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Changing Students' Attitudes Towards Learning Through Learning Instruction on Metacognition
and Growth-Mindset Intelligence

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Abstract

Teaching students how to be successful learners is an important part of a teachers' set of skills to use in the classroom. There are many documented methods on how to do this, but few have recorded the experience of the teacher and the attitudes of the students as the teacher goes about teaching their students different methods of learning and views on intelligence. This project explored the experiences and changes in attitudes of students as they go through the course of the fall semester in a high school geometry class, as well as the experiences of the teacher. Data was collected on students' attitudes and experiences through a series of two self-reported surveys. The teacher's experiences on both interactions with students, and impacts of the project on teaching were recorded in a reflective journal. The results of the data gathered were then analyzed which showed some small gains in the percent of students who gave aligned responses that reflected a growth mindset. Additional findings are also discussed used to make recommendations for future teaching.

Chapter One

Introduction

“Students are more likely to want to learn when they appreciate the value of classroom activities and when they believe they will succeed if they apply reasonable effort” (Brophy, 1987, p. 40). This quotation guides the daily efforts of educators across the country, including myself. This statement is my ultimate goal in the classroom. I want my students to be able to see the value in what they are learning, and be able to apply themselves, and make the effort necessary to become better learners. The difficult task at hand for me, and many other teachers, is how do we as teachers help our students to achieve that goal? This is something that I have been interested in since I began teaching. How do I help my students become the best possible learner they can be? While there are many possible answers to that question, my answer, and method of achieving that goal proposed for this action research project, is based in expectancy-value and goal orientation theory.

Expectancy-value theory suggests that students who are successful will perceive themselves as able to succeed, and will value the success that they have (Chouinard & Roy, 2008). And there is a large body of literature and research (Dweck, 2009; Dweck, 2010; Jang, 2008; Pajares, 1996; Sungur, 2007) that agree with this theory. The first step for me was teaching my students that it is possible to succeed, and to teach them their brains are already wired for success. Then, not only did I have to teach them about it, but I had to find a way to get them to *experience* some success in learning as well. The way I will attempt to accomplish this task is by teaching students about the growth-mindset of intelligence. This idea puts forth that a person's brain is always changing and is able to be changed. This is a biological indicator that intelligence is not something that a student is inherently born with, as many of them believe

(Dweck, 2010).

Furthermore, goal orientation theory suggests that students who are successful learners will be focused on learning and understanding rather than looking intelligent to their peers (Chouinard & Roy, 2008). The research and literature tells us that one way to teach students to value learning and understanding is to teach them how to be more metacognitive (Costa & Kallick, 2008; Fennema & Romberg, 1999; Garner and Alexander, 1989; Hanley, 1995; Ritchhart & Church, 2010; Sungur, 2007). This is the second step in my method. Spending time teaching students metacognition will help them to develop their ability to learn for true understanding.

Given the theories and literature on why teaching students about successful learning and metacognition, the purpose of this project is twofold. First, to investigate how I can help students to become successful learners and second, to investigate the attitudes of students towards their own learning during the project, so that I can monitor how they are responding to being taught how to learn, and not just being taught content. The project is not about how to teach students in a way that helps them gain higher achievement in a specific content area, but rather, how to teach students to be aware of how they learn, and then to teach them how to apply that awareness.

The project took place at a rural/suburban Midwestern high school in my classroom during the first semester of the 2014-2015 school year. The main body of the project (the actual teaching and learning activities) took place during the fall semester, from September 2, 2014 to January 23, 2014. The participants were the 71 students assigned to my three sections of geometry during the aforementioned school year. These students included a mix of males and females aged 14-18 in grades 9-12.

The project was an action research investigation which addressed the following questions; 1) how do students' attitudes towards learning change over the course of a year of learning instruction, and 2) what are my experiences as the teacher as I go about attempting to instruct students on how to be better learners? The data on students' attitudes was mainly collected through surveys (administered two times during the semester). The survey data was analyzed to see how students' perception of learning and value placed on learning changes throughout the course of the project. The data on my own experiences in teaching students how to learn was collected through a reflective journal. The reflective journal was also used to determine how students' attitudes affected my own teaching experience.

This project allowed me, for the first time, to physically document my students' attitudes and values towards learning as I taught them a few different learning strategies over the course of the semester. This information is invaluable to me as a teacher so that I might improve my practice, and help create students that are successful not just in school, but in life. The point of this project was not to prove that teaching students about how they learn can improve their learning, nor is about trying to meet a lofty, unrealistic goal by saying that I will increase their test scores or grades. Rather, it is to document the experience of what works and what doesn't when it comes to teaching my students about how their brain works and teaching them how to be metacognitive learners. My instruction throughout this project attempted to teach my students that they can be successful despite their preconceived notions of their own abilities. The results of this investigation allowed me to reflect on and make changes to my practice so that future students can also see the value in being learning, and become more efficient learners themselves. Teaching students to learn was not just important to me, but also had countless implications in the field of education in general. If the focus in teachers' classrooms can be on teaching students

how to learn just as much as it is on *what* students need to learn, teachers will have students that are more successful in learning whatever content is put in front of them. This will lead students to become better life-long learners, and help them to be more prepared for whatever they might encounter in their futures whatever they may hold.

Chapter Two

A Review of the Literature

In a recent article he wrote for The Huffington Post, Joel Shatzky (2011), an education writer, suggested the following for why students would want to learn:

I think that students are motivated to learn when they see a clear purpose in learning that gives them either immediate gratification or *hope for future rewards* [emphasis his]. [para. 2]... those who are taught must feel some sense that "hard work pays off" in order for them to want to learn. If they are surrounded with failure, they have little reason to believe that they, too, will not be failures, regardless of their efforts. If they see a realizable goal to their hard work, then they have a greater incentive to work hard. They become self-motivated. (para. 4)

So in today's environment of high stakes testing, evaluations, and massive amounts of new content and standards, how do teachers teach students the value in learning? How do teachers show them that the rewards that they seek aren't always immediate, but can pay dividends in their futures? The key to this is to teach students *how* to learn. The ability to be a lifelong learner is and can be that reward that Shatzky proposes students are looking for. In order to help students become lifelong learners, teachers must help students develop a set of behaviors which can help them navigate the challenges they encounter every day in the classroom and in their lives (Costa & Kallick, 2008). For teachers to understand how to develop these behaviors, they must understand what the traits of a successful learner are. Then, they have to determine what students need to practice in order to develop those traits. Finally, teachers must determine what skills to teach in the classroom in order to develop their students into life-long, effective learners. These three topics will be explored more in depth in this review of relevant literature.

What are the Traits of a Successful Learner?

In order to understand what makes a learner successful, the traits that define what a successful learner is must be explored. The traits a successful learner has can be broken down into three main areas, although each area could consist of many subtopics. A successful learner practices metacognition, is motivated, and has a high level of self-efficacy (Costa & Kallick, 2008). In the following pages, the research and literature on each of these three traits will be explored more in depth.

Successful learners are metacognitive. Metacognition in its most basic form is defined as thinking about one's thinking. Successful learners not only think about the content they are learning, but also the process by which they are learning it. In their book, Art Costa and Bena Kallick point to metacognition as one of their "16 essential characteristics for success." They say that metacognition "is our ability to know what we know, and what we don't know" (Costa & Kallick, 2008, p. 24). Costa and Kallick believe this to be so important they list it as an essential characteristic of successful *people*, and does not limit its potential to simply students. This sends a clear message that being metacognitive is not only important for school aged children, but for the success of a person's entire life.

However, there is a large body of research and literature relating metacognition not only to successful life-long learning, but also to a student's academic success (Costa & Kallick, 2008; Garner & Alexander, 1989; Hanley, 1995; Ritchhart & Church, 2011; Sungur, 2007). In an article they wrote in 1989, Garner and Alexander pointed out that metacognition is something that develops with age and experience, but even adults "seldom complete tasks by stopping periodically to enquire of ourselves, "Am I understanding this" (Garner & Alexander, 1989, p. 145)? Costa and Kallick also share this view; they say that, in general, people are not always

aware of *how* they are actually accomplishing the task of learning. One reason they propose to explain our lack of awareness is that people don't often reflect enough on their experiences. People will rarely, after completing learning task, reflect back on what strategies they used to accomplish the task, or how efficiently they did it (Costa & Kallick, 2008). In order to become used to reflecting back on their learning, people must first be taught how to do it, and be taught about which strategies they might employ. Garner and Alexander have said that the research shows metacognitive strategies are sometimes acquired without direct instruction, but more often than not, they can *only* be acquired with direct instruction (Garner & Alexander, 1989).

Sungur (2007) also explained what it means to be metacognitive. He points out that there are two types of tasks that can occur during learning. They are cognitive tasks, which could be strategies such as reading a text, note taking, or creating a graphic organizer. Then there are the metacognitive tasks, which are used for "planning and monitoring one's learning" (Sungur, 2007, p. 316). Being metacognitive is even more than a planning session for learning; it is also being aware of which metacognitive strategies are suitable across academic disciplines and learning tasks. Ritchhart and Church (2010) talk about metacognition in this way as well. In fact, in their book *Making Thinking Visible*, they point to Australian educational psychologist J.B. Biggs, who said that "students have to be realistically aware of their own cognitive resources in relation to task demands, and then to plan, monitor, and control those resources" (as cited in Ritchhart & Church, 2010, p. 15). The literature gives a clear definition of what metacognition is, and indicates that it does have an effect on students learning, but what influences students' use of metacognitive strategies? The literature indicates there are many factors involved, but one of the most influential is the student's motivation to learn.

Successful learners are motivated. Chouinard and Roy (2008) explain that there are

several educational theories that may help to explain student motivation. Expectancy-value theories say that a student's level of engagement and achievement are best predicted by that students' perceived ability to succeed, and the value they place on that success. It follows then, that students who believe that they can succeed, and value succeeding in their learning will have the highest levels of engagement and achievement, and potentially be the most successful learners. Goal theory suggests that there are two general goal orientations a student could have. They are a performance goal orientation, and a mastery goal orientation. Students who have a performance goal orientation value tend to value demonstrating competence to others, while students with a mastery goal-orientation place a high value on learning and understanding (Chouinard & Roy, 2008). These two educational theories (expectancy-value and goal) suggest that a successful learner has a perceived ability to succeed, and values success, as well as having a mastery goal orientation. So by teaching my students these skills and values I hope to help them become successful learners both in school, and in their lives.

There have been numerous research studies on how a student's level of motivation is linked to their achievement. Sungur (2007) hypothesized that students' use of metacognitive strategies was linked to their motivational beliefs. In his research, he used a path model to determine the relationship between metacognitive strategy use, motivational beliefs and effort regulation. The results of the study revealed that metacognitive strategy use could have a potential positive effect on students' learning and achievement, but that would only happen if students were motivated enough to persist through any challenges or distractions they might encounter (Sungur, 2007). His results also showed that highly motivated students who focused on learning for the sake of learning, and viewed the course content to be useful and interesting, were much more likely to use metacognitive strategies to help in their mastery of the content.

The results of Jang's (2008) research suggest that student motivation can be greatly influenced by the perceived value of the task which they are trying to accomplish. He also investigated whether giving students some type of rationale for completing the task would help them to become more motivated to complete it. He found that when provided with a rationale for the task, students had an increased level of motivation, and therefore were more likely to learn during a task which they may have originally viewed as boring or unimportant (Jang, 2008).

Garner and Alexander (1989) also proposed that motivation was an important part of students' learning, specifically as it related to them employing different learning strategies. They point out that unless someone actually *wants* to accomplish what is being asked of them, they will be less likely to use different learning strategies. This research agrees with the article written by Shatzky (2011). Garner and Alexander suggest that one reason students try limited approaches to a task is because they might be motivated more by the completion of the task than their performance on or effectiveness in completing the task. If this is the case, then students will be very motivated to get the task done, but have little or no interest in what they actually were asked to learn. It is clear from the literature that both high levels of motivation and use of metacognitive strategies are traits that successful learners have, but is there a factor that influences both of these things? The literature suggests that a student's self-efficacy can have an effect on a student's motivation, and thus, also affect their use of metacognitive strategies.

Successful learners have a high sense of self-efficacy. Self-efficacy is most easily described as a person's faith in their own abilities. There has been extensive research on positive correlations between a student's self-efficacy beliefs, and their academic achievement (Pajares, 1996). Martinez-Pons, Zimmerman, and Bandura (1992) establish that self-efficacy plays an

even greater role in learning than simply knowing a repertoire of learning strategies. They specifically stated that they found “knowledge of learning strategies does not ensure their effective and consistent use” (Martinez-Pons, et al. 1992, p. 674). In fact, they go on to say that “Students who perceived themselves as capable of regulating their own activities strategically are more confident about mastering academic subjects and attain higher academic achievement” (Martinez-Pons, et al. 1992, p. 674). In other words, students could know numerous learning strategies, and how to use them, but if they do not believe in their own abilities, they will be less likely to think about using them, and fail to reach their full potential.

Semra Sungur (2007) hypothesized that self-efficacy beliefs for learning and performance were related to metacognitive strategy use. During his study of 291 high school students he found, using a path model, that a student's level of self-efficacy was linked to their use of metacognitive strategies and to their level of motivation. His results also suggested that students who are self-efficacious in their learning approached difficult tasks as challenges, not as obstacles which they could not overcome and should stay away from. Furthermore, his results found that students' belief about their control over their learning was a predictor of a student's level of self-efficacy. These results strengthen the idea that students will not be successful and effective learners if they do not *believe* that they can be effective and successful learners.

Carol Dweck (2010) wrote an article for Educational Leadership in which she outlined two different types of intelligence mindsets. The fixed intelligence mindset is the belief that a person's capacity for intelligence is a trait they receive at birth, and that it has a fixed amount that cannot be changed. Students who have a fixed intelligence mindset often value looking smart over all else, often at the expense of an important learning opportunity (Dweck, 2010). These students are ones that will often not take a risk to learn, or take an opportunity to learn

from mistakes. On the other hand, a growth intelligence mindset is one in which a person views their intelligence as ever-changing and limitless. They will meet challenges in their learning head on with enthusiasm and will not hesitate to take risks or make mistakes in order to gain learning experiences. Students with this mindset would view failures as one step close to the solution and are likely to have a much higher belief in their own abilities (Dweck, 2009). Students who learn in a classroom culture of a growth intelligence mindset will have a much stronger belief in themselves, and thus a high level of self-efficacy.

The research and literature are quite clear that a successful learner is metacognitive, motivated, and has a high level of self-efficacy. It is also clear that motivation, self-efficacy, and metacognition are all closely related to one another. In order for a student to efficiently and effectively employ metacognition, they must be a motivated learner. In order to be a motivated learner, the student must have a high level of self-efficacy, and believe that successful learning is within their abilities. The question then is how do teachers and students become metacognitive, motivated learners with a high level of efficacy? In the next sections, the literature and research on how teachers can explicitly create this kind of environment, and what students explicitly have to do will be explored.

What do Students Need to do to Become Successful Learners?

In order for a student to become a successful learner they must employ a variety of learning strategies and be aware of which strategies are appropriate for a given task. Simsek and Balaban (2010) studied a group of 278 undergraduate college students, who were both high and low achieving students, to see whether they used different learning strategies. They also investigated to what extent their preferences were related to their level of achievement. What they found was that the use of learning strategies had a significant and positive correlation to

students' level of achievement. The more and better strategies a student employed, the higher their level of achievement. Furthermore, they found that while the more successful students did employ many types of learning strategies, they did not all employ them all equally or prefer the same types for a given task (Simsek & Balaban, 2010). This seems to suggest that students who keep a wide variety of learning tools at their disposal, and know which learning tools work best for them, tend to be the most successful learners. How do students then choose which tools are best for the job? The answer lies in practicing metacognition.

Students must practice metacognition. Gerard Hanley (1995) gives the following advice on how students can become successful learners through metacognition. He stated "To become better critical thinkers, students must develop expert thinking skills, and become experts at choosing the best skills for a particular situation" (Hanley, 1995, p. 68). In his advice he is touching on two important parts of learning. He asserts that students must not only develop a variety of cognitive tools, but more importantly, they must be aware of how and when they can deploy them, which is metacognition. It is easy to see that one without the other will not produce a successful learner.

Thomas Carpenter, University of Wisconsin Madison Curriculum and Instruction Professor also lists reflection on learning (metacognition) as a key to students being successful learners in a math classroom. He says that reflection plays an important role in solving unfamiliar problems. In those cases, students can't just apply a set of procedures, they need to identify the relationship between what they already know, and the problem at hand. Students then have to choose what exactly it is from their background knowledge that will help with the specific task (Fennema & Romberg, 1999). While it is known that students have to be reflective and practice metacognition frequently in order to hone their skill, the literature proposes that

their motivation and self-efficacy also play a large role in their success.

Students need self-efficacy and intrinsic motivation. The literature reveals that students must be motivated to learn successfully, and that to be motivated they need to have a strong belief in their abilities. Some of this can be taught by the teacher, but a lot of student's motivation has to come from within. The literature suggests that there are a few ways students can motivate themselves. One of those ways is that they are intrinsically motivated. Students who see value in a task, or are interested in the subject they are learning will experience a higher level of motivation (Jang, 2008). Another way students can be motivated is by some extrinsic factor such as a reward, although this was found to not lead to students who learn as successful as those students who are intrinsically motivated (Jang 2008).

Students with a high self-efficacy are also most likely to be successful learners. These students will usually have a growth-mindset in terms of their intelligence (Dweck, 2010). They view difficult problems as challenges which they must meet head on, and view failures as just another step towards the correct solution. Students also will tend to value the process of solving a problem over how smart they look while doing it. Students with a high level of self-efficacy are OK with taking academic risks because they believe it will result in a learning experience. Having a high level of self-efficacy is probably one of the most difficult things for a student to have, yet it is one of the most important pieces in becoming a successful, motivated, metacognitive learner. In the next section of this review, the literature and research on what teachers can explicitly do in their classrooms to teach students to be metacognitive, motivated, and have a high level of self-efficacy will be explored.

How Can Teachers Develop Students that are Successful Learners?

An increasingly large body of literature and research points out that a teacher needs to be able to develop students' knowledge about how to learn in addition to teaching them content area material (Hanley, 1995; Nordell, 2009; Schofield, 2012). The evidence and results of this research points to the explicit instruction of cognitive strategies, and metacognitive strategies for regulation (Askill-Williams, Lawson, & Skrzypiec, 2012). In order to be able to explicitly teach students how to learn successfully a teacher must foster an environment of learning in their classrooms. They must explicitly teach students about metacognition and metacognitive strategies and routines, as well as communicate clear content and behavior objectives. Finally, teachers must be able to reflect on and make changes to their instruction.

Foster an environment for learning. Before students can be successful learners, the teacher must develop a classroom environment where challenge, effort, and learning from mistakes is the norm. Carol Dweck (2010) points out that one way this can be done is to teach students about the growth-mindset view of intelligence. One way teachers might do this is by having a workshop to teach about the brain works, giving special attention to the fact that the brain makes new connections every time they overcome a learning challenge. It is important to point out that those connections are what will increase students' own intellectual abilities over time (Dweck, 2010). She also points out that praising students' effort over praising their intelligence is one way to promote a growth mindset. She also mentions that this will help students to focus on performance on a task as opposed to task completion. When students truly value their performance on a learning task, they become true and successful learners (Dweck, 2010). Finally, she points out that, in order to foster an environment for learning, students need to know that the process by which they learn is more important than the end-product.

The Common Core standards for mathematical practice are a group of standards that

foster this process over product mindset. They give students a set of process objectives that they should be able to do, which would allow them to take on any mathematical challenge. Topics that are emphasized by these process standards include making sense of problems and persevering in solving them, constructing viable arguments and critiquing the arguments of others, and using appropriate tools strategically (Common Core State Standards Initiative, 2010). It is easily seen how having students practice these can lead them to mastering any mathematical content. The process standards also address topics from the literature that can be applied across disciplines. If the process standards are emphasized in the classroom by making them a part of the content instruction, then essentially, teachers are emphasizing the process over the product, which will help foster an environment for learning. In addition to creating and keeping their classrooms as an environment for learning, teachers must teach their students a variety of metacognitive routines, and in which situations to deploy them.

Explicitly teach metacognitive routines and strategies. The research and literature implies that building the amount of learning and metacognitive strategies a student has at their disposal, and teaching how to use the appropriate strategies for a given task are key to creating a successful learner (Askill-Williams, Lawson, & Skrzypiec, 2012; Nordell, 2009; Schofield, 2012). Shawn Nordell (2009) examined how explicitly teaching students learning and metacognitive strategies would affect their level of achievement. During a one day workshop, he had students first self-assess their learning techniques, and then taught them about how to monitor their learning, and assess their knowledge. He also explicitly taught the students learning strategies that they might employ such as active reading, note taking techniques, and study skills. His results show that the students who attended the workshop showed significantly higher achievement over the course of the semester than students who did not attend the

workshop.

In another study, Linda Schofield (2012) observed what exactly teachers were doing in their classrooms to foster and teach metacognitive skills. She found, through her observations that the teachers who were the best at fostering metacognition had “highly structured activities, explicit goals of improving performance and scaffolding understanding through thoughtful questioning and clarifying all appeared to motivate the students to practice” (Schofield, 2012, p. 58). She also observed modeling metacognition was another way for teachers to help their students to be metacognitive. Overall, in classrooms where she observed the aforementioned practices happening, students experienced a significant positive affect on their achievement. Askill-Williams, Lawson, and Skrzypiec (2012) found similar results in their study of how teaching strategies for cognitive elaboration and metacognitive regulation effected students awareness of them. They found that when strategies were explicitly taught and modeled, students were more aware of different strategies available, and were more likely to use them. In the next section, using and communicating learning objectives will be explored as a means to have students practice cognitive and metacognitive strategies.

Communicate clear content and learning behavior objectives. Debora Reed (2012) said “when students are aware of the connection between an activity and the lesson objective, this awareness can guide their work and support their learning” (Reed, 2012, p. 22). It follows from this that if objectives are made about the content of a lesson, than students will use that awareness to help guide and support the learning of that content. Other research and literature supports the idea that clearly communicating objectives to students can help them to become more successful in their learning. Phillips and Phillips (2010) pointed out that learning objectives are critical to measuring learning because they communicate not only the desired

outcome of the learning, but they also can communicate the level of performance needed to complete the learning. It is clear from the literature that setting objectives for students is an essential task to create a successful learner, but what if objectives were communicated about not only content, but what is expected in terms of a student's learning? These objectives would have nothing to do with content, but rather would be all about *how* they are learning.

Conway (2011) explains that the best way to create objectives on how a student learns is to have the students set some of their own learning process objectives. This allows students to shape and define where they are headed, before they evaluate their progress, as well as evaluating the effectiveness of the objective that they created. Whether student or teacher created, there is little research on setting up objectives that define the learning process. However, the research and literature does find that making objectives in general can help a student to learn, and be more aware of what they are learning. In the final section, the literature and research on teachers reflecting on, evaluating, and making changes to their practice will be explored.

Reflect on, evaluate, and make changes to their practice. The Wisconsin state teaching standards state that "Teachers are able to evaluate themselves" as one of the 10 essential standards that every teacher in the state must practice daily (Wisconsin Department of Public Instruction, n.d.). This particular standard requires that a teacher must be reflective, and continually evaluate the effect of their choices on students, parents, and professionals. Artzt and Armour-Thomas (2002) offer the following statement on teacher practice. They said "Reflection, although necessary, is not sufficient for transformative teaching. They (teachers) must be willing to *acknowledge* problems that may be revealed as a result of the reflective process" (Artzt & Armour-Thomas, 2002, p. 7). That is to say that teacher must not simply reflect on their teaching, but also evaluate their practice and make changes to it in order to create

a better learning experience for their students. There are a variety of ways in which teachers can be reflective and evaluative. Artzt and Armour-Thomas point out that teachers' self-assessments could involve pre-lesson thoughts, actual lesson planning, making changes during the course of a lesson, or reflection and change after a lesson is over. No matter the type of reflection, the most important thing to do is to use these reflections to change and drive instruction.

Summary and Synthesis

Overall the research and literature is quite clear on what makes a successful learner. Expectancy-value, and goal orientation theory states that the most successful students will perceive themselves as able to succeed, will value success in learning, and will be focused on learning and understanding rather than how smart they appear in the eyes of their peers (Chouinard & Roy, 2008). The research and literature clearly agrees with the theory by describing that a successful learner is someone who is motivated (values success) (Garner & Alexander, 1989; Jang, 2008; Sungur, 2007) has a high level of self-efficacy (perceived ability to succeed) (Dweck, 2009; Dweck 2010; Jang, 2008; Martinez-Pons, Zimmerman, & Bandura, 1992; Pajares, 1996; Sungur 2007), and is a regular practitioner of metacognition (mastery goal-orientation) (Costa & Kallick, 2008; Garner and Alexander, 1989; Hanley, 1995; Ritchhart & Church, 2011; Sungur, 2007). It is also clear that students must practice metacognition and reflect on their own learning paying close attention to the *process* by which they learn. The research and literature tells us that there are many ways teachers can help students to reflect on that process, and help them to have a higher value of self-efficacy and motivation.

While the majority of research in these areas mostly show self-efficacy, motivation, and metacognition all linked to each other (Jang, 2008; Sungur 2007), and ultimately to higher levels of academic achievement (Sungur, 2007), very few address the journey that students and

teachers take as they set out to learn about how they learn. Documenting that journey and process will be the focus of the action research project guided by the review of this literature.

Chapter Three

Methods

Many research studies in the past have linked self-efficacy, motivation and metacognition to academic success; very few have studied students' attitudes towards their own learning.

Fewer still have documented the teachers' attitudes and experiences while they go about teaching students how to learn. It is the purpose of the following action research project to determine how students' attitudes towards learning can be changed over the course of a semester of instruction on how to learn. This action research sought to discover my experiences and attitude towards teaching students how to learn. The study was conducted over the course of the first semester of the 2014-2015 school year which began on September 2, 2014, and ended on Jan 23, 2015.

During the course of the year students were taught about how they learn, specifically about the growth-mindset vs. set-mindset of intelligence, as well as a variety of metacognitive strategies. During this time I kept a journal reflecting on the process of teaching my students, as well as on my observations of their learning. In addition to my own reflections, students were asked to reflect, through a variety of surveys, on their own learning process. These surveys focused on uncovering students' attitudes on learning in general, their motivations for learning, and their attitudes on metacognition.

The following pages of this chapter contain the details on the methods used in this study. First, I give the context in which the project was completed and share background information on the participants. Then I take a closer look at the questions that guided the project, and the methods used to address each one. Next, the procedures for conducting the project are given along with a detailed timeline along which the project was conducted. Finally, I discuss each instrument used for data collection, and how I analyzed that data gained from those instruments.

Context

This project was conducted at a mid-western community high school in the United States. The school district which contains the high school is a rural/suburban school district which services approximately 5,000 students in kindergarten through twelfth grade. The district contains six elementary schools, one middle school, and the one high school. The high school itself serves over 1,700 students in the ninth through twelfth grades. The district was recently ranked as “exceeds expectations” on its state evaluation, and earned a high enough ranking to be in the top 10 scoring districts in the state. The high school was also recently named to the College Board’s AP Honor Roll.

The school community is populated with approximately 92% white students and 8% minorities consisting of approximately <1% American Indian, 1% Asian, 1% Black, 4% Hispanic, and 1% of students identifying with two or more races. The school community has approximately 15% of students characterized as economically disadvantaged. Of the district’s students, 13% qualify as special needs students. Over 95% of the high school’s students graduate and of those 64% attend college after graduation.

Participants

The participants in this study were the 71 students in my three geometry classes during the fall semester of the 2014-2015 school year. They were all high school students between the ages of fourteen and eighteen and were expected to be in good physical and mental health. See table 3.1 for a breakdown of their gender and special needs status.

Table 3.1
Distribution of Participants by Class, Gender and Special Needs Status

	Females	Males	Special Needs
Class 1	7	16	4
Class 2	9	11	3
Class 3	19	9	4
Total	35	36	11

Questions

There were two main questions that I sought to answer in my action research study. They were: 1) how do students' attitudes towards learning change over the course of a year of learning instruction, and 2) what are my experiences as the teacher as I go about attempting to instruct students on how to be better learners? The purpose of the first question was to investigate my students' knowledge on the learning process, and to identify their attitudes before and after learning instruction takes place. The purpose of the second question was to investigate the process that I went through as the teacher as I instructed my students how to become better aware of how they learn over the course of a semester. Additional questions that were answered here included: 1) what were some successes and failures I experienced during the course of the project, and 2) how did students' reactions to being taught how to learn affect my teaching of math content.

To address the first question on student knowledge of and attitudes towards learning in general, two surveys (see Appendix A) were employed before and after the semester to detect any changes. I also made some casual observations of students in my own journal as they went

through the variety of learning exercises during the semester.

To address the second question on my experiences as the teacher, a reflective journal was used to record thoughts I had on the process of teaching students how to learn. The reflective journal was also used to record any failures or successes, as well as any joys or frustrations I had during the semester. Finally, reflections in my journal on my observations of students provided insight into how the student's reactions to being taught how to learn affected my teaching of the math content in those three geometry classes.

Procedures

The procedure for implementing the research project began on the first day of school, September 2nd, 2014. Students in my geometry classes were given a survey (see Appendix A) which had two purposes. First, the initial survey provided a baseline for students' knowledge about the learning process. Areas that were covered in this survey included the students' knowledge on metacognition, fixed vs. growth mindset of intelligence, as well as their knowledge about how they felt they learned best. The second purpose of the survey was to provide a baseline for students' attitudes towards learning, as well as their level of self-efficacy in regards to school and learning. The development of this survey was intended to address question one of the research study and it was administered two times during the course of the semester. The survey was given on the first day of school, and once more after the students' final exam (see Table 3.2). The survey took students about 15-20 minutes to fill out.

Following the survey, a one day lesson on fixed vs. growth intelligence mindset was taught, as well as a class discussion of what metacognition is, and how it can be helpful in learning. Students were then asked to read and annotate the article "Even geniuses work hard" by Carol Dweck (2010). This was followed by a class discussion of the article and its main

ideas. Following that we had a short discussion about what metacognition is and how that plays into the learning process. During this lesson, I recorded some casual observations on their discussion and work in my journal. I also shared the results of the knowledge section of the previous day's survey with the class. The purpose of sharing these results was to inform the class on which type of intelligence mindset they have. The Reflection on my observations was completed after the lesson to provide data on the second research question which is on my experiences (success or failure) of teaching students how they learn.

Next, students were given a chance to practice a variety of metacognitive routines throughout the course of the class's regular units of math instruction. These routines were introduced in the first unit, and then used in each successive unit as part of my normal instruction. This allowed the routines to become part of students' math instruction, and not seem like something extra they had to do. These routines included a pre unit Think-Puzzle-Explore (Appendix B), and unit reports and reflections (Appendix C). The purpose of these routines was to help students reflect on the process of learning as well as the content they have learned, and to help students recognize how those reflections helped them become a better learner. While these specific activities were repeatedly practiced at the beginning (Think-Puzzle-Explore) and the end (Unit Report) of each unit, students were asked to reflect daily in their own notes on some questions given to them during instruction. These questions were directed towards getting students to really think about what they really did and did not learn, such as asking which topics they thought they understood well, and which they did not feel they understood after completing that lessons homework.

Finally, right after the students took their final examination for the semester (see Table 3.2), I administered the knowledge and attitudes survey a second time. This survey provided the

final pieces of data needed to determine the changes in students' knowledge and attitudes towards learning. I also reflected on my own teaching experiences and included any observations I made on students during the last units of the semester. This reflection, again, covered any successes or failures that I experienced, as well as how I thought teaching about intelligence, metacognition, and metacognitive routines may have affected my students' learning.

Table 3.2 Timeline for Implementation of the Project

Dates	Description
Sept. 2	Trial items on the survey with a few students external to the study to check for comprehension and interpretation
Sept. 2	Analyzed trial survey results and revised survey to improve clarity
Sept. 3 – Jan. 20	Implemented project with classes
Sept. 3	Administered pre- survey.
Sept. 4	Taught intelligence and metacognition lesson
Sept. 5	Think-Puzzle-Explore One
Sept. 18	Unit Report and Reflection One
Sept. 22	Think-Puzzle-Explore Two
Oct. 8	Unit Report and Reflection Two
Oct. 10	Think-Puzzle-Explore Three
Oct. 29	Unit Report and Reflection Three
Nov. 3	Think-Puzzle-Explore Four
Nov. 20	Unit Report and Reflection Four
Dec. 2	Think-Puzzle-Explore Five
Dec. 18	Unit Report and Reflection Five
Dec. 22	Think-Puzzle-Explore Six
Jan. 9	Unit Report and Reflection Six
Jan. 16	Administered Post-Survey
Jan. 19	Analyzed Post-Survey Results.

Instruments for Data Collection

The main instruments used to collect data during the implementation of my project were the survey and a reflective journal. The surveys were used to collect data on my students' knowledge of different areas of learning, as well as their attitudes towards learning in general. The reflective journal was used to collect data primarily on my own experiences during the semester, but also on how my teaching about learning has an effect on my students. The journal was also used to collect data on casual observations of students' knowledge and attitudes toward learning during the semester.

The survey (see Appendix A) included Likert-type items in which students rate their level of agreement to statements as strongly agree, agree, somewhat agree, strongly disagree, disagree, and somewhat disagree. In this case, the statements were about students' knowledge of, and attitudes towards learning. This survey was developed using a framework from a metacognition blog by Frank Noschese (Noschese, 2012). His design provided a framework into which I put questions that I developed on my own, as well as rewording a few of his. The survey I developed based on Noschese's design contains 27 questions which are designed to give insight into my first research question. The survey is designed to do three things. The first questions (1-9, 13) were designed to determine students' attitudes towards learning, their own ability to learn, and their work ethic. The next sets of questions (10-12) were designed to assess students' knowledge of metacognition. Questions 14-19 were designed to assess students' knowledge on growth-mindset intelligence. Questions (20-25) were designed to collect information on how students think they learn best. Finally, two free response questions (26, 27) were given to identify what students thought the purpose of math instruction was, and when they might use it in their current

or future lives.

In addition to the survey, a reflective journal was used to help answer research question two. I not only reflected on my own experiences during the semester, but also made some observations of my students' attitudes towards some of the practices I was integrating into class. The reflective journal is arranged by unit, so there are six total reflections covering each of the units taught during the semester. Each reflection focused on the success or failure of learning activities (metacognitive activities, and growth-mindset lesson) and any observations I made about my students. The observations focused on the effect student attitudes towards learning have on my own teaching of the math content. The main purpose of the reflective journal was to document my journey in teaching students how to learn, as well as documenting any frustrations or successful moments I experience.

The reflective journal focused on two questions that helped answer both research questions. First, the journal was used to make casual observations on what I perceived my students' attitudes were as they go about learning how to learn. Sub-questions that were addressed as indicated by my journal observations include: 1) Are students resistant to learning how to learn, 2) Which activities seem to be successful in getting students to learn and which ones are unsuccessful? 3) Do students seem to be buying into the ideas of a growth-mindset intelligence, and using metacognition? Second, the journal was used to document my experience in teaching students how to learn. Questions that were addressed include 1) does this activity seem worthwhile to teach based on my students reactions to it, and 2) does teaching this activity make teaching the math content easier?

Analysis

The data from the surveys was compiled and analyzed by myself at the end of the fall

semester. Each student's responses were assigned a number 1-6. These numbers corresponded with their answers on the survey with 1= strongly agree and 6 = strongly disagree. Students' answers were then entered into a spreadsheet by question number, and a pivot table was used to obtain the frequency of each answer for each survey question. These frequencies were then divided by the total number of participants who took the survey (pre survey n=71, post survey n=70), even if they did not answer every question, to turn the frequencies into percentages. The survey was analyzed by looking at the percentage to which students agreed (at any level) or disagreed (at any level) with each statement. From there I investigated how the percentages changed for the class as a whole between the pre and post surveys. A survey key was created to show which level of agreement (agree or disagree) aligned with a research aligned response (when applicable). For example, item 18 states "You can greatly change how intelligent you are." In this study, based on research, the research aligned response would be that students agree with that statement. Using the response key, I compared my students' answers to the research aligned ones and looked for any connections or similarities between the two. It is also important to note that not all survey questions had an aligned response. For example, the first set of questions (1-9, 13) were purely to gain insight into the learning habits of my students. In these cases, the data was analyzed by looking for change in percentages between the pre and post surveys.

The free response survey questions were analyzed by using grounded theory for qualitative data analysis (Patten, 2009). This theory involves three parts. First, I read through the answers to the free response questions in order to begin to understand and interpret the information, as well as begin to get a sense of categories and sub-categories that were present. Next, the question responses were coded to reflect the emergent categories. Finally, the

percentage of participants who used each of those emergent categories was determined by taking the frequency of that category and dividing it by the total number of participants on each survey (pre survey n=71, post survey n= 70) whether they answered every question or not. Finally, I developed an overarching category under which the categories and sub-categories found earlier fit. This method helped me to use the survey free response question responses to note any changes that occurred in the categories used for each set of responses on the pre and post survey. Lastly, my own reflective journal was used to reinforce and comment on the information I acquired through the surveys. Interesting connections between the journal and the survey data were noted by highlighting related passages from journal.

Chapter Four

Results and Analysis

The data that was collected from my 71 geometry students gives an interesting look into their minds and their thoughts on their own learning and abilities. The data was analyzed by looking at how students' attitudes towards learning changed over the course of the semester of learning and math instruction. The results of my data collection will be discussed in the following four categories, 1) changes in how students view their own attitudes and abilities, as well as their thoughts on their own work ethic, 2) changes in students' knowledge of metacognition, 3) changes in students' thoughts on the growth mindset view of intelligence, and 4) any changes in how students think they learn best. Other student data to be reported included qualitative data recorded on the students' free-response portion of the survey. This data includes changes in students' answers to the following two questions: What are some examples of where you might have to use math in your future and why do you suppose you have to take a math course just about every year you are in school? Finally, data gained from my own perspectives and experiences will be explored through the use of a reflective journal.

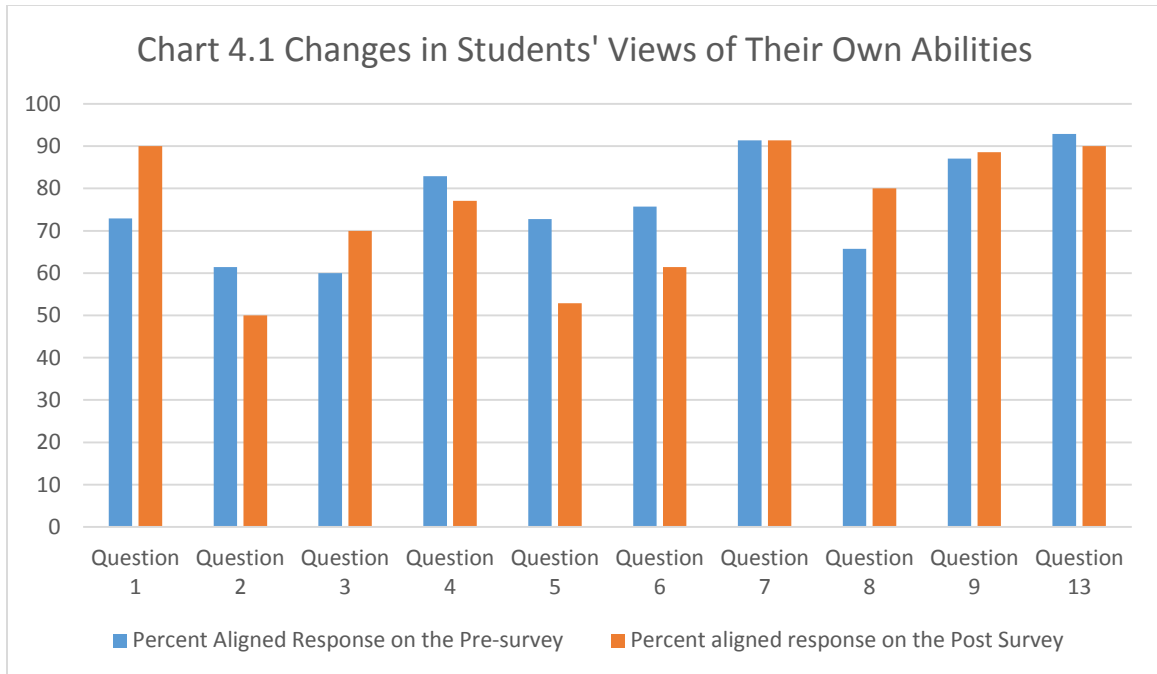
Students' Attitudes, Abilities, and Work Ethic

The results in Table 4.1 and Chart 4.1 show the responses of students by percent of total participants to the first nine questions of the survey (Appendix A) as well as question thirteen. The table also shows the majority students' responses on both the pre and post test, as well as how it aligns with the research based characteristics of a successful learner. It is important to note that in some cases not all students answered all of the questions in this series, and thus, the percentages do not always add up to 100 in this table, and the ones that follow. Again, percentages were calculated by taking the frequency of each category (any level of agreement or

disagreement) and dividing it by the total number of participants who took the survey, whether they completed every questions or not, as noted in each table.

Table 4.1 Students' Views of Their Own Abilities

Survey Question	Pre-Survey (n=71) Majority	Post Survey (n=70) Majority	Aligned Response
<i>1. I have trouble finishing homework assignments on time.</i>	Disagree (72.9%)	Disagree (90%)	Disagree
<i>2. I can focus on studying.</i>	Agree (61.4%)	Disagree (50%)	Agree
<i>3. I have a hard time concentrating.</i>	Disagree (60%)	Disagree (70%)	Disagree
<i>4. I can motivate myself to do schoolwork.</i>	Agree (82.9%)	Agree (77.1%)	Agree
<i>5. I would choose an assignment I can learn from even if it doesn't guarantee a good grade.</i>	Agree (72.8%)	Agree (52.9%)	Agree
<i>6. I think the material I learn in this class isn't useful because I'll never use it.</i>	Disagree (75.7%)	Disagree (61.4%)	Disagree
<i>7. If I try hard, I will understand the material.</i>	Agree (91.4%)	Agree (91.4%)	Agree
<i>8. I am not confident I can learn complex material.</i>	Disagree (65.7%)	Disagree (80.0%)	Disagree
<i>9. Even when class is uninteresting I manage to keep working until finished.</i>	Agree (87.1%)	Agree (88.6%)	Agree
<i>13. Learning something new is hard, but I can learn it if I have to.</i>	Agree (92.9%)	Agree (90.0%)	Agree



One of the pieces of data that is easy to see and was a bit surprising is that for most survey items the majority of student responses aligned with what I would prefer their response to be both prior to, and after a semester of instruction with a few exceptions. One of the more interesting responses came from item two on the survey which states; I can focus on studying when there are other interesting things to do. On the pre-instruction survey the majority of students (61.4%) indicated that they agree in some form with the aforementioned statement. On the post survey, after participating in a whole semester of instruction, the results switched to the opposite response. More students indicated that they had a harder time focusing on studying when there were more interesting things to do at the end of the semester.

Another interesting result was the responses to item five on the survey which states: When I have an opportunity in class to choose, I would choose an assignment that I can learn from even if it doesn't guarantee a good grade. On the pre instruction survey the majority of students (72.8%) said that they agreed in some form with the above statement. What was surprising about this item was that on the post instruction survey the results were much less

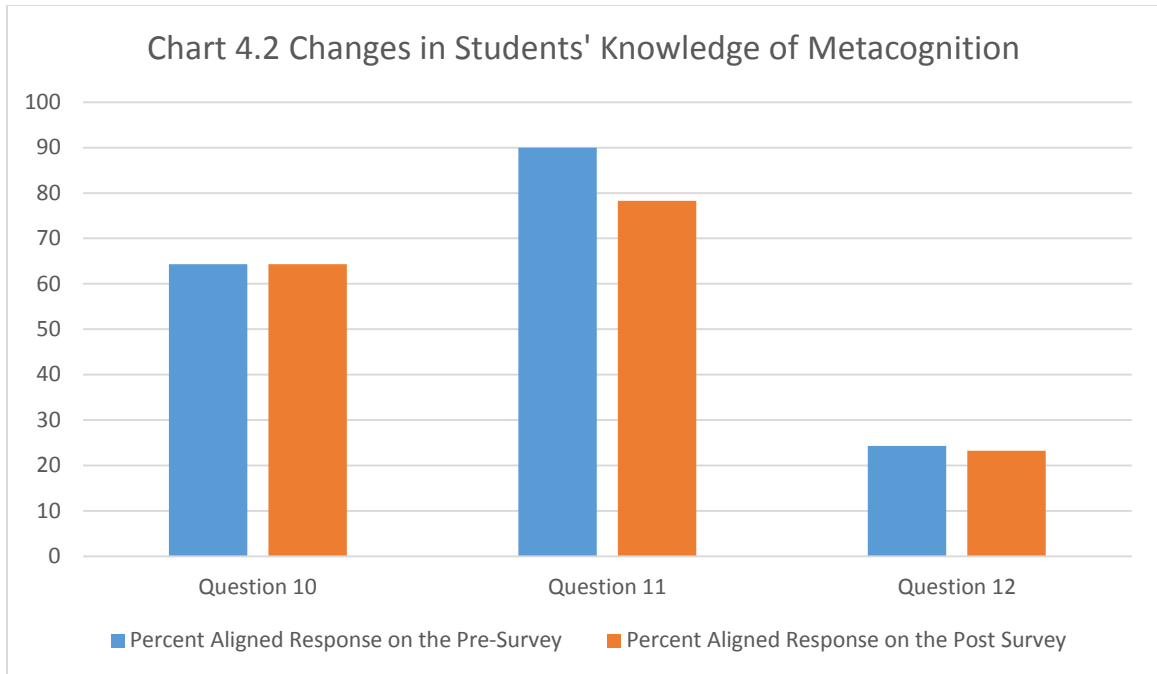
defined. On this survey only 52.9% of students said they would choose to do that assignment even if it meant not getting a good grade, while 45.7% of students said they would still try it.

Knowledge of Metacognition

Table 4.2 Students' Knowledge of Metacognition

<i>Survey Question</i>	Pre-Survey (n=71) Majority	Post Survey (n=70) Majority	Aligned Response
<i>10. Knowing the process of how to solve a problem is not as important as getting the solution.</i>	Disagree (64.3%)	Disagree (64.3%)	Disagree
<i>11. I reflect on how I learn, and mistakes I made, in order to do better next time.</i>	Agree (90.0%)	Agree (78.3%)	Agree
<i>12. I know what it means to practice metacognition.</i>	Disagree (75.7%)	Disagree (76.8%)	Agree

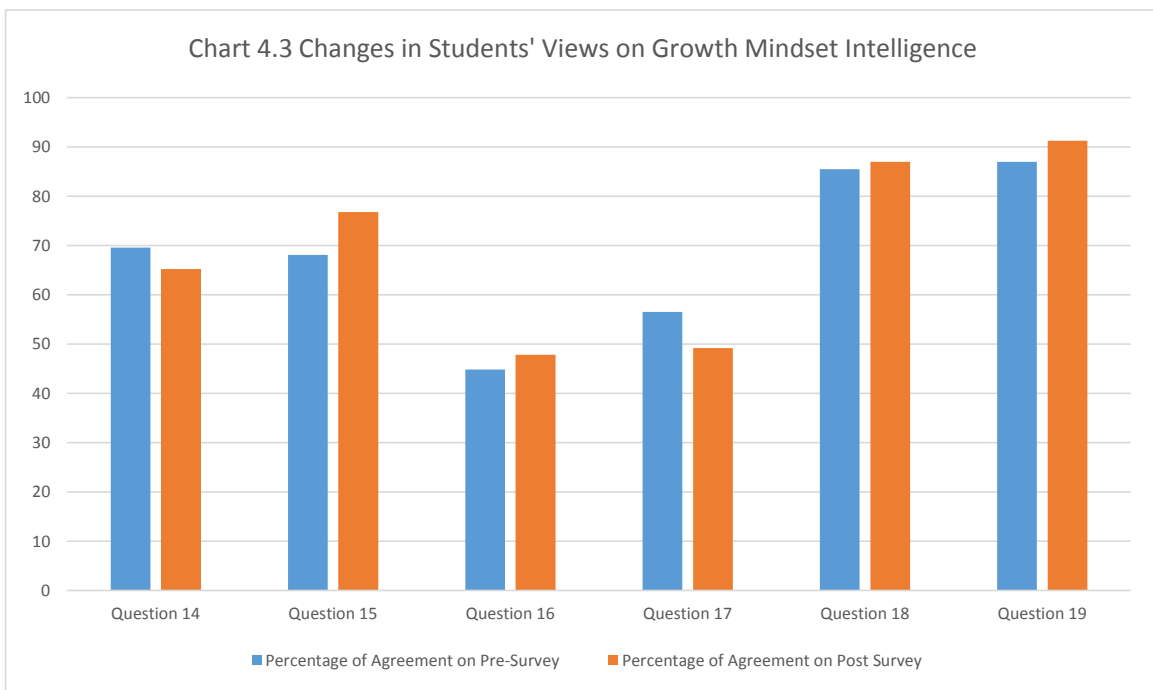
Table 4.2 (above) and Chart 4.2 (below) shows the percentage of students responding to the statements about their knowledge of metacognition both before and after instruction. The aligned responses are ones that students would have given if they know about metacognition and acknowledge its importance in the learning process. As is seen in the table, students know that reflecting on their learning is important. Item eleven on the survey stated: “I reflect on how I learn, and mistakes I made, in order to do better the next time around.” On this item, the majority of students on both the pre (90.0%) and post instruction (78.3%) survey agreed with that statement in some way. An unexpected result was that after receiving specific instruction on how to be more reflective learners, on the post instruction survey, almost 12% fewer students thought that this was important.



Another unexpected result came in students' answers to item twelve. That item states: "I know what it means to practice metacognition." Even though I had used this term constantly, the results show that only a small percentage (25.3%) knew what metacognition was before any instruction, and about the same percentage (24.2%) knew what it meant after a semester of instruction. This result was quite surprising considering how much I talked about and used that term in class. This shows that students didn't necessarily connect what they were doing to the concept of metacognition. I was pleased to see, however, that they still knew the process of metacognition was important (as indicated by #10 and #11), even if they didn't know what it was called (#12).

Growth Mindset View of Intelligence

The survey items that addressed the concept of the growth mindset view of intelligence were ones that I was most curious about. Before starting my research I would have thought that this was something that very few students would believe in. During previous years of instruction, it was easy to overhear students tell me how they just weren't any good at math, even though the research says that isn't necessarily true. I hoped to find that I could influence my students a bit and get them to see that they weren't born with some fixed amount of intelligence, but that through learning they could change their intelligence. The results to these questions are



displayed in Chart 4.3 and Table 4.3.

As the table shows, the majority of students indicated that they were in line with the desired response with the exceptions of items sixteen and seventeen. Respectively, these items state “Memorizing math formulas will make you a good mathematician” and “Learning something new does not mean you are changing your ability.” On question sixteen, the majority of students on the pre (65.2%) and the post (52.2%) instruction surveys indicated that they agree in some

way with that statement. However, on the post survey I saw that there was a reduction in the percentage of students who agree with that statement, and an increase in students who disagreed with that statement. On the statement seventeen, initially, the majority (56.5%) of students, albeit not overwhelming, agree with the idea that learning does not mean you are changing your ability.

Table 4.3 Students' Views on Growth Mindset Intelligence

Survey Question	Pre-Survey (n=71) Majority	Post Survey (n=70) Majority	Aligned Response
<i>14. You have a certain amount of math ability and it can't be changed.</i>	Disagree (69.6%)	Disagree (65.2%)	Disagree
<i>15. How intelligent you are mostly determines how well you can do in school.</i>	Disagree (68.1%)	Disagree (76.8%)	Disagree
<i>16. Memorizing math formulas will make you a good mathematician.</i>	Agree (65.2%)	Agree (52.2%)	Disagree
<i>17. Learning something new does not mean you are changing your ability.</i>	Agree (56.5%)	Disagree (49.2%)	Disagree
<i>18. You can greatly change how intelligent you are.</i>	Agree (85.5%)	Agree (87.0%)	Agree
<i>19. You can greatly change your ability to do math.</i>	Agree (87.0%)	Agree (91.3%)	Agree

When asked that question again at the end of the semester the majority had shifted. Now, more students disagreed (49.2%) with the statement than agreed (47.8%) with it. This is by no means an overwhelming majority shift, but seems to indicate a step in the right direction.

Another interesting statement to look at is item eighteen and how it compares to item seventeen discussed above. On both pre and post surveys many students did not believe that learning changed your ability. Item eighteen, which states “You can greatly change how

intelligent you are” hints at the exact same idea with a little bit different wording. On this question, an overwhelming majority on both the pre (85.5%) and post (87.0%) surveys agreed in some way with this statement. This led to me to conclude that while my students believe that you can change your intelligence, they may not connect it to the learning process.

How Students Think They Learn Best

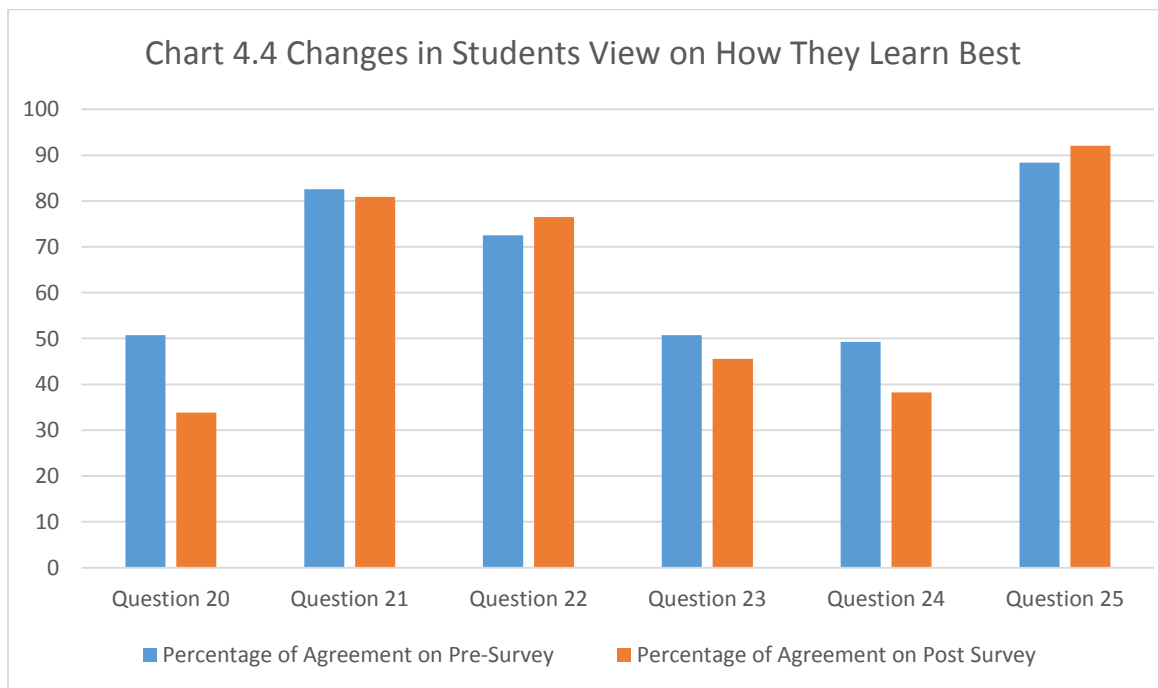
The final statements on the survey asked students to comment on how they think they learn best. The results for these statements are displayed in the Table 4.4 and Chart 4.4 below. For these items there wasn't really a particular research aligned response to each statement. They were intended to discover students' opinions and attitudes on the way that they think they learn. On the following page, Chart 4.4 breaks down students' responses to each question by the level of agreement (percent of participants that choose any level of agreement).

Table 4.4 Students' Views on How They Learn Best

<i>Survey Question</i>	Pre-Survey (n=71) Majority	Post Survey (n=70) Majority
<i>20. How quickly you can get answers on a test is a good measure of how well you learned.</i>	Disagree (49.3%)	Disagree (66.2%)
<i>21. Practice exercises are the best way to learn math.</i>	Agree (82.6%)	Agree (80.9%)
<i>22. Watching a teacher do examples is the best way to learn math.</i>	Agree (72.5%)	Agree (76.5%)
<i>23. Trying a problem I don't know how to solve is the best way to learn math.</i>	Disagree (49.3%)	Disagree (54.4%)
<i>24. Getting an answer on the calculator isn't really doing math.</i>	Agree (49.3%)	Disagree (61.8%)
<i>25. Knowing why an answer is right is as important as how to find it.</i>	Agree (88.4%)	Agree (91.2%)

On the pre-instruction survey, students had a split opinion on question 20. While 47.8% of students agreed that getting the answer quickly on a test was a good measure of how well they learned something, 49.3% of students disagreed. On this same question on the post test the answer was clear. Only 33.8% of students agreed that getting an answer quickly was a good measure of how well they learned. This is a decrease of 14%. When asked if practice exercises were the best way for them to learn math, 82.6% agreed on the pre instruction survey, and that opinion didn't change much after a semester as 80.9% still agreed.

When asked if watching a teacher go through examples was the best way to learn math, the majority of students on the pre and post survey (72.5% and 76.5% respectively) again responded that they agreed. This indicates that students think that they learn math best both by doing, and by watching someone else do it.

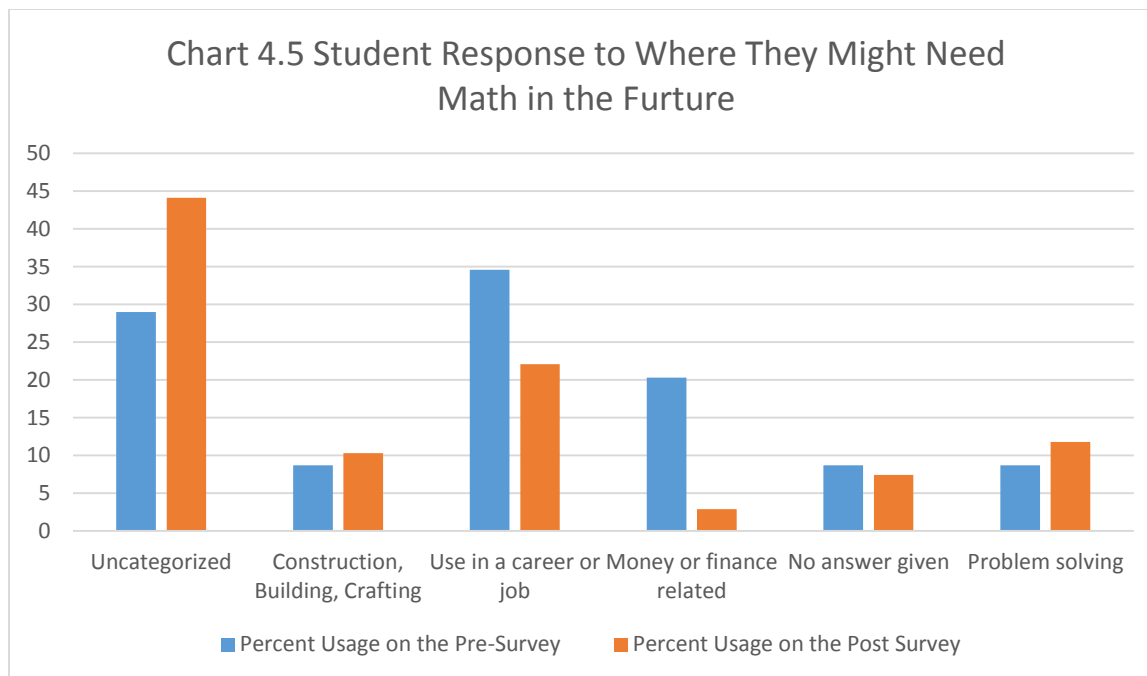


A final interesting result came from statement 25 which asked students to comment on the following statement: "Knowing why an answer is right is as important as how to find it." I was pleased to find that not only did 88.4% of students agree with this statement prior to any instruction, but after the semester of instruction, even more students (91.2%) agreed with the statement.

The Purpose of Math

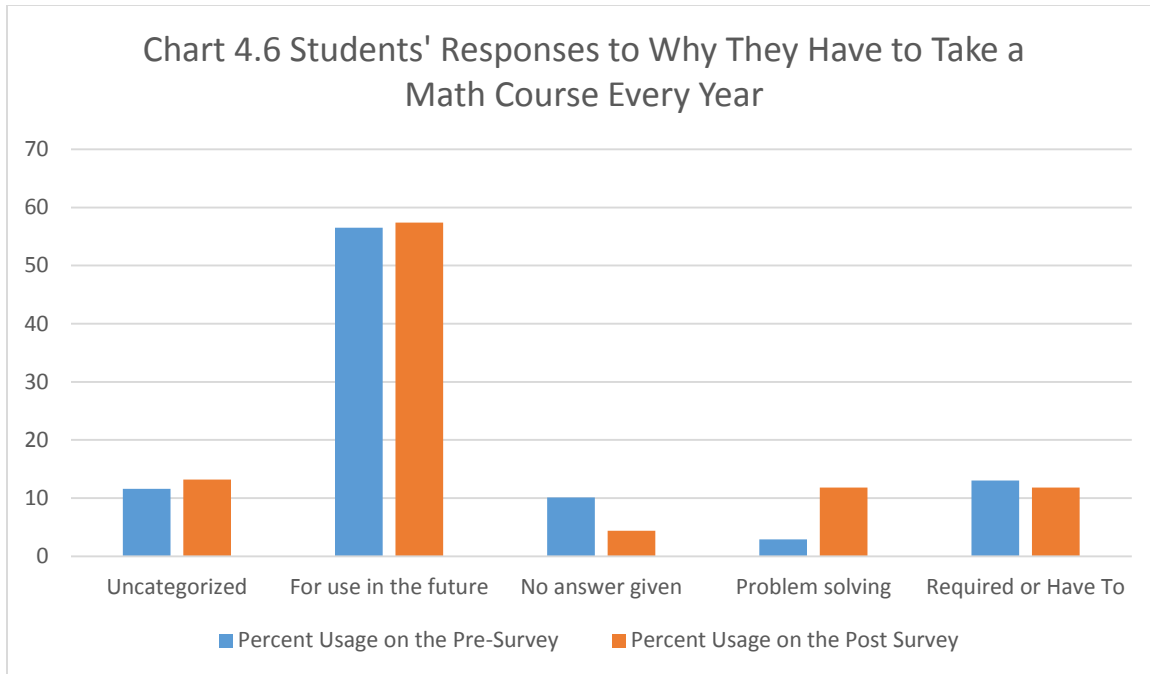
To analyze the free response questions on the student survey, themes were identified and then coded to reflect any emergent categories in the data. The categories of responses that emerged in both questions were similar and are; construction, building, or crafting, for use in the future, for use at a job or career, for use in money or finance, for use in problem solving, and lastly, a response that fit none of those categories after coding. Question 27 on why students thought they had to take math year after year also saw another category emerge of "because it is required." The themes of the responses to questions 26 and 27 can be found in Charts 4.5 and 4.6. Chart 4.5 shows students' responses to question 26, and Chart 4.6 show responses to question 27. Using the Charts below, I looked for changes in the most commonly appearing code under each question.

The data shows that the majority of students (54.9% combined) initially thought that they would have to use math in their future for either a job, or for use with money. On the post survey students drastically reduced (from 20.3% to 2.9%) the thought that they would have to



use math for use with money, while there was a slight increase in the number of students who thought they would use math for construction, and for problem solving. This may have to do with the fact that students were in a geometry class, in which we spend little time on arithmetic, and more time on solving complex problems. Also, the number of students who gave a response that didn't fit into a category increased as well.

On the second free response question, having to do with why students have to take math each year, responses generally stay the same from pre to post survey. The majority of students (56.5% and 57.4%) acknowledged that they need to take math each year because they would need it for something in their future. Again, I saw an increase from 2.9% to 11.8% in the amount of students who said they need math each year so that they can have better problem solving skills, which again could be the nature of the class.



Surprisingly, there was also a slight decrease in the number of students who said that they take math each year because they have to. While it is only a small decrease, it was good to see that only a small percentage of students on each survey gave this as an answer, indicating that students recognize the importance of continuous math education.

My Successes and Frustrations in Teaching

My own personal journal documented in detail the journey that I took when teaching students about how they learn how to become metacognitive learners, as well as helping them to put those techniques into practice. It is clear from my writings that there were some highpoints over the course of the semester, but also many frustrations. Students did the activities without complaint for the most part, which is a good thing to see in the classroom. During the second chapter on an introduction to logic and reasoning, I even had one student ask “Are we going to do this again in the next chapter?” in reference to the unit report. I said “of course!” not really sure if the student was going to be happy about that or not. She replied “good, I really like doing that.” This was one of the best parts of guiding students through their metacognitive exercises.

That small moment after class made the frustrations all worth it, and helped ease my skepticism that what I was doing was actually being bought into by my students. Now of course there were plenty of complainers throughout the semester, and as my journal shows, plenty of students who just didn't buy into this. I would say this group numbered less than fifteen students. For them it didn't seem like the effort was worth the reward.

The majority of students (about 50) fell right between the two groups. They were not outwardly enthusiastic about going through the practices, but they also didn't have anything bad to say either. It is these students that I hoped to win over by the end of the semester. As the small increases in the aligned responses suggest, I may have gotten a few of these "middle of the road" students to buy into the whole metacognition and growth mindset ideas. It certainly wasn't a lot of students, maybe five, but those few students made me feel like the work that I was doing, and that they were doing was not for nothing.

One of my biggest frustrations, as is mentioned in my journal multiple times, is when I discovered that students were being dishonest with themselves when it came time to complete their unit report and reflection (see Appendix C). These students filled out higher percentages than they actually knew, or just made up numbers to get through the activity. This was noted in my journal on a few occasions, with at least one reference being made to a specific, although unnamed student. I made it clear that they could be honest in reporting their results by saying that any grade they earned for doing the activity was not tied to how they scored themselves. To me I thought this would give them the freedom to report the truth, whether it was good or bad, to me, and to themselves. In my journal I concluded that these students were ones that were simply going through the motions. I like to say that these students are good at playing the "game of school." They are generally well behaved, get all of their work done, and are all around good

students. However, it can be frustrating to see these students just blowing something off that could help them to become even better. I will need to find a way to engage these students and convince them that what they are doing can be useful to them. Over the course of the whole project, there were frustrations, but also plenty of those moments that make the effort worth it.

Effects on My Teaching.

In looking through my journal entries it is clear that while I experienced a few successes and frustrations during the semester, the project's learning activities did have a small effect on my teaching. In my journal I noted multiple times how I felt that students were really getting the math content that we were learning. For example, in an entry from unit 4 I note "At least a lot of students came to me for some extra help this unit. This makes me feel like they are at least motivated to learn, and I like to think I had a small part in that. In any case, students did pretty well on their unit tests." Alternatively, I also mention how taking the time to do these activities in the classroom took some time away from content instruction. I think this speaks to a need to better integrate the content and the learning activities in my classroom. I would like them to complement each other, instead of being two distinct types of classroom activities. So while I did feel that there was both positive and negative effects on my teaching, those effects were small.

Chapter 5

Conclusions and Recommendations

From the data that was collected and analyzed, it appears that I was unable to change the attitudes towards learning of the majority of my group of students. However, I wouldn't go so far as to say that it didn't work at all. Throughout the study I got glimpses of success with some students, such as when my journal noted the student who told me that they thought the unit reports were helpful. Yet, in general, the survey results also show that while students sometimes changed their opinions, it wasn't always the majority of students that changed.

Limitations.

While my study did give some insightful results, it is important to know that it has some limitations on its use outside of my classroom. One limitation of my project is the small sample size. With only 71 students, all of the same race, and from the same town, it is impossible to generalize the results of my study to a larger, more diverse population. Also, having my entire sample in grades 9-12 in Geometry also limits the implications to that group only. Perhaps if this study was done on different age groups, it would yield different results.

Another limitation of this study is that it was done external to any graded work. Students work on my main instrument, the survey, was not graded. Also, having students self-report on the surveys is another limitation that might have allowed me to influence their responses. For example, at the beginning of the year, they might be worried about what I would think of them based on their answers, whereas at the end of the semester we had built a relationship and they might have felt that they could answer differently than they would have at the beginning. Other limitations still can include the lack of a control group for comparison, as well as my direct involvement in the study, which could have skewed the way students responded to the survey.

However, despite its limitations, the study did yield some interesting information that I can use to inform and guide my classroom instruction in the future.

Conclusion and Recommendations for the Future

Based on the survey data on the growth mindset of intelligence that shows slight increases in the percent of students who gave aligned responses (see Chart and Table 4.3) on some questions, I have concluded that simply introducing students to Carol Dweck's work on the growth-mindset of intelligence and having them read and discuss an article was not enough to overcome their own views that they had been constructing since their first experiences in school. While the data shows that some gains were made, none of the survey items saw a great increase of students giving an aligned response. I think that this will be one of the biggest challenges to overcome in the future.

One way that I can continue to work on helping my students buy into the growth-mindset idea is to work on continuing to create a classroom environment where challenge, effort, and learning from mistakes is the norm (Dweck, 2010). One way that Dweck (2010) suggests that a teacher can do this, and that I intend to try more next year, is to make it very clear that the process by which students are learning is more valuable than the end product. Another thing that I can do is work on differentiating my learning instruction more. Shatzky (2011) says in his article that students need some kind of reward in order to be motivated to learn. In this study it appears that more motivation is needed for students to buy into these ideas about growth-mindset intelligence. This "reward" that they seek can be successes that my students experience after struggling to learn something new. That success will be more experienced if I can differentiate more so that more students get a taste of the reward. This might cause students to be more motivated to change their attitudes over the course of the year.

In our current school climate of testing and Student Learning Objectives (SLO) where educators are forced to evaluate their students by only the end product, it is difficult, but not impossible to show students that the process of learning is still just as important. One way that teachers can accomplish this is by changing what that end product looks like. My future SLO might be designed so that the goal I am helping my students to reach includes things like metacognitive practice or math practice standards. This is another way that I can show my students that I value the practices and processes of learning, not simple a score on a test.

Another area that I can continue to work on is helping my students to become metacognitive learners. While during this study students were introduced to a few ways to reflect on their learning, it is clear that different or additional strategies are needed, in the future. The research says that teaching students a variety of different strategies, as well as showing them when to use them can help them to become more successful at being metacognitive (Askill-Williams, Lawson, & Skrzypiec, 2011; Nordell, 2009; Schofield, 2012). Perhaps the two strategies (Think-Puzzle-Explore and the Reflective Unit Report) I introduced were not enough to help students build up their repertoire enough so that they had different strategies to use in different situations. Also, while I did show students when to use each of the two strategies, perhaps the use of those strategies was limited to the beginning and the end of each unit, leaving them with nothing much in between. One way that this can be remedied in the future would be to require students to practice more metacognitive activities throughout the unit so that they see it is important to reflect on their learning continuously, not just at the beginning and the end of a unit.

Again, the small gains made in the percent of students who gave aligned responses (see Chart and Table 4.2) still make me feel like my students just viewed the activities I had them do

as just another hoop to jump through to get through the year, as noted in my personal journal throughout the semester, and not as useful as I had hoped. One of the reasons that this might be is that I could have made it clearer that the learning activities and the math they were doing were connected, and in fact to be the most successful in learning the math, they had to be successful in learning. Instead, I feel like the students continually saw the projects' activities as something that they had to do in addition to the math they were learning. In the future it will be important to find better ways of integrating the learning and mathematics instruction. This could be done by setting up a system of completing classroom activities so that students show that they have learned the math, and they show it by using some of the tools they have picked up during any instruction on learning. Furthermore, the work students completed for the study, for the most part, was not graded. Perhaps this led them to not place as much value on it as other classroom activities. In the future, students would receive grades for completion of all the classroom activities (surveys, think-puzzle-explore, unit reports, and others as they come up), this might help them to answer more honestly because there would be more perceived value in the activities I was asking them to complete.

While I started this project with some lofty goals of getting students to be better learners in general, it is clear to me that changing students' attitudes towards learning over the course of a single semester, or a year for that matter, is more difficult than I anticipated. While I did make small gains in changing my students' attitudes as shown in their increase in aligned response percent, those increases did not come on every question, and were not as big as I anticipated at the beginning of the project. What is needed to make students become motivated, metacognitive, and growth mindset oriented learners is a well thought out, systematic approach. Research says that to foster these traits in their students, teachers must create an environment where these kinds

of activities are the norm (Dweck, 2010). While my students did show some change in their views towards metacognition and growth mindset (see Chart and Table 4.2 and 4.3), they would leave my classroom each day, and with that, the environment that I was working to provide was gone allowing students to go back to the ways that they had always tackled learning. I would recommend that when trying this in the future, in order to have any real effect on our students, teachers have to work together to create this kind of environment beyond the walls of their own classroom. I will work with the other math teachers in my building next year to try and get a few others to work on creating more classrooms where being metacognitive learners, and valuing a growth-mindset of intelligence is the norm. By exposing more students to this kind of environment, it might be possible to get more students to value that environment, and use it to experience success in their learning.

While the project did not create any sweeping changes in my students' attitudes, there are some things that teachers can take away from this study to help them improve the learning environments in their own classrooms. First, it is possible to help students become metacognitive, but to do this in the most effective way students need to be given a variety of strategies to work with. In this study I only used two different activities repeatedly throughout the semester. In the future I will try some additional strategies in order to help my students add a variety of tools to their "tool box." Most of those strategies will focus on guiding students towards a "productive struggle" that ends up with them being successful in the end. One way I can achieve this is by focusing my teaching more around the mathematical practice standards, which will help me teach students how to learn, approach, and do math, rather than just teaching them how to do some selected example problems and hope they can apply what they saw to other tasks. For students, this will mean doing less but more difficult exercises and really breaking

down how we approach each one, as opposed to “drill and kill” type homework assignments each night.

There are also many school and district resources at my disposal, including the project CRISS (Creating Independence through Student-owned Strategies) instruction that all teachers in my district receive training in. This program helps teachers develop meaningful, student centered learning activities for their classroom. With these additional strategies, students might be more prepared to tackle different learning tasks. Second, it seems that simply teaching students about the growth mindset model of intelligence is not enough to convince them that it really works. Students need to experience it, not just learn about it. I feel like the students who bought into that idea already had that mindset to some extent. In the future, teachers would have to come up with activities that show their students that there are a variety of ways to approach any given problem or task, and again, to practice them often enough to make this the culture of their classrooms. This might be accomplished first by showing students that can experience success in learning through differentiated instruction, no matter how the student views their own level of intelligence.

Overall, the main takeaway from this project is that to create any real change in the classroom, teachers have to make whatever it is that they want students to do, become the culture in their classrooms. Activities have to be carefully planned and executed so that there is little noticeable difference between the content instruction and any learning instruction that takes place, and it has to be clear to students that one needs the other in order for successful learning to take place. This has been one of the hardest parts of conducting this project, and will be one of the hardest things for teachers to work on in the future. While it was difficult for me, the surveys indicated that I did cause students to slightly change their attitudes with my growth-mindset and

metacognitive activities by the percentages gained in their aligned responses. This means that changing students' attitudes is not impossible. While this task can be time consuming and difficult, it is worth taking on so that students can develop lifelong learning skills that will help them to be successful well beyond the walls of my classroom.

For the next school year, and the ones that follow, I will continue on working to shift my students' attitude on learning by creating a culture of "celebrated struggle" in my classroom. I will design and require more classroom activities that focus on the process and content of math together instead of as two separate things. I will also incorporate more metacognitive and growth mindset oriented activities in my classroom, so that my students have a chance to experience them more than just learning that they exist. Furthermore, I will employ strategies like differentiation that allow my students to take different approaches to tasks while still showing that I value the approach that they are taking. To see if my efforts are working, I might choose different methods of data collection than I did in this survey in order to minimize my influence over students' responses. One way that I could accomplish this is to look for indicators that students are using the strategies we are using in class on their work without them being required. I could also incorporate what I have learned in this project into future professional practice goals, and student learning objectives. While working on changing the way I teach, changing my classroom culture on one that celebrates struggles with success and not task completion and grades, and changing students attitudes towards their learning will not be easy, I look forward to the opportunity to teach future students that process of learning math, or any other thing they choose, will be a valuable tool to them not just in school, but also in their lives.

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Appendix A: Student Knowledge and Attitudes Survey

Name (optional): _____

Date: _____

Please rate your level of agreement to each statement.

	Agree			Disagree		
	Strongly	Agree	Somewha	Somewha	Disagree	Strongly
1. I have trouble finishing my homework assignments by the time they are due.						
2. I can focus on studying when there are other interesting things to do.						
3. I have a hard time concentrating on school subjects.						
4. I can motivate myself to do schoolwork.						
5. When I have an opportunity in class to choose, I would choose an assignment that I can learn from even if it doesn't guarantee a good grade.						
6. I think the material in this class is not really useful for me to learn because I won't ever use it.						
7. If I try hard enough, I will understand the class material.						
8. I am not confident that I can learn complex material.						
9. Even when the class material is uninteresting I manage to keep working until I finish.						
10. Knowing the process of how to solve a problem is not as important as getting the solution.						
11. I reflect on how I learn, and mistakes I made, in order to do better the next time around.						
12. I know what it means to practice metacognition.						
13. Learning something new is hard, but I can learn it if I have to.						

	Agree			Disagree		
	Strongly	Agree	Somewha	Somewhat	Disagree	Strongly
14. You have a certain amount of math ability and you can't do much to change it.						
15. How intelligent you are mostly determines how well you can do in school.						
16. Memorizing math formulas will make you a good mathematician.						
17. Learning something new does not mean you are changing your ability.						
18. You can greatly change how intelligent you are						
19. You can greatly change your ability to do math.						
20. How quickly you can get correct answers on tests is a good measure of how well you learned.						
21. Practice exercises are the best way to learn math.						
22. Watching a teacher do examples is the best way to learn math.						
23. Trying a problem I don't know how to solve is the best way to learn math.						
24. Getting an answer on the calculator isn't really doing math.						
25. Knowing why an answer is right is as important as how to find it.						

Please answer the following questions using your own words.

26. What are some examples of where you might have to use math in your future?

27. Why do you suppose you have to take a math course just about every year you are in school?

Appendix B: Think-Puzzle-Explore Activity**Essentials of Geometry: Think-Puzzle-Explore**

Directions: Read through the list of I can statements for chapter 1 and then fill in each of the boxes below.

What do you *think* you know about the topics listed in the “I can” statements for chapter one?

What questions or *puzzles* do you have about the topics listed in the “I can” statements for chapter one?

How might you *explore* (get the answers to) the questions you have about the topics listed in the “I can” statements for chapter one?

Appendix C: Unit Report and Reflection**My "I Can" Unit Report**

Name: _____

Section	On my review	On my Quiz	My Average is:
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Section 1.1

I can identify and name undefined terms such as point, line, and plane.

I can identify and name defined terms such as line segment and ray.

____/ 14____/ 13____/ 27

____%

Section 1.2

I can apply the segment addition postulate to solve problems.

____/ 19____/ 9____/ 28

____%

Section 1.3

I can use the distance and midpoint formulas in geometric and algebraic situations.

____/ 11____/ 17____/ 28

____%

Section 1.4

I can classify angles based on their measure.

I can apply the angle addition postulate to solve problems.

____/ 37____/ 12____/ 49

____%

Section 1.5

I can use special angle relationships (supplementary, complementary, linear pair.....) to find angle measures

____/ 16____/ 12____/ 28

____%

Section 1.6

I can classify polygons based on their number of sides, as well as identify their parts (sides, vertices....).

____ / 13

____ / 12

____ / 25

_____ %

Any sections that you score less than 80% on are ones that are especially important to review before your test. Please list those sections below, as well as what you plan to do to study for them. Be sure to stop by Mr. Mack to pick up the reviews for the sections you need to study.

Section to Review:

How I will study

Which sections did your report indicate that you have not finished learning? Do you agree? Why or why not?

Which sections did your report indicate that you have done a good job of learning? Do you agree? Why or why not?