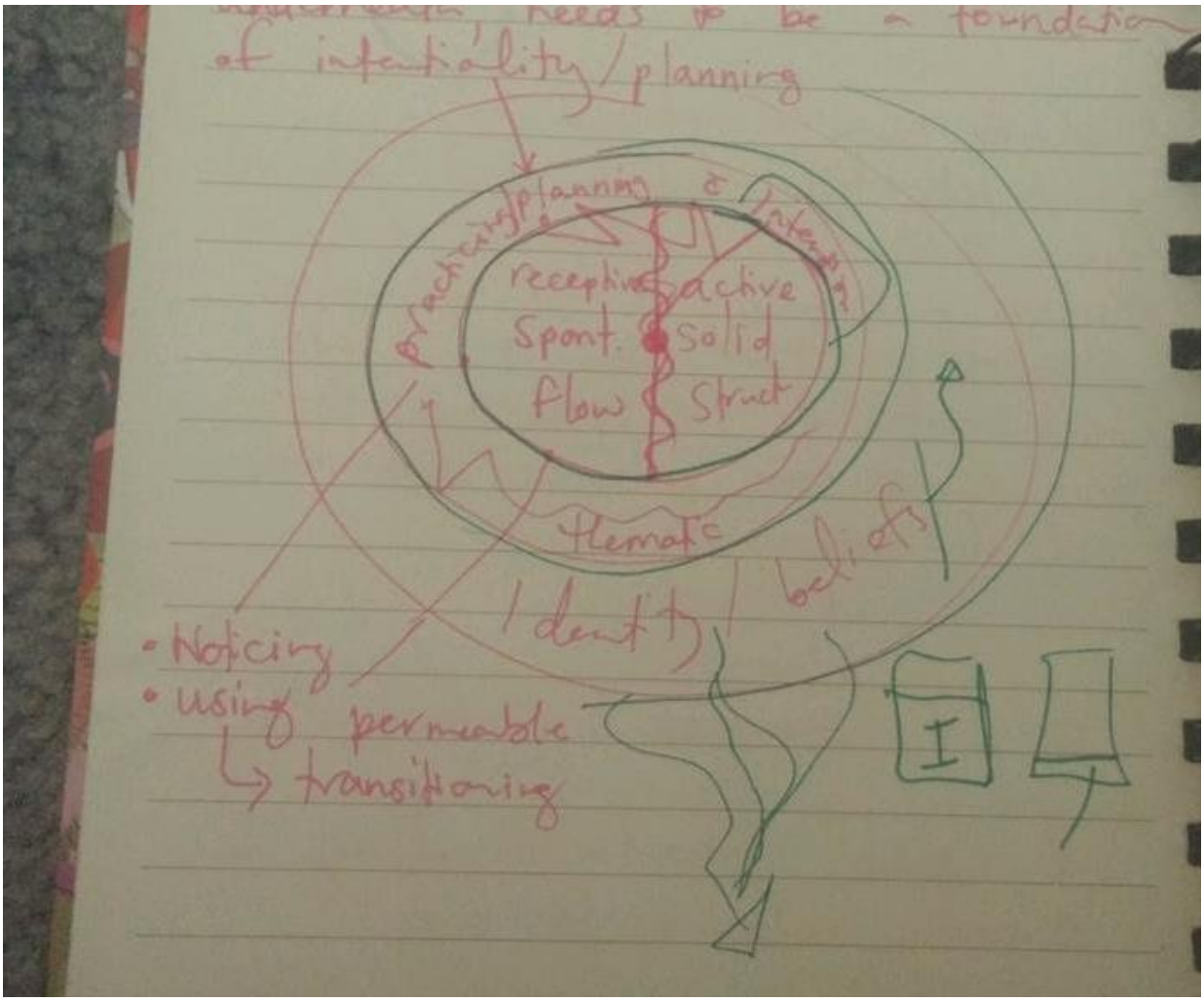
You have spoken about using your creativity, your spontaneity and intentionality for your planning and looking for a balance. You have recognized that context enhances learning but that it also adds complexity. Let's think about your goals and whether what you have heard here matches your feelings surrounding your lived experience. How do you feel about your evolving math identity? This journey will help others in their own journey to transform their math identity to take ownership, increase confidence and increase awareness surrounding the choices they make as math teachers.

Words to ponder and wonder about along our journey and through our shared experiences
Possible prompt: pick one that makes you feel comfortable about our journey so far.

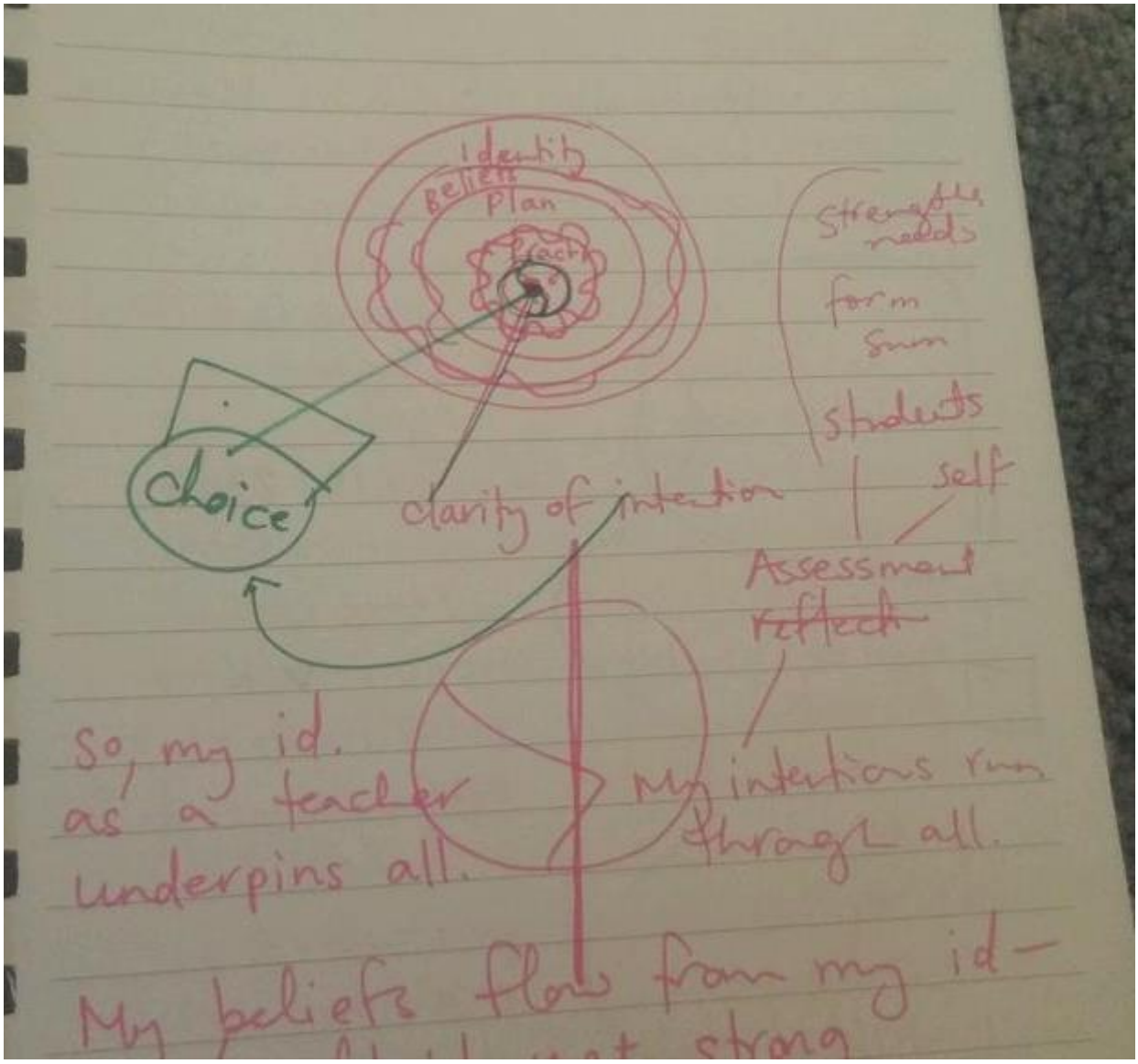
Balance	gaps
planning	risk
trust	relationships
order	safe
creativity	intentionality
comfortable	flow
tension	spontaneity

Appendix IV. Lily's Rough Drawings to Visually Represent her Experience

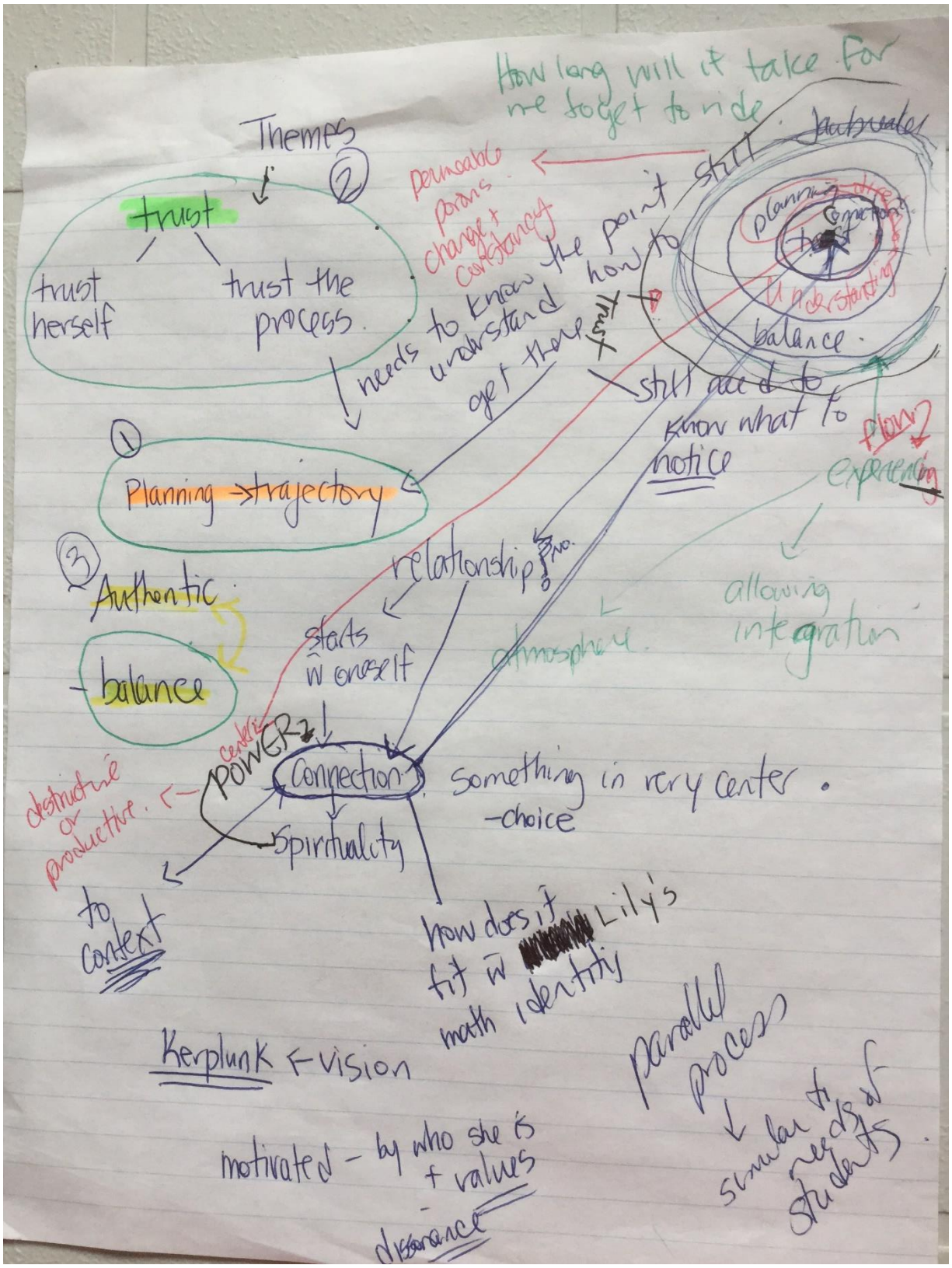
Drawing 1



Drawing 2


Identity
Beliefs
Plan
Teach
Choice
clarity of intention
Strengths
needs
form
Sum
students
self
Assessment
reflect
So, my id.
as a teacher
underpins all.
My intentions run
through all.
My beliefs flow from my id-

Appendix V. Co-constructed Visual Made During our Discussion of Interim Text 4



Appendix VI. Approval Certificate

UNIVERSITY OF MANITOBA | Research Ethics and Compliance
Office of the Vice-President (Research and International)

Human Ethics
208-194 Dafoe Road
Winnipeg, MB
Canada R3T 2N2
Phone +204-474-7122
Fax +204-269-7173

APPROVAL CERTIFICATE

March 11, 2016

TO: **Rhonda Hawthorne** **(Supervisor: Ralph Mason)**
Principal Investigator

FROM: **Zana Lutfiyya, Chair**
Education/Nursing Research Ethics Board (ENREB)

Re: **Protocol #E2016:011 (HS19362)**
"A teacher's journey to transform her math identity"

Please be advised that your above-referenced protocol has received human ethics approval by the **Education/Nursing Research Ethics Board**, which is organized and operates according to the Tri-Council Policy Statement (2). **This approval is valid for one year only and will expire on March 11, 2017**.

Any significant changes of the protocol and/or informed consent form should be reported to the Human Ethics Secretariat in advance of implementation of such changes.

Please note:

- **If you have funds pending human ethics approval, please mail/e-mail/fax (261-0325) a copy of this Approval (identifying the related UM Project Number) to the Research Grants Officer in ORS in order to initiate fund setup. (How to find your UM Project Number: http://umanitoba.ca/research/ors/mrt-faq.html#pr0)**

- **if you have received multi-year funding for this research, responsibility lies with you to apply for and obtain Renewal Approval at the expiry of the initial one-year approval; otherwise the account will be locked.**

The Research Quality Management Office may request to review research documentation from this project to demonstrate compliance with this approved protocol and the University of Manitoba *Ethics of Research Involving Humans*.

The Research Ethics Board requests a final report for your study (available at: http://umanitoba.ca/research/orec/ethics/human_ethics_REB_forms_guidelines.html**) in order to be in compliance with Tri-Council Guidelines.**

Appendix VII. Information and Consent Form for Use of Teacher Participant Data

UNIVERSITY OF MANITOBA | Faculty of Education

230 Education Building
University of Manitoba
Winnipeg, Manitoba
Canada R3T 2N2
Telephone (204) 474-9014
Fax (204) 474-7550

Information and Consent Form for Use of Teacher Participant Data

Research Project Title: A Teacher's Journey to Transform her Math Identity

Principal Investigator and contact information: Rhonda Hawthorne

Research Supervisor and contact information: Dr. Ralph Mason, Professor, University of Manitoba

This consent form, a copy of which will be left with you for your records and reference, is only part of the process of informed consent. It should give you the basic idea of what the research is about and what your participation will involve. If you would like more detail about something mentioned here, or information not included here, you should feel free to ask. Please take the time to read this carefully and to understand any accompanying information.

My name is Rhonda Hawthorne. In addition to being a teacher educator at the University of Winnipeg, I am also a Master's student at the University of Manitoba. As part of my Master's Thesis, I am conducting a research project on a teacher's experiences with math, her growth, transformation, and goals. The study is titled "A Teacher's Journey to Transform her Math Identity". My research puzzle using narrative inquiry will surround the questions: what factors influence a teacher's motivation to grow and to make math meaningful to her students? What factors influence a teacher to commit to lifelong learning in math? My hope is that by narratively inquiring into these lived experiences that others will be motivated to grow as math teachers, provide support to others, and share their stories with others.

There will be three phases to my study. The three phases will be: early conversations about your relationship with mathematics, classroom visits followed by conversations, and the sharing and co-composing of interim research texts. My study will take place over 10 weeks where I would meet with you three times before entering your classroom to discuss two retrospective pieces to your story. The first conversation would surround your story as a student of math, the second conversation would be the story surrounding your time as a math learner in teacher education, and the third conversation would be to discuss and share an interim research text. Then I would visit your classroom over eight weeks, one to two times a week. Each visit will include a classroom observation and time for a reflective conversation once a week. We would reflect on the class together as you describe it. I would provide support, using questions to help you to reflect deeply and support you to state goals and plan to enact them. Then I will prompt you to reflect on whether you felt you had learned anything about math today or teaching math. We would discuss your motivation, your math identity, and your growth as a teacher. To conclude the reflective conversation, we would discuss the next steps. In a way you will be participating in an individualized professional development that will provide you with the opportunity to reflect on both your ongoing and past math classes, in regards to your confidence, pedagogy, math identity, and efficacy. The topics will be based on your needs and your reflections.

While in the classroom activity phase of data collection, my field texts (data) will consist of field notes, transcripts of conversations (recordings will be made of parts of the conversations), and journal writing. My field notes will include observations you as the teacher including your instructional moves, pedagogic decisions, use of mathematical explanations and elaborations, strategies for sponsoring visualization, use of contextualized examples, examples of questioning techniques, and instructional management. The transcripts of the conversations will contain lively conversation that will show your learning, growth, evolving math identity, future goals, and my support. I plan to create a journal where I will reflect on the experiences, field notes taken, and conversations in a way that is meaningful to me. It is my belief that this journal will help me think through some of my observations, make connections, and develop the experiences to reflect the relational nature of my field notes and our conversations. A journal will also be kept by you to help you reflect on your experiences, growth and future goals.

The time commitment for the study is approximately 16.5 – 22 hours. Phase 1 would involve conversations between you and I about your experiences as a student and teacher of math (approximate time commitment 2 hours), phase 2 would be classroom observation (approximate time commitment depends on the length of time per math class, if the classes are 40 minute long, with one or two observations per week between 5 hours, 20 minutes and 10 hours, 40 minutes), follow-up conversations that will occur after the observations and reflecting in a journal about your experiences (approximate time commitment 6 hours), and phase 3 would include reflecting in a journal about your experiences and an opportunity to co-compose interim text (approximate time commitment 3 hours). The total time commitment would be between 16.5 and 22 hours.

I will write an interpretation based on the experiences and field texts. The drafting and co-composing of interim research texts will allow me to continue to engage in relational ways with you. I will take the time to share the interim research text with you as a partial text that will be open to allow an opportunity for us to co-compose the text. We will participate in the interpersonal relational act of sharing interim text to negotiate shared understanding. You would have an opportunity to respond to the interim research text with my interpreting to ensure that what emerged reflected your lived experiences. My interim research texts will include narrative accounts of the experience as it relates to my research puzzle. I will be looking to discover the factors that motivated you to grow, to make math more meaningful for your students, and the factors that made you commit to lifelong learning in mathematics. There is minimal risk to the research project. Minimal risk is defined as the risks that might be encountered in day to day life.

Confidentiality will be ensured by using a pseudonym for you, your school, your school division, and other identifying factors will be omitted in all dissemination of the research. All data will be stored on my computer with password protection or my iPad with touch ID and password protection. Audio recordings will be made of our conversations using an app on my iPad, the app and iPad require touch ID or a password. The conversations will be transcribed from my iPad to my password protected computer, the file with the transcribed conversations will also be password protected. I will completely erase the data from my iPad as soon as the data is transcribed and stored on my computer. The data will be with me at all times as I travel from your school to my home. At home the data will be stored in a locked filing cabinet. Only I will have access to the locked data. I may be sharing anonymized data with my Faculty Advisor Dr. Ralph Mason. Only I will have access to the raw data, my advisor would see the data with the pseudonyms. All data will be destroyed five years after the research has been completed, August 2021.

Your decision to take part in this study is voluntary. You may refuse to participate or you may withdraw from the study at any time. You may also indicate to me that I leave out certain parts of our conversations as data source. There will be no negative consequences. Your principal will be aware of the study and your participation as the observations take place in your school.

The results of this study are to be used within the context of my Master's thesis. There are likely to be presentations, lectures, and publications for preservice teacher audiences and teacher audiences after the thesis is completed. I will provide you with a completed copy of the thesis study in September 2016.

Your signature on this form indicates that you have understood to your satisfaction the information regarding participation in the research project and agree to participate as a subject. In no way does this waive your legal rights nor release the researchers, sponsors, or involved institutions from their legal and professional responsibilities. You are free to withdraw from the study at any time, and /or refrain from answering any questions you prefer to omit, without prejudice or consequence. Your continued participation should be as informed as your initial consent, so you should feel free to ask for clarification or new information throughout your participation.
The University of Manitoba may look at your research records to see that the research is being done in a safe and proper way.
This research has been approved by the Education/Nursing Research Ethics Board. If you have any concerns or complaints about this project you may contact any of the above-named persons or the Human Ethics Coordinator at 204-474-7122 or by email at humanethics@umanitoba.ca. A copy of this consent form has been given to you to keep for your records and reference.

Participant's Signature _____ Date _____

Researcher's Signature _____ Date _____

Appendix VIII. Information Form for the Principal

UNIVERSITY OF MANITOBA | Faculty of Education

230 Education Building
University of Manitoba
Winnipeg, Manitoba
Canada R3T 2N2
Telephone (204) 474-9014
Fax (204) 474-7550

Research Project Title: A Teacher's Journey to Transform her Math Identity

Principal Investigator and contact information: Rhonda Hawthorne

Research Supervisor and contact information: Dr. Ralph Mason, Professor, University of Manitoba,

Dear Principal,

My name is Rhonda Hawthorne. In addition to being a teacher educator at the University of Winnipeg, I am also a Master's student at the University of Manitoba. As part of my Master's Thesis, I am conducting a research project on a teacher's experiences with math, her growth, transformation, and goals. The study is titled "A Teacher's Journey to Transform her Math Identity". My research puzzle using narrative inquiry will surround the questions: what factors influence a teacher's motivation to grow and to make math meaningful to their students? What factors influence a teacher to commit to lifelong learning in math? My hope is that by narratively inquiring into these lived experiences that others will be motivated to grow as math teachers, provide support to others, and share their stories with others.

This research has been approved by the Education/Nursing Research Ethics Board. If you have any concerns or complaints about this project you may contact any of the above-named persons or the Human Ethics Coordinator at 204-474-7122 or by email at humanethics@umanitoba.ca. I am requesting your permission to conduct the study with a teacher in your school as the participant. A copy of her consent form will be attached to this letter. I will contact you at a mutually convenient time to go over the details of my study and to address any questions or concerns you may have.

Thank you for your support.

Rhonda Hawthorne

Appendix IX. Research Support Form (Superintendent)

Research Project Title: A Teacher's Journey to Transform her Math Identity

Principal Investigator and contact information: Rhonda Hawthorne

Research Supervisor and contact information: Dr. Ralph Mason, Professor, University of Manitoba

Dear Superintendent,

My name is Rhonda Hawthorne. In addition to being a teacher educator at the University of Winnipeg, I am also a Master's student at the University of Manitoba. As part of my Master's Thesis, I am conducting a research project on a teacher's experiences with math, her growth, transformation, and goals. The study is titled "A Teacher's Journey to Transform her Math Identity". My research puzzle using narrative inquiry will surround the questions: what factors influence a teacher's motivation to grow and to make math meaningful to their students? What factors influence a teacher to commit to lifelong learning in math? My hope is that by narratively inquiring into these lived experiences that others will be motivated to grow as math teachers, provide support to others, and share their stories with others.

There will be three phases to my study. The three phases will be: early conversations about her relationship with mathematics, classroom visits followed by conversations, and the sharing and co-composing of interim research texts. The data will consist of field notes, transcripts of conversations (recordings will be made of parts of the conversations), and journal writing. My field notes will include observations of the teacher including her instructional moves, pedagogic decisions, use of mathematical explanations and elaborations, strategies for sponsoring visualization, use of contextualized examples, examples of questioning techniques, and instructional management. The transcripts of the conversations will contain lively conversation that will show her learning, growth, evolving math identity, future goals, and my support.

Confidentiality will be ensured by using a pseudonym for the participant, the school, the school division, and other identifying factors will be omitted in all dissemination of the research. All data will be stored on my computer with password protection or my iPad with touch ID and password protection. I may be sharing anonymized data with my Faculty Advisor Dr. Ralph Mason. Only I will have access to the raw data. All data will be destroyed five years after the research has been completed, August, 2021.

I am requesting your permission to conduct the study with a teacher in your school division as the participant and to observe her teaching in her classroom. A copy of her consent form will be attached to this letter. I will contact you at a mutually convenient time to go over the details of my study and to address any questions or concerns you may have.

The results of this study are to be used within the context of my Master's thesis. There are likely to be presentations, lectures, and publications for preservice teacher audiences and teacher audiences after the thesis is completed. I will provide you with a completed copy of the thesis study in September 2016.

Your signature on this form indicates that you have understood to your satisfaction the information regarding participation in the research project and agree to the study occurring in your school division with one of your teachers. In no way does this waive your legal rights nor release the researchers, sponsors, or involved institutions from their legal and professional responsibilities. You are free to

withdraw from the study at any time. Your continued participation should be as informed as your initial consent, so you should feel free to ask for clarification or new information throughout your participation. The University of Manitoba may look at your research records to see that the research is being done in a safe and proper way.
This research has been approved by the Education/Nursing Research Ethics Board. If you have any concerns or complaints about this project you may contact any of the above-named persons or the Human Ethics Coordinator at (204) 474-7122 or by email at humanethics@umanitoba.ca. A copy of this consent form has been given to you to keep for your records and reference.

Superintendent's Signature _____Date _____

Researcher's Signature _____ Date _____

Thank you for your support. As soon as I receive your support I will proceed with fulfilling any requirements or obligations your school division has.

Rhonda Hawthorne

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