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Secondary Mathematics Teachers' Mindsets

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ABSTRACT

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Much research supports that student mindset influences how well students do in school and that teacher actions influence student mindset. Research has also shown that just because a teacher has a growth mindset, it does not imply that their students will also have a growth mindset. This research looks closer as to why a teacher's mindset does not correlate with their students' mindset by further examining teacher mindset and the connection between teacher mindset and teacher actions. In summary, teachers' mindsets do not directly influence student mindset for a few reasons: secondary mathematics teachers have different mindsets towards honors and regular students, while they have heard about mindset, they do not understand mindset deeply, and mathematics teachers do not know how to help their students develop a growth mindset.

Keywords: growth mindset, fixed mindset, mathematical mindset, secondary mathematics classroom, teacher development, honors students, regular students, learning mathematics

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CHAPTER ONE: INTRODUCTION

Many people struggle with mathematics. It often has a stigma that only the smartest and the brightest people can do it, a message that is perpetuated from generation to generation (Boaler, 2008; 2016). Parents and teachers allow students (and themselves) to give up on mathematics too easily by sending the message "It's ok, you're not a math person" when they struggle. Many students and adults give up on learning mathematics and accept that many people will fail and hate mathematics. The trauma experienced in mathematics classrooms is remembered for years to come (Dweck, 2016). Something needs to be done to change the way mathematics is viewed in classrooms across America, and a powerful tool for change can come from the mathematics teachers. There have been many changes in how mathematics is taught through the generations and the ways mathematics education researchers have tried to improve (Kilpatrick et al., 2001; Schoenfeld, 2016). However, the negative connotations of mathematics continue to be perpetuated through different curriculum reforms (Boaler, 2008). A different type of reform is needed to change the way mathematics is perceived.

A socio-psychological intervention is a different type of change because it does not look at a group's content specific skills. For example, a group of surgeons looking for a way to improve the outcomes on a surgical procedure, developed a 19-point checklist to go through before each surgery. There was nothing revolutionary on the checklist; it included steps like verifying the patient's identity, having each member of the team introduce themselves and their role in the surgery, and confirming that the records have been accurately labeled. This simple checklist did not change the surgeons' skills, but drastically changed their outcomes. Surgical complications decreased 36% and the number of deaths decreased 47% (Haynes et al.,

2009). This was not an intervention that targeted the surgical skills component of the surgery, but the socio-psychological component.

In education, socio-psychological interventions are "typically brief exercises that do not teach academic content but instead target students' thoughts, feelings, and beliefs in and about school" (Yeager & Walton, 2011, p. 267). People view these interventions with varying degrees of acceptance. On one side of the spectrum, people can see social-psychological interventions as a hoax or, on the other end, a magic bullet (Yeager & Walton, 2011). It is hard for some people to understand how socio-psychological interventions like a surgical checklist can be effective. In the hospital, people assumed the items on the checklist were already being done, but after the study, researchers realized that these items were not done consistently. Basic things that make a significant difference were taken for granted. The same is true for our teachers in the classroom.

A popular social-psychological intervention is teaching students to believe that their intelligence is malleable - a growth mindset. The belief that intelligence is not malleable, but rather a predetermined quantity that cannot change is called a fixed mindset, and many studies have found that a student's mindset influences their schooling (Dweck, 2006; Blackwell et. al., 2007; Boaler, 2016). For example, researchers went into a middle school to teach students how their brain (intelligence) can grow. Jimmy was described as "the most hard-core, turned-off low-effort kid in the group" (Dweck, 2006, p. 59). He was deeply touched when he learned that his brain could grow. He had tears in his eyes and said, "You mean I don't have to be dumb?" (p. 59). Even more exciting was that this was not a onetime change of heart: his teacher reported that he went from rarely turning assignments in to putting in hours and seeking feedback before it was even due to get the most out of his assignments. He went from getting Cs and lower to getting a B+ on his assignment. Learning that his brain could grow changed his whole approach

to school and learning. Helping students develop a growth mindset has powerful consequences in their lives like it did for Jimmy.

This is not to say that a growth mindset is more important than other skills that comprise good teaching. The surgical checklist did not allow for a person off the street to come in and greet each person by name and magically be able to perform a surgery with better outcomes than a trained surgeon. However, teachers can be good at classroom management and know their content well but still have students who do not believe they can learn. If students can believe in their ability to learn, then they will be able to learn more and be receptive to the good teaching happening in the classroom. Part of teachers' roles should include helping student develop a growth mindset. A student's mindset influences their willingness to persevere in learning mathematics (Dweck, 2006). For example, students with different mindsets who come across a challenging problem in a math class will respond in different ways; a growth minded student would see the problem as an opportunity to grow and will look for additional resources to find a solution, while a fixed minded student would think it was outside of their capabilities and give up for fear that attempting the problem would reveal what they do not know. Teachers, administrators, and parents are seeing the benefits of a growth mindset and want that for themselves and for their students.

There has been much research done that shows students with a growth mindset perform better academically (e.g. Blackwell, 2007; Boaler 2016; Park et al., 2016**)**. On the Program for International Student Assessment (PISA) given in 2012, students were asked to complete a mindset survey in addition to testing for math knowledge. Students with a growth mindset significantly outscored students with a fixed mindset (Boaler, 2016) approximately the difference of an entire school year worth of knowledge. After being tested both for mathematical content

and mindset at the beginning and the end of the school year, students with a growth mindset learned more than their peers with a fixed mindset (Park, et. al., 2016).

Besides better test scores, students with a growth mindset enjoy mathematics more. Instead of being discouraged when things get challenging, students with a growth mindset see the challenge more like a puzzle (Boaler, 2016; Dweck, 2016). The ideas behind mindset began when Dweck was observing how young children respond to puzzles that get harder and harder. Some students, as expected, would just give up when the puzzle got harder; others enjoyed doing the harder puzzles saying things like, "I love a challenge!" and "I was hoping this would be informative!" (Dweck, 2006, p. 3). Students who have a growth mindset persevere when the going gets tough and actually enjoy the challenge and learning process.

Students can be taught a growth mindset. Blackwell et al. (2007) studied students with a fixed mindset from elementary that carried to middle school and saw that these students had a drop in their mathematics grades when they transitioned to middle school. These students were taught an eight-week course about the malleability of their intelligence which led to improvements in their mathematics grade. Developing a growth mindset helped the students get better grades. Dweck (2006) ran another experiment teaching some students about the malleability of their intelligence while the other group had a class on study skills. The teachers did not know who was in what class but consistently noticed the positive change in the students who developed a growth mindset. Another example of students who had been taught about a growth mindset was a nationwide mindset course that was taught to over 160,000 students in Chile. Claro et al. (2015) found that students who adopted a growth mindset in every socioeconomic status saw improvement in grades and in their likelihood to graduate from high school

Mindset about mathematics can be different than mindset in other subjects. Because of the messages that have been passed down through the generations, students struggle with mathematics more than other subjects (Boaler, 2008, 2016; Dweck, 2016).

> My work on mindset and math over recent years has helped me develop a deep appreciation of the need to teach students about mindset *inside* mathematics, rather than in general. Students have such strong and often negative ideas about math that they can develop a growth mindset about everything else in their life but still believe that you are either achieve highly in math or you can't. To change damaging beliefs, students need to develop *mathematical mindsets*" (Boaler, 2016, p. ix).

Students' mindsets are influenced by many factors, including their teachers. My study will further explore mathematical mindsets, specifically teachers' role in sending mathematical mindset messages through teacher practices.

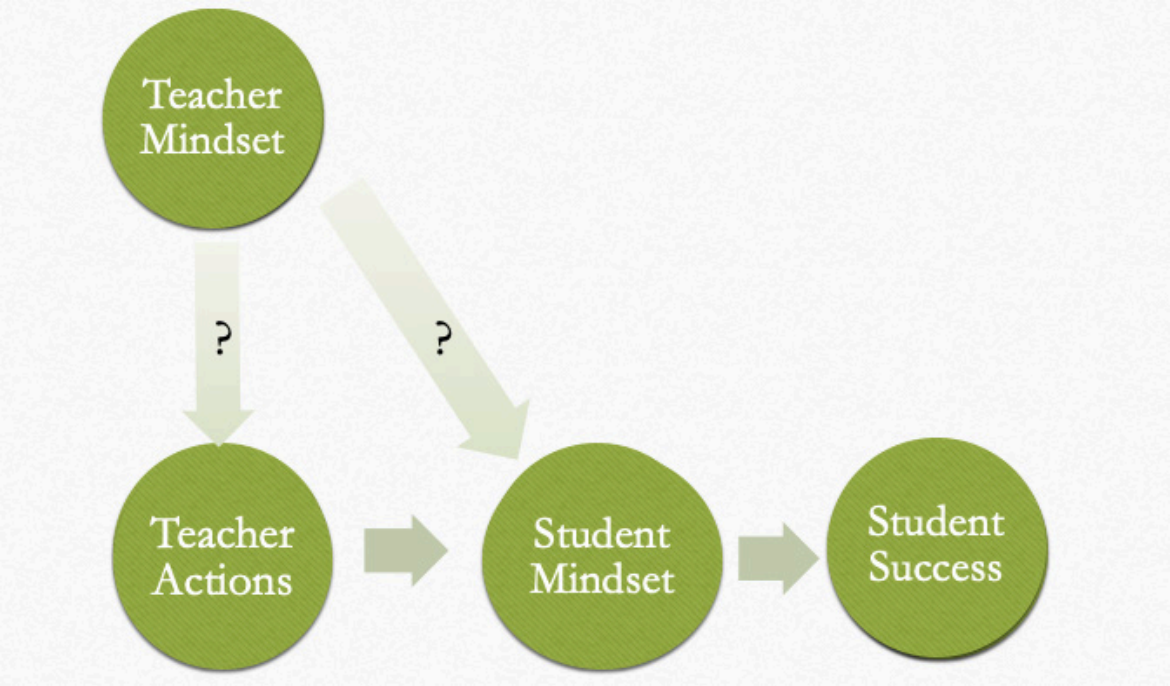
Teacher actions play a role in student mindsets. For example, Marva Collin was a teacher in an inner-city Chicago School who had students who had been labeled as "slow" or "retarded." She believed they had genius inside them and thus treated them as such. In other words, she believed that her students' intelligence could grow. She took students who came into her school with very low reading abilities, they could not even spell their names, and by the time they left four years later, the students not only had learned to spell their names, but they went on to become doctors, lawyers, and other professional careers (Ross, 2018) One student who came as a "retarded" student to start, four years later read 23 books over the summer including classics like *Jane Eyre* and *A Tale of Two Cities*. Believing that her students had the ability to grow changed her students' lives (Dweck, 2006). This teacher's actions of setting high expectations for her students helped the students develop a growth mindset and learn more than they had before.

In summary, as displayed in Figure 1 below, teacher actions influence student mindset, and student mindset influences student success. The arrow between teacher mindset and student mindset represents teacher mindset directly transferring to student mindset. For example, this

would be a clear connection if the students in a class with a growth mindset teacher showed more of a growth mindset by the end of the school year, but there would not be a connection if teacher mindset did not correlate with student mindset. The arrow between teacher mindset and teacher actions represents how mindset influences what teachers decide what actions they do in their classrooms such as do they decide to teach mindset explicitly int their classrooms, how they want to use praise in their classroom, decisions about retake policies for example. Since research has shared that student mindset has so much influence on student success, I want to better understand teacher mindset and teachers' efforts to teach students to have a growth mindset. I am going to see if the teacher mindset influences students directly or through the teacher actions.

Figure 1

Flow Chart of Teacher Influence to Student Mindset.



Purpose

The purpose of this study is to better understand teacher mindset and teachers' efforts to teach students to have a growth mindset. There are multiple sources that influence student

mindset, but in the mathematics education community, the one source of influence we can have the most impact on is the teachers' influence on student mindset. By understanding teachers' interaction with and understanding of mindset better, more can be done to help teachers help their students develop a growth mindset. While it is important what and how teachers teach, all the updates in research cannot have as strong of an impact upon students who believe they cannot learn mathematics. Helping students develop a growth mindset unlocks students minds to get a better grasp on the mathematics being taught. By studying teacher mindset and their efforts to teach students to have a growth mindset, we can understand how teachers can better help their students develop a growth mindset.

CHAPTER TWO: BACKGROUND INFORMATION

This chapter will discuss the theoretical framework and literature related to teacher's efforts to influence student mindset and will end with the research questions of the thesis. The framework will discuss how we are defining and using mindset in this study. The literature review will build the case that there is a solid connection between teacher action and student mindset and that there is not a clear connection between teacher mindset and student mindset, building to the research questions.

Theoretical Framework: Mindset

Carol Dweck, the originator of the mindset construct, said about her work, "For thirty years, my research has shown that *the view you adopt for yourself* profoundly affects the way you lead your life" (p. 6, 2006). Mindset as defined by Dweck (2006) is how one views the malleability of intelligence. The two ends of the mindset spectrum are thinking your intelligence can change (a growth mindset) and thinking your intelligence is constant (a fixed mindset). While this is a very simple idea, a person's mindset trickles into many facets of life and can have profound impact. People with a growth mindset see the utility of effort, though mindset is about more than effort; mindset is about the ability to grow. Mindset is seen in how a person reacts to hardship, how they decide what new things to try, and how they talk about their abilities. People with fixed mindsets give up when faced with something hard, because if they try the challenging task and fail, they see it as a reflection of their lack of abilities. People with growth mindsets, tackle the challenging task because they know they will stretch and learn something along the way. If they finish, growth mindset people do not take this as a sign of their permanent intelligence, but as an indicator that they have room to grow in that area. People with fixed mindsets can still try new things, but they try things they have certainty that they can

accomplish or are within their ability levels because they do not want to uncover where they are lacking, as opposed to people with growth mindsets who try new things to see how they push themselves and grow. Mistakes are defining of limitations to people with fixed mindsets whereas they are opportunities for growth for people with growth mindsets. As Dweck explains in her 2006 book, "For simplicity I've talked as though some people *have* a growth mindset and some people *have* a fixed mindset, in truth, we're all a mixture of the two" (p. 217). Over a decade later, her work has been read by millions and influenced teachers around the world ("Edu-Scholar Public Influence Rankings", 2019), so now is the time to move past the foundation and dive deeper into mindset, specifically for the teachers in the mathematics classes.

Mindset is often discussed in a very general way with statements about if a person believes they can change their intelligence. Jo Boaler has taken the work of Dweck and applied to mathematics studying how mindset influences students in math classes. She found that students can have growth mindset views in most aspects of their lives but can still have a fixed mindset about mathematics (Boaler, 2016). Reflecting on our lives, it is likely we will find instances where we have believed our intelligence can grow and other times where we believed our intelligence is fixed. Fixed mindsets in math can be attributed to many different sources that will be discussed later in this chapter, but include messaging from society ("girls aren't good at math"), labels from parents ("we're not math people in our family"), and classroom practices from teachers ("do it right the first time as there are no retakes in this class") (Boaler, 2016; Dweck, 2017; Haimovitz & Dweck, 2016; Rattan et al., 2012). Since mathematics is a subject embedded with fixed mindsets, it is important that mathematics teachers understand mindset beyond just a surface level understanding.

To have a growth mindset does not imply that someone thinks they can grow all the time about anything. As mentioned earlier, people have different mindsets about different things in their lives, and no one can have a growth mindset about everything all the time (Dweck 2007, 2016), so when I say someone has a growth mindset, it means that generally they have a growth mindset for most categories, though typically I will specify what topic they have a growth mindset about. People who really understand mindset recognize they have areas of growth and fixed mindset in their lives and are working to change those fixed mindsets to growth mindsets.

Sometimes teachers think they have a growth mindset, but their actions send fixed mindset messages; this phenomenon is called a false growth mindset. False growth mindset happens when people are not really understanding the definition of mindset or when they do not know how their actions are sending fixed mindset messages. In education, Dweck (2016) has described three main ways to identify false growth mindset: using praise as a consolation prize, helping students set high goals without support, and blaming the students' fixed mindsets. False growth mindset will be discussed further later in the literature review.

Literature Review

Since I am interested in better understanding teacher mindset and teachers' efforts to teach students to have a growth mindset, the literature review will discuss how teacher actions do influence student mindset. As mentioned in Chapter One, a growth mindset can be taught to students, showing that mindset is not a fixed trait, but a trait that can change. There are many influences on students' mindset including society, parents, and teachers. While this study is focusing on secondary mathematics teachers, we will situate our discussion of teachers by briefly discussing other sources of influence on student mindset.

Societal and Parental Influent on Student Mindset

Some influences of student mindset come from cultural norms in a society. In the United States, it is common to believe you are either a "math person" or "not a math person" which is a very fixed way of looking at mathematical ability (Boaler, 2016). A growth mindset message, that is more prevalent in Asian communities, is that anyone can learn math if they work hard enough (Rattan et al., 2012). Other cultural messaging that students hear is that math and science are for the boys and that girls are better at non-STEM subjects (Boaler, 2013a). Any message that says certain abilities, skills or knowledge are not attainable molds students' beliefs about themselves, sends fixed mindset messages, and prevents growth.

Student mindset is also significantly influenced by their parents. For example, how parents praise their children significantly affects the child's mindsets. If they praise them with labels (you're so smart!) or praise their performance (great test score!), they are sending fixed mindset messages to their children, while parents who praise the process (you really worked hard!) reinforce to their children that they can grow (Dweck, 2007). Children's mindset was most influenced by how parents handled failure (Haimovitz & Dweck, 2016). Parents who help their children learn from failures by pointing out what went well and what can be improved for next time realize that failure does not define who they are but can be an opportunity to learn and grow. Conversely, parents who do not see failure as an opportunity to grow, but as a negative label to be avoided at all costs, tend to avoid putting their kids in situations where they might fail, or bail out their children before they fail and send the message to their children that their abilities are innate and that their actions do not influence their intelligence (Haimovitz & Dweck, 2016). Interestingly, children's mindset was influenced more by the parents' action rather than just the parents' mindset. Dweck (2006) found that parents could have a growth mindset, but that

did not mean their children also had a growth mindset. In fact, a lot of their children did not have a growth mindset. Parents' actions had more influence on their children's mindsets than just the parents' mindset.

Teacher Influence on Student Mindset

There are many ways in which teachers influence their students in the classroom. In this section we will look at how teacher action influences student mindset and how teacher mindset influences student mindset, the two arrows on the chart that connect teacher mindset to student mindset (see Figure 1).

Teacher Actions Influence on Student Mindset

Similar to the study previously mentioned, if teachers use failure as a learning opportunity, it will send growth mindset messages to students (Haimovitz & Dweck, 2016). Along with handling failure, how teachers handle mistakes also impacts student mindset. Teachers who help their students see value and learn from mistakes will help their students realize that they can learn and grow (Boaler, 2016). Moser and his colleagues (2011) measured brain activity and found that the brain became more active when a mistake was made, even when the mistake was not immediately recognized. The study also found that students with a growth mindset had more continued brain activity after the mistake than students with a fixed mindset. Students with a growth mindset are more aware when they make a mistake and are more likely to go back and learn what they did wrong leading to even greater learning (Moser, 2011). In many mathematics classrooms, teachers conduct class in a way where mistakes are not seen as good. This can be seen when teachers make students stand in the corner for messing up their times tables, tell students they don't belong in the class if it's not easy for them, or even just telling a student they are wrong. Instead, mistakes can be "springboards for inquiry" helping

students learn from the partially correct student contribution (Boaler, 2016; Borasi, 1994). Mistakes can be springboards for student engagement (Borasi, 1994) in the class when teachers place value on mistakes and use them as an opportunity to help students learn. The teachers are showing that a mistake is not the end, but a part of the process of growing their brains. For example, when a student expands $(a + b)^2$ as $a^2 + b^2$ instead of $a^2 + 2ab + b^2$, rather than making the student feel bad for doing it incorrectly, the teacher could use this as a teaching moment. The teacher could refer to this as a valuable mistake or a "favorite mistake" (Boaler, 2016, p. 17) because a lot of people do the same thing and then thank the student for bringing up this mistake and then use it as a teaching moment. While observing a mathematics class in Shanghai, Boaler (2016) saw the teacher give students deep conceptual problems and then listened to the students share their responses and found that the teacher was purposely calling on students who had made mistakes. The students were happy to share those ideas with the class and the class was learning from those mistakes. When mistakes are valued, students can feel more safe sharing their answers regardless if they are completely correct or not and leave the interaction feeling useful and helpful for contributing to whole class learning instead of feeling bad about messing up in front of the class.

Teachers who place high emphasis on student performance develop more of a fixed mindset in their students than teachers who have a lower performance orientation (Park et al., 2016). A high-performance orientation includes placing a lot of pressure on homework and tests that have large consequences such as a large percentage of their grade, placement into future classes, or a reflection of the students worth. It's been shown that as early as elementary school, teachers who emphasize performance over mastery of the content moved their students towards a fixed mindset compared to where their students' mindset started at the beginning of the school

year (Park et al., 2016). As teachers help their students really understand a topic (mastery orientation) as compared to just getting the right answer (performance orientation), they will help send growth mindset messages to their students.

Students can receive fixed mindset messages from how mathematics classrooms are divided by ability groups (Boaler & Foster, 2014; Dweck, 2006). This is often manifested as honors or advanced classes and regular or remedial classes. Students are placed in these classes in the early years of their education, often middle school, but sometimes earlier, and it is hard to change tracks. This tells the students that their mathematical ability and knowledge is unchangeable because the type of mathematics class they are in is not easily changed (a fixed mindset message) (Boaler & Foster, 2014). This is harmful not just for the students in the lower classes, but also for the students in the higher classes who feel pressure to maintain their status as an honors student. Students who feel that intelligence is a fixed trait avoid situations where they might expose a weakness or flaw in fear of then being defined by that failure (Dweck, 2006). Students are given fixed mindset messaging through the types of activities and curricula used for different classes. Often the advanced groups are expected to do mathematics at a higher level while lower classes are expected to do the bare minimum. Students recognize when they are being grouped by their abilities, even at a young age. (Boaler, 2016). When all students were taught an advanced curriculum, the students in the regular or non-honors classes performed better than students in divided classes (Burris et al., 2006). Parents of high achieving students often argue that their honors' student will be negatively impacted by mixing students of different abilities, but Burris et. al. showed that when classes were all integrated and not separated by ability, there was no drop in the scores of the typically high performing students while lower performing students performed better. In a study done at "Railside School" (Nasir et al., 2014)

detracking their classes, among other changes to their program, resulted in more enjoyment in mathematics and more students in calculus in high school than ever before. All students were more engaged and enjoying mathematics because the classes were all integrated which sent the growth mindset messages that the students could learn mathematics.

Praise can serve as good motivation and positively reinforce good qualities in students, but if done incorrectly praise can send fixed mindset messages (Dweck, 2007; Haimovitz & Dweck, 2016). Praising a student's performance alone sends a message that the performance or outcome is the most important part of the learning process. This action also sends the message that the performance reflects the amount of intelligence the student has. Just praising the performance does not acknowledge the work the student has done to perform well in the first place. Rather than praising the performance, praising the process helps students recognize that the outcome was a result of what they had done so they can repeat those actions for future success in learning (Dweck, 2007; Haimovitz & Dweck, 2017). For example, when a student performs well on a test, teachers should praise the work the student did throughout the semester leading up to the test like her good note taking or how she participated well in the study groups. This will help the student realize that they learned something new through their actions and can continue to grow as they continue that process.

It is important to note that praising effort for not doing well is not emphasizing a growth mindset (Dweck, 2006; Gross-Loh, 2016). Praising effort that is not productive does not send growth mindset messages to students. If they are getting praise for effort that is not helping them learn, then students need to be taught better practices to guide their learning. They need to learn what did not work from their failure, so they can improve. Carol Dweck further explains the problem with just praising effort.

> Teachers were just praising effort that was not effective, saying "Wow, you tried really hard!" But students know that if they didn't make progress and you're praising them, it's a consolation prize. They also know you think they can't do any better. So, this kind of growth-mindset idea was misappropriated to try to make kids feel good when they were not achieving (Gross-Loh, 2016).

If students are handed out consolation praise for trying hard when they experienced failure, they receive fixed mindset messages saying their intelligence is fixed and they are not able to learn whatever they failed at (Clinkenbeard, 2012; Dweck, 2006;).

False growth mindset is when people use growth mindset ideas in a way that actually sends fixed mindset messages (Dweck, 2016). Using praise as a consolation prize as discussed in the previous section, is an example of a false growth mindset. While praising students' work helps students see value in their process that leads to their growth, when praise is used as a consolation prize for poor performance, the message is that even with their efforts they still failed and are not capable of doing better (a fixed mindset). Another characteristic of a false growth mindset is when teachers tell students they can accomplish anything, but do not give them any steps to accomplish the big goals. While a great tenant of growth mindset is aiming for and achieving high goals, when teachers help the students dream big without any help working on the steps to accomplishing the goal, then when the students cannot reach their high goal, it reinforces the idea that they are not capable of hard things. Dweck said, "Skilled educators set high standards for students but then help them understand how to embark on the path to meeting those standards. It's not a hollow promise" (2016). The other main characteristic of a false growth mindset is blaming a students' mindset for their failures. A teacher's job is not to blame a student for having a fixed mindset, but to recognize the fixed mindset and work to help the student develop a growth mindset by creating a growth mindset classroom.

From the previously discussed research, we can see that different teaching practices send growth and fixed mindset messages to their students. Practices that send growth mindset include emphasize learning not speed in the classroom (Dweck, 2010), viewing failure as a learning opportunity (Haimovitz & Dweck, 2016), praising students' processes (Dweck, 2007), and teaching students their abilities can grow (Blackwell et al, 2007; Claro et al, 2015). Some teaching practices that send fixed mindset messages to students include emphasizing performance over learning (Park et al, 2016), placing students in honors and regular classes (Boaler & Foster, 2014; Burris et al., 2006), and labeling students (Dweck 2007). As I later look at what teachers report doing in their classrooms to teach mindset, the research just discussed will help us know what actions send growth or fixed mindset messages to their students.

Teacher Mindset Influence on Student Mindset

Teachers who believe in their students' abilities to learn and succeed but have a fixed mindset about their own abilities to teach mathematics still do not foster growth mindsets in their classrooms (Dweck, 2006). For example, Dweck shared the story about how the basketball coach Bobby Knight believed that his players could improve and that it was his job to help them improve - a growth mindset perspective of his players. However, his methods of coaching reflected a very fixed mindset about his own coaching abilities because he felt mistakes and losses were a direct reflection of his failure as a coach. Instead of seeing failure as an opportunity for growth, he saw it as a reflection of what he was lacking as a coach. Every time his team lost it was a personal failure for the coach, so to prove his worth to himself, he bullied his team into winning. This created a toxic environment in his team that sometimes led to success, but more often led to a diminished self-worth and a loss of love for the game amongst the players (2006). This example demonstrates how the mindset of a coach, a type of teacher,

about themselves impacts their students despite having a growth mindset about their students' abilities.

Research Problem

As previously discussed, as parents' mindset does not directly transfer to their children, teachers' mindsets do not directly transfer to their students. Multiple studies comprising hundreds of teachers and thousands of students looking for this connection between teacher mindset and student mindset from lower to upper grades, found that such a connection did not exist (Haimovitz & Dweck, 2017; Hooper, et. al, 2018; Park et al., 2016; Sun, 2015). Sun (2015), looking for a connection between teacher mindset and student mindset, went into teachers' classrooms who had a growth mindset based on in depth surveys, and observed the messages they sent to their students through their actions. Surprisingly, teachers who scored very high on the mindset scale sent a wide variety of messages through their actions. Sun (2015) reported that two teachers who both scored 5.7 out of 6 on the mindset survey (very high belief that intelligence is malleable) consistently performed growth mindset teaching practices while another teacher with a nearly identical mindset survey score performed mostly fixed mindset teaching practices. Of the seven teachers that exhibited a growth mindset on a survey and who were observed many times, five of the seven teachers sent mindset messages through their actions that were inconsistent with their beliefs about the malleability of intelligence as measured by a survey. This tells us that teachers who believe in the ideas of a growth mindset do not necessarily do things to send growth mindset messages to their students. This is where I want to focus my study: why is there a disconnect between teachers' mindsets and students' mindsets? If teachers think it is enough for them to just have a growth mindset in order for their students to have a growth mindset, it is problematic because they are not actually helping their students

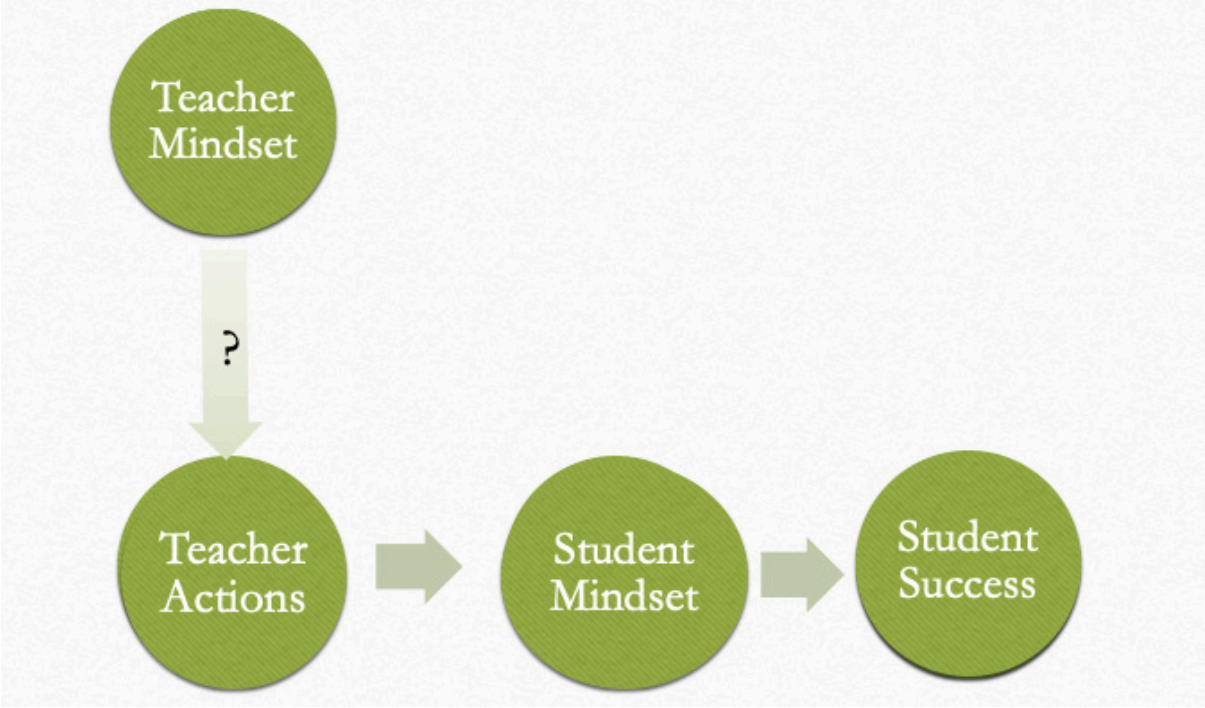
develop a growth mindset. I want to understand why teachers with a growth mindset are not having an influence on their students developing a growth mindset.

Research Questions

As visualized in Figure two, the research has established clear connections between teacher actions and student mindset and student mindset and student success. The studies discussed in the last section also establish that there is not a direct link from teacher mindset to student mindset (Haimovitz & Dweck, 2017; Hooper, et. al, 2018; Park et al., 2016; Sun, 2015). To better understand the disconnect between teacher mindset and student mindset, I want to look at two main sections: the teacher mindset and the connection between teacher mindset and teacher actions. The first two research questions address teacher mindset and the second two questions address the connection between teacher mindset and teacher actions.

Figure 2

Updated Model of How Teachers Influence Student Mindset



1. Is teacher mindset about learning mathematics different than mindset about intelligence?
2. Do mathematics teachers have different mindsets towards honors and regular students?
3. Are mathematics teachers intentionally trying to help their students develop a growth mindset?
4. Do mathematics teachers know how their actions send growth and fixed mindset messages to their students?

One possible explanation of why teachers with a growth mindset are not helping students develop a growth mindset is because they have a fixed mindset about the subject they teach, in this case mathematics. Experts Dweck (2012) and Boaler (2016) have both said that students have more of a fixed mindsets towards mathematics than any other subject, so I want to explore if mathematics teachers have more of a fixed mindset towards mathematics as well.

Research has mentioned that separating students into honors and regular classes sends fixed mindset messages to their students through the labels associated with being in each class (Nasir et. al., 2014; Sun 2015). In personal conversations with coworkers, I have heard how teachers often have labels for their honors and regular students as well, so I wanted to see if these conversations with a handful of teachers were thoughts other teachers had as well. If teachers only have a growth mindset towards some of their students (the honors students), then that could be another possible reason teachers' mindset is not influencing their students' mindset.

The third research question asks if teachers are actually trying to send growth mindset messages to their students. If teachers are not trying to teach mindset or do not know they need to be doing something to teach mindset, then that would be an obvious reason why their mindset

is not transferring to their students. Also related to question three, question four is looking to see if teachers know how their actions are influencing their students. If teachers misunderstand the messages their actions are sending, then teachers are not getting their desired message across resulting in the disconnect.

By finding answers to these questions, we can better understand why there is a disconnect between teacher mindset and student mindset which can help us learn how to help teachers help students develop a growth mindset.

CHAPTER THREE: METHODS

The purpose of this study is to better understand teacher mindset and teachers' efforts to teach students to have a growth mindset and why there appears to be a disconnect between teacher mindset and student mindset. To do this, I sent a survey to secondary mathematics teachers in Utah and asked questions about mindset and their efforts to teach students about mindset. This chapter will describe the participants, survey, and analysis that I used to answer the research questions. The appendix has a copy of the survey statements and questions (Appendix A) and coding protocol (Appendix B).

Participants

The participants in this study are secondary mathematics teachers in Utah. I originally planned to contact teachers in the Alpine, Provo, Nebo, Jordan, and Canyons school districts but then I expanded the study to send to all secondary mathematics teachers in Utah. I sent a short email explaining the study to the teachers via their work email which I found from school and district websites. I was hopeful teachers would participate in the study because they want their voices to be heard. They did not know that the study was on mindset before they started, but they knew it is a survey about helping students learn. The teachers also knew that they were entered into a random drawing for amazon gift cards. After sending emails to 1516 teachers, and two follow up emails to teachers who had not started the survey yet, 497 teachers started the survey, and 406 completed the survey entirely, a rate of about 27%.

Survey

Dweck (1999) developed a survey that can be reduced to three Likert scale statements, which she claims can measure mindset. However, these statements in this short survey are very generalized and only deal with the nature of intelligence in general. Dweck has also mentioned

in an interview (Gross-Loh, 2016) that no one can have a growth mindset about everything all the time, so I designed a survey to also include statements more specific relative to learning mathematics. It still includes the original statements about intelligence as well so we can compare the responses to different subsets of statements.

The survey is comprised of four types of questions. The first three types of questions are Likert-type questions with: (a) statements about the mindset of intelligence, (b) statements about mindsets about students' learning mathematics, (c) statements about mindset relative to honors and regular students learning mathematics. The fourth type of question were free-response about teachers understanding of mindset. Mindset about intelligence means the statements will talk about how intelligence can grow, whereas the statements about students' learning mathematics will talk about students' abilities to learn mathematics. The first three types of questions are answered through a six-point Likert scale where one stands for strongly disagree and six stands for strongly agree with a given statement. The first three types of statements are mixed together randomly to get the teachers to read each statement thoroughly instead of responding to each statement similarly based on the section the statements are in. The last section is comprised of free-response questions. The first type of survey statements were developed by Dweck (1999), and have been used for over 20 years with high reliability and validity since the beginning (Dweck, 1999). The second type of statements taken from Sun (2015), are about mindset as it pertains to students learning mathematics. The third type of statements about how teachers view honors and regular students were modified from Dweck's (1999) and Sun's (2015) surveys to reflect mindsets about honors and regular students.

The free-response section of the survey is to gain more insight into what teachers believe about mindset and its applications in their classrooms. The free-response section of the survey

began by asking teachers to explain what they think mindset is in order to bring to light what background knowledge and understanding they took into the first section of the survey. Next, the survey asked teachers what kind of mindset they think they have about learning in general, about learning mathematics, and about how mindset affects students. To help the teachers be on the same page in answering these questions, a definition of growth and fixed mindsets was included after the teacher had provided their own definitions of mindset for the teachers to refer to. This helped me understand how teachers interpret mindset and help us understand teachers' orientations about mindset in the analysis. This section also included questions about teachers' beliefs about their influence on their students' mindset and how they believe they influence their students' mindset.

This survey was given in a small-scale pilot study to a group of 12 mathematics education graduate students to see what types of results it would produce. I recognize that these 12 participants will have similarities in terms of level of education (all working on a masters degree), and most have a similar level of experience in the classroom (0-3 years) so that affected the outcomes. I expected that their results would tend towards the growth mindset end of the scale, but I wanted to see if the questions would elicit different responses based on the nuances of their different beliefs. Even though the participants were all mathematics education graduate students, there was variety between their responses. The averages of all the Likert scale questions with the lowest being 1 and the highest being 6 ranged from 3.54 to 5.64, a difference of 2.1 points, about a third of the scale. How the questions are scored will be explained in more depth in the survey analysis section.

As I was reviewing the results of the pilot survey, I identified five statements that got very different responses than the other statements. I looked at these statements to see they got

different responses because of poor wording or because it identified a fixed mindset trigger in the participants. Interestingly, four of the five statements that were flagged were the second type of statement, mindset relative to students learning mathematics. The fifth statement that was flagged was the third type, mindset relative to honors and regular students learning mathematics. Figure 3 lists these five statements.

Figure 3

Selection of Potentially Problematic Survey Statements

Q9	In math class there will always be some students who simply won't "get it."
Q11	Some students are not going to make a lot of progress this year, no matter what I do.
Q3	Most of my students are capable for the kind and level of math instruction I am expected to teach.
Q15	In my class(es), students who start the year low performing tend to stay relatively low.
Q23	Given the same prerequisite knowledge, I can use the same activities and lesson plans for all my classes, both honors and regular.

I first checked to see if the statements reflected the idea that students' math ability could grow. With Q9, I added to the statement the stipulation that students can learn things eventually to now read, "In math class there will always be some students who simply won't *ever* 'get it'" (changes notated in italics). When teaching a topic for the first time, there will undoubtedly be students who do not understand initially, but by adding "won't ever get it" we can see if teachers acknowledge students will understand eventually (growth mindset) instead of interpreting this statement as not understanding something initially.

For Q11, the statement was too strongly worded to apply to the different progress levels of students. Instead of saying that the students are going to make *a lot of* progress, I eliminated *a lot of,* so the statement now reads, "Some students are not going to make progress this year, no matter what I do." Students come into classrooms with different knowledge and different learning speeds so everyone will make different amounts of progress during the year. By getting rid of the quantifier "a lot of" for progress, the statement is more inclusive to all the learning that can happen in a classroom.

Taking a second look at Q3, I realized that the statement was asking more about the curriculum teachers were teaching than about how teachers see their students' ability to learn, so the statement was taken out of the survey. Q15 gets at the fixed mindset idea that students who are low performing are not able to learn and will thus stay low performing. Though people had a lower average score on this statement than they did for the other statement in that section (mindset relative to students learning mathematics), this statement still gets at the idea of students' ability to learn. Q23 is being kept for the same reasons.

In the free-response section, "Do you believe you have a growth or a fixed mindset towards your students' abilities to learn mathematics? In other words, do you think your students' ability to learn mathematics is fixed or can grow?", two of the twelve people responded to the questions about the mindset *of* their students, not their own mindset *about* their students. To account for this, I took out the last sentence. Looking back, I can see how the second sentence would make it confusing whose mindset I was referring to.

An important aspect of teacher thinking I wanted to get out of the question "Do teachers influence student mindset about mathematics? Explain." was how much teachers think they influence their students' mindset in comparison to the other factors influencing student

mindset. I modified the question with *how much* at the beginning so that it now reads "*How much* do teachers influence student mindset? Explain." I wanted to capture how much teachers felt that they influenced their students' mindset by asking them to explain, but instead they just talked about what they did to help their students which I captured in the next question in which I added "Explain" at the end of the question to encourage people to elaborate on their initial one word answer

In the responses, I noticed that the participants who had been teaching for longer tended to have a lower mindset score than those who had recently graduated (within the last two years). This prompted me to include in the survey the number of years they have been teaching so I could further look for correlations between the number of years taught and mindset score. After a conversation with a current mathematics teacher and their struggle to hire mathematics teachers with degrees in education, I thought it could be enlightening to see if mindset scores also correlated with the types of degrees earned (mathematics education, other education fields, or other any other non-education related degree).

I also was worried about how long the survey would take teachers to complete. Since teaching is a very busy profession, the goal was for the survey to take 15-20 minutes. In the pilot study the participants only took 5-15 minutes, so nothing was removed solely to make the survey shorter.

Survey Analysis

The first section of survey questions received inputs of one through six from teachers indicating how much they agree or disagree with the statement. The scores will reflect where the teacher is at on the mindset scale where the higher scores reflect more of a growth mindset and the lower scores reflect more of a fixed mindset. Because of the wording of some statements,

those responses will be reversed scored to correspond with the same mindset scale of six being growth and one being fixed, then all scores will be averaged together (Sun, 2015; Dweck, 1999). Statements where the response of "strongly disagree" would correspond with a growth mindset response will be coded as a 6. Scores above a 4.0 will be considered a growth mindset and scores below a 3.0 will be considered a fixed mindset. The scores from 3.0-3.9 are considered to be mid-range and cannot be safely put into one camp or the other (Dweck et al., 1995; Gutshall, 2013; Sun, 2015). I divided the statements back into groups and found a mindset score for each type of statement. I ran paired t-tests on the difference between mindset about intelligence and mindset about student learning, and between different pairs of statements to see if there are statistically significant differences between different types of mindsets and statements.

Next, I looked at the free-response questions to see if teachers are aware of their beliefs on the malleability of intelligence. I hypothesized that teachers would say they have more of a growth mindset than their answers from the first part of the survey indicate. I also looked for what teachers believed their influence is on their students' mindset in general and about mathematics and to see if teachers have different mindsets toward different groups of students. The goal is that the survey will show areas where teachers tend to have more of a fixed mindset.

To code the free-response section of the survey, I used a chart that shows the different evidence I'm looking for each response (Appendix B). Responses to the question "Have you heard about mindset before? If so, what does it mean to you?" were coded first to see if the teachers have heard of mindset before and then for how well the teachers understand the definition. Explanations that include how the intelligence grows will be coded as knowing the

definition of mindset and those responses that do not include growth of some kind will be coded as not understanding mindset.

The next question "Do you believe that you have a growth or fixed mindset in general?" was coded twice: did they self-describe as having a growth or fixed and does their answer reflect a correct understanding of mindset. While some people only responded in one-word answers "growth" or "fixed," I analyzed the teacher responses who elaborated more. I similarly analyzed the question asking the teachers if they had a growth or fixed mindset towards' their students. I then analyzed the responses to see if teachers had the same mindsets about themselves as they did about their students.

Then the following question "Does a students' growth or fixed mindset influence how well they do in a math class?" was coded for a yes or no response and then for what type of influence the mindset has. The types of influence of mindset on students include only discussing that growth mindsets helped their students succeed, only discussing how a fixed mindset was hurtful for students' learning, or discussing both types of influence.

The next question "How do you think students develop a growth or fixed mindset?" was coded by the different types of influences. Initially, the influences on the teachers included friends, parents, teachers, society, an innate trait, and an other category. Because of the vagueness of some of the responses I added some bigger categories of adults in general and experience, and school and changed parents to be family members. Each response was coded with each different type of influence. For the next question I coded to see if teachers believe they have an influence and then how much influence they feel they have on their students. The way the questions was worded did not lend itself to a clear differentiation about the level of

influence teachers believe they have on their students, so the question was coded by the categories a little influence and a lot of influence.

In the final question about what teachers are doing to influence student mindset, I coded the question three times. First the responses were coded if teachers were doing anything intentionally in their classrooms to influence mindset and then what the teachers were doing: explicitly teaching students about mindset, posters and bulletin boards, relationships with students, and indirectly teaching mindset through their teaching practices. Then I coded the responses which indicated they taught mindset through indirect teaching practices to categorize what practices the teachers were doing. The growth mindset practices I was looking for were a retake policy, celebrating mistakes, praising the students' process, and valuing learning over speed. The fixed mindset practices I was looking for included labeling students and a high-performance orientation. Because some practices were not related to mindset and other practices were too vague to code, I created the following additional codes: talking about effort, teachers talking about the multidimensionality of math, and separating celebrating student mistakes and modeling mistakes as a teacher.

Because some responses showed evidence of teachers who claimed to have a growth mindset about themselves and students but still made fixed mindset comments, I examined these responses for evidence of a false growth mindset. False growth mindset is when teachers say they had growth mindsets but are actually sending fixed mindsets to their student. Thus, I was able to find questions that could help identify teachers who potentially had false growth mindsets and then analyze their responses. Dweck (2016) lists three main ways teachers have false growth mindsets: praising effort alone as a consolation prize, helping students set high goals with no support, and blaming a students' fixed mindset for poor performance. I had previously coded the

teachers who used praise and celebrated effort in their classrooms and the teachers who directly taught mindset in the how teachers are teaching mindset to their students question. For the blaming mindset, I looked at the teachers who only mentioned how a fixed mindset is hurtful in the question asking if mindset influences how well students do in class. While this likely did not capture every teacher who has a false growth mindset, it helped us find some of those teachers who do and better understand them.

CHAPTER FOUR: RESULTS

This chapter will detail the quantitative and qualitative results gathered from the 406 completed surveys. The quantitative section will describe what people responded to the Likert scale statements and what the numbers represent. In the qualitative section, I will report on what the types of responses teachers gave to the open response questions and give examples of the types of responses received.

Quantitative

The quantitative data works to answer the first two research questions about the differences between mindset about intelligence and student learning as well as the difference between honors and regular students. The first data we will be examining is the mindset of teachers about intelligence and mindset about students learning mathematics to help answer the first research question. Figure 4 gives the breakdown of each category including the number of statements, the average score, and standard deviation of each section. We will examine the data separately and how teachers scores compared group to group.

Figure 4

Basic Statistics of the Types of Questions

	Number of questions	Average	Standard Deviation
Mindset about intelligence	8	4.7992	0.8692
Mindset about learning mathematics	7	4.8223	0.5787

The scores range from 1-6 where 1 indicates a very fixed mindset and 6 represents a very growth mindset. The category “mindset about intelligence” shows how much teachers think their intelligence can change. A score closer to 6 indicates that teachers think their intelligence

can grow while a score closer to 1 indicates that teachers think their intelligence cannot change. High scores in the category "mindset about learning mathematics" indicate that teachers think their students can grow their capacity to learn mathematics while low scores indicate that teachers think their students cannot increase their capacity to learn mathematics.

These scores were calculated by taking the responses to statements in the category and then averaging them. The average of all the scores in the category mindset about intelligence is 4.7992. The highest score in this category was a 6 (very high growth mindset score) and the lowest score of anyone was 1.5 (a very fixed mindset score). To score a 6, the participant had to answer 6 on all the statements in the category. While there were people who had the maximum mindset score in individual categories, there was not a person who had a maximum mindset score for every statements, indicating that no one has a "perfect" mindset.

Figure 4 shows the average score of each section while the Figure 5 shows how many people fall in each numerical range of scores. Figure 3 shows that not many teachers had mindset scores from 0-3 and the vast majority had scores above 4, meaning that the vast majority of teachers taking the survey had growth mindset responses. It is very interesting that the majority of teachers who responded to the survey have growth mindsets.

Figure 5

Distribution of Responses for Different Mindset Categories

	Counts for 1-1.99	Counts for 2-2.99	Counts for 3-3.99	Counts for 4-4.99	Counts for 5-6	Total
Mindset about intelligence	2	14	40	147	203	406
Mindset about learning mathematics	0	2	27	187	190	406

A question I had was how teacher mindset about intelligence compares to mindset about learning mathematics. The first analysis I did was calculated by taking a teacher's mindset about intelligence score and subtracting it from the mindset about learning mathematics score so differences that are negative indicate a higher mindset score about learning mathematics than about intelligence and differences that are positive indicate that the teacher has a higher growth mindset about intelligence than learning mathematics. The closer the difference is to zero, the closer the two mindsets are aligned. Figure 6 is organized according to the number of teachers that fit in each range. The ranges start out as one apart, but for the data close to zero I shortened the range to be 0.5 to get a closer view of what was happening around where the data was centered.

Figure 6

Differences Between Teacher Mindset About Intelligence and Learning Mathematics Arranged by How Many Teachers are in Each Range of Difference

Difference range	Number of teachers in this category
(-4, -3)	1
(-3, -2)	8
(-2, -1)	29
(-1, -0.5]	40
(-0.5, 0]	118
(0, 0.5]	121
(0.5, 1]	69
(1,2)	19
(2,3)	1

This majority of the data is centered within half a point of zero showing that 59% of the teachers had similar mindsets about intelligence and learning mathematics. 22% of the data is above 0.5 which indicates these teachers have a higher mindset about intelligence than about their students abilities to learn mathematics and 19% of the teachers have more of a growth mindset towards their students' learning mathematics than intelligence in general.

Next, I ran a paired t-test on the difference between the teachers' mindsets about intelligence and learning mathematics. In comparing the teachers' averages, the two tailed p-value was 0.546 indicating that there is not a significant difference between the two mindsets. I then looked at statements from the mindset about intelligence section and paired them up with similar statements in the mindset about learning mathematics section. I came up with three statements, two of them that were fixed mindset statements and one was a growth mindset statement. The paired statements and their corresponding p value are in the table below.

Figure 7

Paired Statements Between Mindset About Intelligence and Learning Mathematics with their Corresponding P-Value

Pair number	Mindset about intelligence	Mindset about learning mathematics	mean difference	P-value
1	Your intelligence is something about you that you can't change very much.	In my classes, students who start the year low performing tend to stay relatively low performing at the end of the year because they can't learn any more math.	-0.2685	p<.0001
2	You have a certain amount of intelligence, and you can't really do much to change it.	There are limits to how much people can improve their basic math ability.	0.3103	p<.0001
3	No matter how much intelligence you have, you can always change it quite a bit.	No matter where a student starts, they can continue to learn more math in my class this year.	-0.8892	p<.0001

I recognize that these statements are not a perfect pair, but I feel like they are similar enough to warrant the comparison. I chose pairs one and two because they both talk about the limits of intelligence/learning and pair three because they both talk about the lack of limits. We see that all three statements had p values of less than .0001 indicating that the difference between the mindset about intelligence and mindset about learning mathematics was significantly different for each pair of statements. We see that the average differences for pairs 1 and 3 are negative indicating that the teachers have a higher growth mindsets about learning mathematics than they do about intelligence, but on pair two, the average difference is positive indicating that for this pair of statements, teachers have a higher growth mindset about intelligence than learning mathematics. Because we have two of the three pairs with high growth mindset scores

about learning mathematics and the other pair higher mindset score about intelligence, that could indicate why the average difference between the statements about intelligence and statements about learning mathematics was not significant.

The second main point of the quantitative section revolves around analyzing the differences between honors and regular students. The statements about honors and regular students were written in four pairs that asked the same thing but interchanging honors students with regular students. An attribute of a fixed mindset would be seeing honors and regular students as having differing potential, so I calculated the difference between their responses to each pair of statements. In Figure 8, each statement is separated by columns and the rows indicate how many points of difference between the teacher responses to regular students and honors students. Where the row and column intersect is how many teachers had that difference between regular and honors students for each statement. These differences were calculated by taking the regular students' response and subtracting the honors students response, so zero represents the same mindset for both groups of students, negative difference represents a higher mindset score about honors students, and a positive difference represents a higher mindset score towards regular students.

Figure 8

Differences Between Teacher Responses to Honors and Regular Students

Difference	To teach my honors/regular classes, I have to show my students examples in order for them to complete similar questions on their homework.	My honors/regular students can change their basic intelligence in math quite a bit.	In my honors /regular classes, students are not able to learn mathematics.	My honors/regular students can be good at math if they put in the necessary work.
-5	0	0	4	0
-4	3	0	1	0
-3	32	0	2	1
-2	91	1	9	2
-1	128	35	110	32
0	97	284	257	342
1	4	73	17	28
2	1	12	3	1
3	0	1	1	0
4	0	0	0	0
5	0	0	2	0

It is of note that the scores are congregated around zero and then tail off towards 5 and -5. Three of the four pairs of statements had the vast majority of responses at zero indicating that most teachers had the same responses for both their honors and regular students. For the statements in column three, most of the data that is not zero is on the negative side indicating that these teachers have higher growth mindset toward their honors students than for their regular

students. The statement in column two has more nonzero scores on the positive side of the scale. The statement in column one is the only statement where the majority is not at zero where only 97 teachers, less than a quarter, have the same response for both classes. The majority of responses are in negative side of the scale.

I took the pairs of statements and ran a paired t-test to see if the difference between teacher response between honors and regular students was statistically significant. The results are in the table below.

Figure 9

Comparison of Paired Statements about Honors and Regular Students

Pair	Statement	Mean difference	P-Value
1	To teach my regular/honors classes, I have to show my students examples in order for them to complete similar questions on their homework.	-1.1380	p<.0001
2	My regular/honors students can change their basic intelligence in math quite a bit.	0.1552	p<.0001
3	In my regular/honors classes, students are not able to learn mathematics.	-0.3	p<.0001
4	My regular/honors students can be good at math if they put in the necessary work.	-.0222	0.2934

What we can see in this table is statements one through three have statistically significantly differences between teachers' views on honors and regular students, while teachers see the students with the same mindset relative to statement four. Also of note is that pairs one and three have negative differences indicating a higher mindset score towards honors students while pair two indicates a higher mindset score towards regular students.

On the survey, there were four other statements that compared honors and regular students directly in the statement itself. Figure 10 shows the four statements and their average in each column.

Figure 10

Average Scores of Statements Directly Comparing Honors and Regular Students

	All students (honors and regular) are capable of solving challenging problems	My regular students (not honors) have as much capability to learn mathematics as my honors students.	Honors students are more capable of problem solving than my regular students.	Students who start middle school in a regular math class are not capable of being successful in an honors math class later.
Average	5.377	5.175	3.899	4.928

Figure 10 shows that teachers on average have high mindset scores when asked statements that typically related to growth mindset (capable of change), whereas the statements asking about problem solving, teachers indicate that honors students are more capable than regular students. This is an example of a question that was reverse coded, so teachers who strongly disagreed with this statement would enter a 1 on the survey, but then their response was coded as a 6. So, the average of this question after it was reverse coded was close to a four indicating that the average response for teachers was a "slightly disagree" with that statement. While slightly disagreeing that honors students are more capable of problem solving than regular students shows more of a growth mindset than any sort of agreeance, it still indicates that on average, mathematics teachers have room to grow on how they view their regular students' problem solving abilities.

Qualitative

The free-response questions work to answer the last two research questions to see if teachers are intentionally trying to help their students develop a growth mindset and if teachers know how their actions send growth or fixed mindset messages to their students. For questions about the creation of the survey questions, see Chapter Three, and to see a copy of the entire survey, see appendix A. For each free-response question, there will be a table with each of the codes for the question and how many responses were collected for each code. After the first qualitative question, the participants were given a brief definition of mindset to refer back to answer the questions to ensure that the teachers are all working from the same definition when questions ask about mindset.

Question One

In order to know if teachers know how their actions send growth or fixed mindset messages to their students, first we need to know if they have heard of mindset. For the first question, I looked for how many people knew about mindset (363 teachers) and how many people had not heard of mindset (43 teachers) as self-reported. Then I coded if their definition represented a correct understanding of mindset. I only coded their definition if they said they had heard of mindset.

Figure 11

Coding of Question 1

Categories of understanding mindset	Examples
Correct understanding: 291	“A growth mindset is the idea that no matter where you are at in your learning, you can always learn more. A fixed mindset is the idea that I can't learn more because I'm not capable”
Incorrect understanding: 11	“Isn't growth mindset where you grade your students based on their growth and not on your current curriculum standards? I follow a lot of math teachers on Twitter and I see them posting the ways they track students’ progress and they call it "growth mindset."
Partial understanding: 16	“Yes, UCTM had breakout on this subject this year. Growth mindset emphasizes that it is ok to make mistakes and mistakes is where the most learning can occur.”
No definition: 45	“Yes - I have read mathematical mindsets, and have used some growth mindset activities in class”
363/363	

This information is interesting as it shows that 89% (363/406) of the teachers have heard about mindset and that at least 84% ((291+16)/363) of those people have at least partially correct understanding of mindset. This number is probably higher because it is likely that at least some of the 45 people who did not give any definition did know the correct definition. These numbers show that at least 76% (307/406) of our sample population has heard about mindset and has some understanding.

Question Two

For question two, “Do you believe that you have a growth or fixed mindset in general?” I coded the responses for growth, fixed, or both and looked for evidence that they had a correct understanding of mindset from what the teachers responded (Figure 12), and from their responses, I looked to see if they had a correct understanding of mindset (Figure 13).

Figure 12

Coding of Question 2

Code	Example
Growth: 317	"Growth. I have the perspective I can always learn more. Ability to learn more also increases over time, but desire to learn is paramount."
Fixed: 16	"I think I actually have a fairly fixed mindset but I want to have a growth mindset. I know that as I was growing up I had pretty fixed mindset because I can see how my fear of failure effected my choices and decisions."
Both: 68	"I'm trying to have a growth mindset, but catch myself at times having a fixed mindset about myself"
n/a: 5	

We can see from Figure 12 that only 4% of people say they only have a fixed mindset. It is also interesting to note that only 17% of teachers recognized that they had both mindsets even though everyone does indeed have both mindsets.

Figure 13

Coding from Question 2 if the Teachers Seem to Understand Mindset Based on their Responses

Indicated correct usage of mindset	Example
Yes: 307	"It wasn't really until high school when I realized I could learn anything I wanted if I was willing to study and work hard."
No: 14	"Growth, I have a positive outlook on things even when things are bleak."
No explanation: 80	"Growth"
401/401	

Note: Figure 13 only totals to 401 because the five n/a responses were not included from Figure 12

When coding the data to see if teachers understood mindset, I looked for indications that growth can happen. However, according to Dweck (2010; 2017) no one has a growth mindset

about everything, nor does anyone have a growth mindset all the time, which begs the question if people who say they do not ever have a fixed mindset at times really understand mindset. Perhaps the better indication of people's understanding of mindset is if they indicate that they have both growth and fixed mindsets. However, the question did not ask them if they had a fixed or growth mindset, it just asked for their mindset in general, which could explain why participants did not indicate that they have both mindsets.

Question Three

To start to understand if teachers are intentionally trying to help their students develop a growth mindset, we need to know if teachers believe they can influence student mindset. The responses to "Do you believe you have a growth or a fixed mindset towards your student's abilities to learn mathematics?" are recorded below.

Figure 14

Coding of Question 3

Code	Example
Growth: 332	"Growth. All students can become better at anything they practice. Math is like free-throw shooting. If you practice it and are taught the correct way to practice, you will improve and become "good" at it."
Fixed: 12	"Fixed: Some students simply cannot comprehend certain topics. I think there is a limit to what people can learn. All students can learn some mathematics for sure, not all students can learn every topic taught in high school - especially in the time allotted."
Both: 62	"Growth but I do believe that it's hard not to fall in the trap of having a fixed mindset. This comes from long periods of time having to deal with students that refuse to want to learn and progress in math."
406/406	

After analyzing the results found in Figure 14, I noticed the similarity between the responses in questions two and three and compiled them into their own table (Figure 15) for comparison.

Figure 15

Comparison of Self-Rated Teacher and Student Mindset

	Growth	Fixed	Both
Rate your own mindset (teacher's mindset)	316	16	68
Mindset about your students' ability to do mathematics	330	12	62

Figure 15 shows that similar numbers of people had growth mindsets about themselves and about their students for growth, fixed, and both. I then decided to look at the individual teachers who switched mindsets about themselves and their students and found that 78% of teachers (315/406) recorded that they had the same mindset toward themselves as they did their students, and 91 teachers did not. Figure 16 shows the 91 teachers who have different mindsets about themselves then about their students. The different intersections indicate how many teachers had different the mindset about themselves (the rows) as they did their students (the columns).

Figure 16

The Change of Mindset Score from Teacher to Student

	Self-described mindset about students learning mathematics (columns)		
Self-described mindset (rows)	Growth	Fixed	Both
Growth	n/a	7	31
Fixed	7	n/a	5
Both	40	1	n/a
Total: 91/91			

What this table shows us is that the most people who switched their answers switched from saying they had both mindsets about themselves and only mentioned a growth mindset about their students (40/91) and the second highest was participants who only mentioned a growth mindset about themselves and mentioned both mindsets about their students (31/91). Only seven participants said they had a growth mindset about themselves and a fixed mindset towards their students while seven different participants had a fixed mindset about themselves while having a growth mindset about their students.

Question Four

Teachers are not going to be intentionally doing anything to influence mindset if they do not believe that a student's mindset influences how well students do in class, which was why I asked question four. Three hundred and ninety-eight of the teachers said that mindset does influence their students in mathematics class and 8 teachers said it does not. I initially recorded if mindset influenced students, and then looked to see if they described that influence as growth

mindset positively helping students, fixed mindset harming students, or if they mentioned the effects of both mindsets.

Figure 17

Coding of Question 4

Code	Example
Yes, growth mindset is good: 69	“Yes. If they believe they can they are more likely to put in the work it takes to achieve.”
Yes, fixed mindset is harmful: 120	“I believe it does. I think that some students have consciously or subconsciously learned that they are either a "math person" or they aren't and that's just the way it is.”
Yes, growth is good and fixed is harmful: 175	“Definitely. If a student believes that if they put in enough effort, they will eventually get it. If they believe that they don't understand math and never will, they will have a very hard time believing me when I tell them it is possible.”
Not mentioned if growth is good or fixed is bad: 34	“Yes!"
398/398	

This data tells us that 98% of the participants believe that a student’s mindset influences how well they will do in math class. 35 more people than the 363 who initially stated that they had heard of mindset (see Figure 11) believe that mindset influences how well students do in class, showing that even some participants who had not heard of mindset before, once hearing briefly about it, believe that mindset influences students. Both a growth and a fixed mindset will influence how the students do in math class, but it is of note that nearly double the number of teachers only said fixed mindset is harmful instead of a growth mindset being helpful. This could be a potential indicator of a false growth mindset which will be discussed later in this chapter.

Question Five

For question five, I was looking to see how teachers think student mindset is developed, for if teachers do not believe they can make an influence, they will not be trying to help their students develop mindset. The responses can be divided into two groups: more broad and more specific. The influences on mindset that are broad are experience, friends, society, and adults in general. More specific influences mentioned are school/teachers, home, and innate traits.

Figure 18

Coding of Question 5

	Code	Description of Code
More Broad	Experience: 162	Past experiences, opportunities students have had, students seeing themselves grow or fail, from challenges students face
	Friends: 47	Any reference to a peer near their age such as friends, siblings, classmates, basically any non-adult person
	Society: 26	The world they grew up in, messaging from society (girls aren't good at math), culture (movies, tv shows, books),
	Adults in general: 51	A broad category for teachers who just mentioned adult Figures but did not specify if they were teachers, coaches, or family members.
More Specific	School/teachers: 163	Teachers past or current, classroom culture (mistakes, retake policies, emphasis on learning), principals, school policies (grading, honors and regular classes), coaches
	Family members: 163	Parents, grandparents, aunts, uncles, lessons learned from any family member or guardian.
	Innate traits: 51	Something the student is born with, a trait that have or they do not have, mindset is a result of other innate traits like optimism or work ethic.

Note: For this question, participants were left with a blank section to answer as many or as little responses as they would like, hence some responses had multiple categories leading to a total greater than 406.

These results show that most teachers believe that mindset is not an innate trait that is unchangeable. It is also interesting that in asking this question about teachers, only 40% of the teachers mentioned anything related to school as a source of influence on the students.

Question Six

Related to question five, I wanted to know how much teachers felt they had an impact on their students' mindsets, and 97% of teachers said they felt like they had some degree of influence. I first looked to see if teachers thought they had significant impact on their students' mindsets, and then if the teachers who said they influenced their students' mindsets, I looked to see if teachers thought they had little impact or a lot of impact.

Figure 19

Coding of Question 6

Code	Example
Some impact: 67	"I think teachers have a bit of influence when it comes to a students' mindset, but they must first have an educational relationship with the teacher."
A lot of impact: 229	"Teachers have a great influence on how students see their own intelligence and how it can grow. Just a teacher's attitude can help a student feel like they can grow in that class. Offering opportunities to grow in knowledge and intelligence is another way teachers can influence students."
Teachers who mention that they have impact, but do not specify how much impact they have: 98	"Teachers can set the tone in a classroom and encourage each student to keep trying until students are successful. Teachers imply by their behavior a belief that students can be successful."
394/394	

These numbers show us that teachers believe they make a difference in their students' mindsets and at least half of teachers (229/406) believe they have a significant impact. In retrospect, I should have had the teachers respond to this on a sliding scale so they could measure their impact themselves rather than me deducting from their responses the level of impact. It is interesting that when directly asked, teachers believe they make an impact on their students'

mindsets, but when they were asked what influenced their students' mindsets, less than half (40%) mentioned teachers or school (Figure 18).

Question Seven

Question seven deliberately asks, "Do you do anything deliberately in your classroom to influence your students' mindsets?" very similarly to the third research question. I coded the responses to see what the teachers do in their classrooms to help students develop a growth mindset if anything. A vast majority of teachers said they were doing things to influence mindset (389/406). After looking to see if teachers do anything deliberately, I then coded to see what teachers are doing (explicitly teaching mindset, indirectly teaching mindset through teaching practices, posters, and relationship with students).

Figure 20

Coding of Question 7: What Teachers do to Influence Student Mindset

Teacher action	Example
Explicitly taught mindset: 94	Lessons, videos, books, and activities that explicitly tell students they are capable of growing
Indirectly teaching mindset through teaching practices: 274	Teaching practices that teach mindset: retake policy, celebrating mistakes, praising students, labeling students, high emphasis on performance, teaching the multidimensionality of mathematics
Posters or bulletin boards: 25	Any materials on the wall including posters, words, and bulletin boards with messaging about brains growing, how students are capable of growing, etc. These may or may not have been accompanied by lessons about mindset.
Relationship with students: 33	Creating relationships with students so students feel like they can trust their teachers, that their teachers believe in them, and that the classroom is a safe space.

Note: Teachers could have mentioned more than one method of influencing student mindset, so the total responses to types of practices are more than the 389 teachers who are deliberately trying to influence student mindset.

Most teachers believe they are influencing their student's mindsets. To see what practices teachers used to indirectly influence student mindset, I then coded the 274 teachers who

mentioned that their teaching practices influence student mindset what types of teaching practices teachers used to teach mindset in Figure 21. These practices fell into two categories: practices that dealt with student affect and practices that dealt with teacher pedagogy and policy.

Figure 21

Teaching Practices that Teachers Use to Indirectly Teach Mindset

	Practice	Example
Affect	Praise effort: 89	"I congratulate the process over the result. If I do praise a result (like a good score), I always combine it with some mention of the process it took for them to get there, like the hard work, diligence and tears that sometimes are she'd. I congratulate improvement even if it's just an F to a higher F."
	Celebrate mistakes: 73	"Celebrate mistakes, a lot of discussion, talk about how failure is good and we learn so much from it."
	Not allowing negativity: 30	"when they tell me "I can't do this" I tell them "You can't do this YET, but you will."
Pedagogy and Policy	Student goal setting: 13	"I give them opportunities to set goals for themselves and see it through"
	Teachers modeling mistakes: 11	"I make mistakes so that my classes can see me struggle and they are able to help me."
	Open ended problems: 14	"I also intentionally choose math problems that are open for exploration, so students don't think that math is only ever finding the right answer."
	Retake Policy: 44	"I encourage quiz corrections and allow retakes."

Note: Teachers could have mentioned more than one method of influencing student mindset, so the total responses to types of practices add up to more than the number of responses.

Additionally, found while coding the responses were 127 teachers who gave teaching practices that were unrelated to mindset or that were too vague to be coded. Also, there were 14 teachers who mentioned practices that send fixed mindsets to their students.

False Growth Mindset

As I was analyzing the data, I began to wonder if any of these teachers could have a false growth mindset: the idea that people can believe they have a growth mindset, but their actions reflect a fixed mindset (see Chapter Two for more research and explanation on false growth

mindset). There are three main indicators for false growth mindset: a) using praise as a consolation prize for failure instead of using praise to encourage the effort that resulted in growing, b) telling students they can do anything without the supports to help them accomplish their big goals, and c) blaming a student's fixed mindset for their poor performance and a permanent attribute of the student (Dweck 2010; 2017). Being able to identify teachers who know how to "talk the talk" but do not know how to "walk the walk" and are not correctly using growth mindset to help their students could be helpful to start thinking about how to bridge the gap between teachers who know about mindset but are not helping their students develop growth mindset.

To find these characteristics, I looked at teachers who mentioned praise as a way to influence their students' mindset (Figure 21), teachers who explicitly taught students their brains could grow (Figure 20), and teachers who only said fixed mindset was harmful (Figure 17). Any of these practices alone do not necessarily equate directly to false growth mindset, so I used these indicators to flag the survey participant and then reread their responses to see if the praise was given as a consolation prize instead of as reinforcing hard work that led to desired result, if the explicit instruction lacked support for students to accomplish big goals, or if the teachers were blaming the fixed mindset for students poor performance.

The survey questions were not initially written to discover if teachers have false growth mindset, so there could be many more teachers that have a false growth mindset than the 50 found in my analysis, but we cannot conclude how many teachers have a false growth mindset at this time. While sorting through the data, I only recorded responses that I could definitely say showed a false growth mindset, but there were others that I did not have enough information about to decide one way or another. For example I coded where the teachers used praise, but

because teachers could be praising their processes that lead to understanding or be giving out praise as a consolation prize, we could only code the responses for false growth mindset that clearly used praise as a consolation prize.

Other Results

During the analysis I noted a common theme throughout these responses, that teachers were discussing obstacles they faced trying to help their students develop growth mindsets. Of the 406 teacher in the survey, there were 126 obstacles mentioned by 115 different teachers, about 28% of the teachers. This is particularly noteworthy because the questions did not ask teachers to discuss obstacles they faced in their efforts to help students develop growth mindset, but 28% of teachers mentioned them unprompted.

Another common theme noticed from the responses is teachers equating mindset to effort alone. When giving definitions about mindset, a lot of teachers only mentioned effort, and when teachers were asked how mindset influences students, over half of the teachers discussed effort. Effort is an important element of growth mindset, because without effort, growth is not possible. However, helping students develop a growth mindset is about giving students the tools they need to be able to grow including goal setting, celebrating mistakes, showing them how to learn from failure, and teaching them about the utility of effort to name a few. Effort was not exclusively coded for in this analysis, but it was discussed by many teachers. More studies on effort could prove noteworthy.

Summary

Results have been found to answer all four research questions about our larger problem why there is a disconnect between teacher mindset and student mindset. There are three main ideas from the results chapter. First, there is not a difference in the average mindset score for

intelligence and learning mathematics, though when we look at specific pairs of questions, we can see some evidence of difference. Second, there are differences in the way mathematics teachers see honors and regular students. Third, while most teachers have heard of mindset and can correctly define it, there is evidence that some teachers do not understand mindset well. In Chapter Five, we will continue to explore other possible explanations for the disconnect by further exploring the teacher mindset portion of the diagram and the arrow connecting teacher mindset to teacher actions.

CHAPTER FIVE: DISCUSSION

This chapter will discuss the common themes found in the data that answer our four main research questions: how our understanding of teacher mindset is more complicated than can be determined by a simple Likert-scale survey, how teacher's understanding of mindset influences the types of actions they use in their classrooms, and what obstacles teachers face in helping students develop a growth mindset. Initially four research questions were laid out in attempts to answer the bigger question why there appears to be a disconnect between teacher mindset and student mindset. While I found answers to the initial four research questions, as new information emerged relative to the big picture questions in different ways, I was lead to surprising answers that sparked more questions for future research.

Initial Four Research Questions

As a reminder, the four research questions deal with two main sections of the flow chart connecting teacher mindset to student success (see Figures 1 and 2): teacher mindset and the connection between teacher mindset and teacher actions.

1. Is mindset about learning mathematics teaching different than mindset about intelligence?
2. Do mathematics teachers have different mindsets towards honors and regular students?
3. Are mathematics teachers intentionally trying to help their students develop a growth mindset?
4. Do mathematics teachers know how their actions send growth and fixed mindset messages to their students?

This chapter will explain the answers I found.

Complexities of Teacher Mindset

A possible reason for the disconnect between teacher mindset and student mindset is because of the way teacher mindset is being measured. In this study, I looked at mindset from perspectives beyond general mindset about intelligence, namely comparing teacher mindset about intelligence and learning mathematics and teacher mindset towards honors and regular students. These comparisons were done to see if teachers have different mindsets about different topics and about different groups of students. In previous studies about mindset, teachers are typically asked questions only about intelligence. People's mindsets can vary based on the different circumstances and different situations can trigger fixed mindsets into people with typically more growth mindsets. Because everyone is a combination of both mindsets (Dweck, 2016), it is important to see where teachers have differing mindsets to see what may be triggering fixed mindsets in the teachers. If there are teachers who have growth mindset scores on the intelligence section of the survey, but show fixed growth mindsets in other areas of the survey analysis, then that would explain in part why the simple measure of teacher mindset does not correlate with student mindset.

Differences Between Mindset about Intelligence and Learning Mathematics

In looking for answers to the first research question, I asked a group of currently practicing secondary mathematics teachers in Utah to respond to statements about mindset about intelligence and mindset about learning mathematics. I found that in this population, beliefs about mindset about intelligence and mindset about students learning mathematics were about the same. The average mindset score of the 406 math teachers who responded to the survey for mindset in general was 4.795 while mindset for learning mathematics 4.820. This was confirmed when I ran a paired t-test on the mean difference between the two mindsets which

resulted in a p-value of 0.546 indicating that these differences are not statistically significant. I also calculated the difference between mindset about intelligence and mindset about learning mathematics and found that 346 teachers had one point or less of a difference between the mindset scores. This shows us that on average math teachers in Utah have similar mindsets about learning mathematics and mindset about intelligence and it's fairly high (4.816, the average of all the scores from all the teachers). Because mindsets about intelligence and mindsets about teaching mathematics do not differ, I cannot claim that it is the source of disconnect between teacher and student mindset.

When I took a closer look at specific statements, I found that there was some difference between teachers' mindsets about intelligence as compared to learning mathematics. I paired statements that were similar in ideas about the limits or lack thereof of intelligence/ability to learn mathematics and ran paired t-tests and found that the difference for each pair was statistically significant with p-values less than .0001. One pair of statements said that "You have a certain amount of intelligence, and you can't really do much to change it" and "There are limits to how much people can improve their basic math ability." These were paired together because they both dealt with limitations that cannot change. For this pair, the mean difference was positive indicating a higher growth mindset score towards the first intelligence statement than the latter learning mathematics statement. Another pair of statements had a negative mean difference indicating a higher mindset score towards learning mathematics. These statements said, "No matter how much intelligence you have, you can always change it quite a bit" and "No matter where a student starts, they can continue to learn more math in my class this year." In this case, teachers had higher growth mindsets that their students can keep learning math more than their intelligence can grow. So, while on average teachers have the same mindset towards

intelligence and learning mathematics, when we look at specific pairs of statements, we see that there are some differences in their mindsets. Because the differences are seen in individual statements and not as a collective score for the section, this could explain in part why previous studies did not find the connection between teacher mindset and student mindset.

Differences Between Mindset of Honors and Regular Students

To test this, I started by checking each individual pair of statements to see if we could get more insight into how teachers see honors and regular student. The only statement where there was not a statistically significant difference between the honors students and the regular students was the statement "My regular/honors students can be good at math if they put in the necessary work." I am guessing this could be because the teachers could see the "necessary work" needed to be good at math as different for each group of students. Also of note, was statement about honors and regular students "To teach my regular/honors classes, I have to show my students examples in order for them to complete similar questions on their homework." This statement had a low average score and was also the only statement that did not talk about their students' abilities in general, but rather about the teacher actions, possibly indicating that it is easier to talk about mindset as an abstract idea, but it is harder to think of all students as capable when put into practice. The only pair of statements that had a positive difference, or a higher mindset towards regular students was the statement "My regular/honors students can change their basic intelligence in math quite a bit." While these teachers had a higher growth mindset towards regular students, the way the statement is worded could indicate that they think their regular students have more room to grow than their honors students, which indicates more a false growth mindset overall. These pairs of statements reveal that teachers do see their honors and regular students differently.

Next, I asked four statements that directly compared honors and regular students within the statement. When we asked teachers about different skills that may not be directly related to mindset, we can see that they view these two groups of students differently. For example, when we asked them to respond to the statement "honors students are more capable of problem solving than regular students," the mindset scores were much lower (3.899). We asked about their problem solving ability in another way by asking them to respond to the statement "to teach my honors/regular classes, I have to show my students examples in order for them to complete similar questions on their homework." We gave this statement about both honors and regular students, and less than a fourth of the teachers had the same response towards honors and regular students (24%). As previously mentioned, there was also a statistically significant different between the two questions indicating that teachers saw honors students with more of growth mindset than their regular students. This indicated that teachers think their honors students are more capable of problem solving so they do not need as many examples before they can do their homework, unlike their regular student counterpart. After comparing the four pairs of statements individually, I averaged the four honors students responses and the four regular students responses and found the average difference between the two averages (all four honors students questions and all four regular student questions respectively), which was negative and statistically significant. This shows that teachers see their honors students with more of a growth mindset than their regular students. Thus, although the teachers say they have an overall growth mindset, if they view students abilities differently it is an indication they have a false growth mindset because they believe they have a growth mindset, but actually have fixed mindsets towards some groups of students.

The analysis is revealing that teachers have a basic understanding that mindset is about students' abilities to grow, but they have trouble seeing the capability of all their students. When given statements comparing the two groups of students, the majority of teachers who did not see the students as having the same capabilities and saw honors students are more capable (see Figure 9 in Chapter Four). The only exception to this trend was when asked about their students' abilities to change their intelligence in math. Seventy percent saw honors and regular students as the same while 21% saw their regular students as being more capable of changing their math intelligence as compared to the remaining 9%. To answer the question "do teachers have different mindsets towards honors and regular students?" we can see that many of them do see these students differently. Having different mindsets toward different groups of students could be another reason why there is a disconnect between teacher and student mindset.

Additional Observations

When asked how teachers think students develop a growth mindset, 51 teachers responded that they thought mindset was an innate trait or based on innate and unchangeable qualities students had. When 13% of teachers discuss mindset in a way that is unchangeable, they are displaying a fixed mindset. These 51 teachers displaying fixed mindsets are more than the teachers who reportedly had a fixed mindset in either mindset about intelligence (16 teachers) or mindset about learning mathematics (2 teachers) sections of the survey. This could indicate that mindset is more complex than can be seen with Likert-scale questions alone because there were 33 more teachers with fixed mindsets recorded in this one question than was noted on the Likert section of the survey.

Mindset is much more complex than just answering 8 basic Likert-scale questions. Even in this survey and in Sun's (2015) survey where different types of Likert-scale questions were

used, when one tries to compile a mindset score based on averages of groups of questions, even if the questions are similar, details and complexities of mindset can be missed if more careful analysis of individual statements is not done.

The Influence of Teacher Mindset on Teacher Actions

This second part of the results deals with the other potential area that could explain why there is a disconnect between teacher mindset and student mindset—the connection between teacher mindset and teacher actions. A teacher's mindset influences the actions and choices teachers make on how things will be done in their classrooms. As discussed in the literature review, teacher actions influence student mindset (see Chapter Two). This section will discuss how teachers view their role in influencing student mindset and how teachers think their actions influence mindset.

How Teachers View their Role in Influencing Mindset

When I asked the teachers to explain how students develop growth or fixed mindsets and less than half mentioned school or teachers (40%). If teachers did not mention themselves in how students develop mindset, they probably are not thinking about how their actions influence student mindset. Another concern I saw from the survey was that teachers are not realizing the level of impact they have on students' mindset in mathematics. About a quarter of teachers, 26%, who talked about the impact they made on student mindset said they made little to no impact on their students' mindsets. If teachers do not think they have an impact, then they are not paying close attention to the mindset messages they are sending students through their practices.

In several survey responses, high school teachers mentioned that they believed they could not have much influence on student mindset by the time they came to them in the upper grades. When teachers believe they do not have an influence on their students' mindset, then

their ability to influence mindset decreases. Here are some examples of teacher responses who think little of their ability to influence their students' mindset in higher grades: "I think the younger the student is, the more influence a teacher has to set up the proper mindsets. When students are in high school, it is more difficult to change their attitudes about their learning abilities." One teacher shared her experiences with different age groups: "Overall, my junior high students would try to be successful. I was able to show a lot of growth with those students because they are still willing to try. High school is much harder; they have already decided whether they are 'good' at math or not. If they have decided they are not good at math, they don't even try." We can see that many of these teachers think it is easier to teach mindset to younger grades or that it is really hard in the older grades perhaps implying that it is too hard or not very likely as seen by comments like "By high school, many students are pretty set." or "As a high school teacher of mainly juniors and seniors, this is a tough battle. Unfortunately, it's a battle that is rarely won at this point in their lives." While nothing concrete can be concluded at this point because this survey did not collect what grade the teachers were currently teaching, further exploration on the how teachers at different grade levels see their abilities to change their students' mindset could prove insightful in future research.

Another way I analyzed the responses to see how teachers saw their role in influencing student mindset was if they were deliberately trying to help their students develop a growth mindset. Specifically, 389/406 teachers self-reported deliberately doing things to influence their students' mindsets. This shows us that most Utah secondary mathematics teachers are aware of mindset and are trying to help their students develop a growth mindset (see Figures 20 and 21 for a full list of what teachers are doing to influence student mindset) to some degree. What was

informative from the survey was how teachers are trying to help their students develop a growth mindset which will be discussed in more depth in the next section.

How Teachers Think their Actions Influence Student Mindset

As previously discussed, many teachers are trying to intentionally help their students' mindset and believe they have some impact on their students. In the next section of analysis, I will discuss if teachers correctly understand how their actions influence mindset. Some teachers are doing things that will help growth mindsets (celebrating mistakes, tying praise to their processes, multidimensional teaching), but other teachers actions are neutral relative to teaching a growth mindsets (asking better questions, using technology, working in groups) , and others are actually sending fixed mindset messages to students (not allowing retakes, focusing on final performances, labeling students).

From previous research (Haimovitz & Dweck, 2017; Hooper et al., 2018; Sun, 2015; Park et al., 2016) we know that teachers' growth mindsets will not directly transfer to students so the 33 teachers who said that creating a good relationship with their students will help them develop a growth mindset are mistaken. Developing relationships with students is an important teaching practice, but a relationship alone will not lead to growth mindsets in students. Research talks about the positive impact of teaching students that their abilities can grow (Dweck 2010; Sun 2015), and it seems like the obvious way to influence student mindset, but only 23% of teachers reported that they took time to explicitly teach students that their abilities can grow. Explicitly teaching students about mindset should be one of the first ways teachers help their students develop a growth mindset (Dweck, 2006, 2016). Other teaching practices can reinforce the idea that they can grow, but if students are not aware that their math abilities can grow, then the good practices will not be as effective. Twenty-two percent of teachers discussed praising

effort, but because many of the responses were so short, it was hard/impossible to tell if the teachers were using praise correctly. If praise is given out as a consolation prize for failed success than it can actually send more fixed messages than growth. For example, when a student brings back a failed test and the teacher says, "It's ok, at least you tried," the student is getting the message that even though they tried, they still are not capable enough of passing the test which sends fixed mindset messages to the students. This is an example of a false growth mindset: you think you are sending growth mindset messages, but you are actually sending fixed mindset messages. This will be discussed more in depth later in this chapter. What I realized from the analysis of what teachers are doing in their classrooms is that many teachers do not know how to effectively help their students develop a growth mindset or how their actions are negatively influencing student mindset.

When I asked teachers how they help their students develop a growth mindset, 21% of teachers said teaching practices that were not related to mindset at all. There were also 50 teachers (12%) who showed signs of having a false growth mindset, meaning they thought they were sending growth mindset messages, but in reality, they were sending fixed mindset messages for students. What we know currently is that some teachers know how to send growth mindset messages and some teachers are not aware of the messages they are sending to their students. This could explain a major reason why teachers' mindsets are not indicators of their students' mindsets. If teachers do not know how their actions can send growth or fixed mindset messages then their impact is significantly lessened.

Obstacles Teachers Face when Helping Students Develop a Growth Mindset

While analyzing the teacher responses in the free-response section, I found 115 teachers that mentioned unprompted by any question an obstacle they faced in trying to help their

students develop a growth mindset. These obstacles included directly saying they did not have the knowledge of what practices influenced mindset, feeling like they do not have time or energy to change something in their classrooms, being afraid of the backlash of change from school administration or parents. Referring to Figure 2, these obstacles would fall into the arrow connecting teacher mindset and teacher actions. If a break down is happening between teacher mindset and teacher actions, that could be one part of the explanation why teacher mindset does not directly transfer to student mindset. During my analysis of these obstacles and other survey responses, I categorized the obstacles teachers face into two main groups: a lack of still of how to help students develop a growth mindset and a lack of understanding about mindset.

Teachers' Lack of Skill in Teaching Growth Mindset

As I was analyzing the survey responses, I began to see that while many people had heard about mindset and could give a brief correct synopsis about it, knowing how to get that information to students required additional knowledge. Ball et al. (2008) discuss that common content knowledge or even specialized content knowledge is not all that is needed to be a good teacher; teachers also need knowledge of content and teaching**.** In other words, just knowing about a topic is not enough to know how to teach it well, and in this case, just hearing about mindset is not enough for teachers to know how to teach it to their students.

I asked the teachers what they do to help develop growth mindset in their classrooms, and it exposed that teachers may not know how to teach mindset. Twenty one percent of teachers gave responses that had nothing to do with mindset, 10% of teachers gave responses that were could have been about either growth or fixed mindset, and 4% of teachers gave us fixed mindset answers. Additionally, 12% of teachers showed a lack of understanding through Dweck's (2016) three main false growth mindset indicators, though other instances of false growth mindset were

also seen. Sixty percent of teachers only listed one way they are teaching mindset to their students which could indicate that they have a limited skillset. Only 23% of teachers mentioned that they explicitly teach their students that their intelligence and capabilities in mathematics can grow, which is a crucial and effective way teachers can help their students develop a growth mindset (Claro et. al., 2016). These percentages show that there are teachers who do not understand how to teach mindset. Teachers who do not know how to teach mindset could be a reason why teachers with a growth mindset are not sharing that growth mindset with their students.

All of these obstacles could indicate another reason why teacher mindset is not transferring to student mindset: teachers lack the skills needed to help students develop a growth mindset. The 126 unprompted obstacles show there are teachers with unanswered questions teachers have about how to teach mindset to their students. The teachers who are not teaching mindset correctly or not teaching mindset in multiple ways show that they need more and better tools on how to help their students develop a growth mindset. All of this indicates that some teachers need help developing the skills necessary for helping students develop a growth mindset.

Teachers Lack of Understanding about Mindset

After analyzing the teachers' survey responses, I noticed that while most could correctly define mindset, their answers made me question if they actually understood what it meant to have a growth mindset. When a teacher said "I do think that some students don't really have a fixed or growth mindset, they just have a 'I don't care, and you can't make me do anything' mindset" it shows that they do not really understand mindset as the student's ability to grow in their intelligence and mathematics skills. While teenagers can show a lack of caring about

school and more specifically math, when teachers use this lackadaisical attitude as an excuse to not help this student develop a growth mindset, the teacher has already lumped them into a category as unreachable which shows the teachers has a fixed mindset toward that student. Dweck (2006) shared a touching story of a boy Jimmy who hid behind this "no effort" attitude, but it was really a cover because he thought he was dumb. When he learned that he was not dumb and that he could learn, his grades increased along with his confidence in himself.

While effort is a characteristic of those with a growth mindset, it is not the defining characteristic of mindset. While coding the data, I noticed that many teachers only mention effort while discussing different aspects of mindset. Many people seem to equate showing effort as having a growth mindset, but a growth mindset is more about seeing your ability to grow. When looking at responses of teachers of how mindset influences their students, well over half discussed how effort, or lack of effort, was the reason for success or failure in the classroom. The survey questions were not designed to see if people only associated effort with mindset so it is hard to definitively say exactly how teachers in the survey correlate effort and mindset, but the responses do indicate that there could be a misunderstanding of mindset.

Another indicator that teachers might not have a deep understanding of mindset is how they self-described their mindset. Mindset is more complex than "yes I have a growth mindset." Three hundred and seventeen teachers only mentioned having growth mindsets while 68 people mentioned having both growth and fixed. Everyone has a combination of both growth and fixed mindsets and being able to recognize what sparks fixed mindsets is how people strengthen their growth mindset. Teachers that do not recognize that fixed mindsets happen to everyone do not understand mindset in very much depth.

A subset of teachers who think they understand mindset are teachers with a false growth mindset. Carol Dweck (2016) explains that false growth mindset is when people twist principles of growth mindset to send fixed mindset messages. This typically happens in three main ways: a) using praise as a consolation prize for failure, b) telling students they can do anything without the necessary supports, and c) blaming a student's fixed mindset for their poor performance because the fixed mindset is seen as a permanent attribute of the student. I found indicators of a false growth mindset from these teachers and found results that support the idea that teachers are not really understanding growth mindset.

I found 89 teachers praised effort. Because of the shortness of their responses, often there was not much information to tell if teachers were praising students' effort in their process (as opposed to praising for their results) or using praise as a consolation prize, but I could only pin down nine teachers who did use praise this way. While we do not know exactly how each of these teachers used praise, those teachers who use praise as a consolation prize are not truly understanding mindset. Teachers are trying to support their students with their comments "I don't care if you get the answer right or wrong, I only care that you are TRYING," but this sort of praise is harmful when students do get the answer wrong. It sends the message to their students that effort is all that matters even if you fail, and now the students are left without the tools, guidance, and support they need to facilitate their growth after failure. Teachers who understand mindset will use praise to help solidify the work it takes to grow, not using praise to reinforce in their minds that they will always be a failure and as a result would probably use care in describing the nature of the praise they were using.

It was harder to tell if teachers were setting high standards without the supports to reach them (the second main indicator of a false growth mindset) because the survey did not ask about

this. I found these teachers who had this type of false growth mindset by looking at the teachers who indicated that they explicitly taught their students mindset (94). Setting high standards without support is an easy mistake for teachers to make when they only have a surface level understanding of mindset. Part of helping students develop a growth mindset involves expanding students' vision of what they can accomplish, but if you tell kids to aim high and there is no support to get there, when students do not accomplish their big goals, they revert back to their fixed mindset belief that they are not capable of the goal further cementing their fixed mindset. Through the survey, I could infer 17 teachers fell into this false growth mindset trap with comments such as "I set high expectations for my students" without discussing if there are any supports for these high expectations. Teacher comments would usually include a vague reference to what students could do to be successful like "Just keep working at it" or "working hard" or "encourage[ing] them to try." These comments do not constitute the support students need to achieve their goals and see growth because they are too vague to be very useful to their students. It would have been interesting to include a question in the survey to better target these two false growth mindset indicators.

The last false growth mindset indicator is teachers who blame failure on students' fixed mindsets instead of helping students who fail. While there are 120 teachers who had responded that a only a fixed mindset was hurtful to their students with no mention to the benefits of a growth mindset, I could confidently infer that 24 teachers blamed fixed mindsets for students' poor performance. Students' fixed mindsets can be very deeply engrained in them from their peers, their family, and from societal norms, but it is important to remember that the fixed mindset does not need to be permanent and can change. Blaming students' fixed mindsets for their poor performance is essentially saying that the mindset cannot change which is in reality a

fixed mindset on the part of the teacher. Students with a fixed mindset do typically perform lower than students with a growth mindset but blaming the fixed mindset will not help the students learn to grow. When a student does perform low, teachers should point out specific places for improvement and guide the students to help for future success.

I interpret false growth mindset not as teachers who have fixed mindsets, but as teachers who do not understand growth mindset very well. Every teacher who had a false growth mindset indicator had a growth mindset about intelligence, learning mathematics, or both from the survey. In actuality, "every one of us is a mixture of both mindsets: sometimes we're in a growth mindset, and sometimes we're triggered into a fixed mindset" (Dweck, 2016). Mindset can move from more fixed to more growth and people can have different mindsets about different things. Everyone has combinations of growth and fixed mindset beliefs but being able to recognize the complexities of mindset shows more depth of understanding of mindset. When "educators [are] declaring themselves to have a growth mindset without actually taking that long journey -- perhaps a lifetime journey" (Dweck, 2016) misunderstandings and misapplications happen, sending fixed mindset messages to students. Not understanding mindset in depth can contribute to the disconnect between teachers' mindsets and teacher actions which in turn causes a disconnect between teacher mindset and student mindsets.

Significance and Implications

We already knew that teachers' mindset do not directly transfer to their students (Haimovitz & Dweck, 2017; Hooper et al., 2018; Sun, 2015; Park et al., 2016), but now we know that if a teacher has just a basic definitional understanding of mindset it is not enough to help students develop a growth mindset. This highlights the importance of helping teachers understand more fully and the mindset messages their actions send to students. While many

teachers have heard of mindset, false growth mindset is not nearly as well known. By educating teachers about the traps of a false growth mindset, they can recognize where they are sending fixed mindset messages to their students unintentionally and then adjust to help students develop a growth mindset. Overall, teachers need to learn how to help their students develop a growth mindset.

An implication for leaders hoping to teach mindset to their teachers is to recognize that mindset is more than just a growing brain or a stagnant brain. It is important to include in trainings about practices that send growth mindset messages and practices that send fixed mindset messages, so teachers are aware of the mindset impact their actions are creating. Special attention should be paid to the three areas of false growth mindset: giving praise as a consolation prize, telling students they can do anything without the support to get them there, and blaming a child's fixed mindset as their reason for failure. If leaders want teachers to implement a growth mindset into their teaching, it is important to help them see what actions are beneficial and which actions are potentially harmful for students' growth mindsets.

Basically, we see from this study that knowing about mindset is not enough to teach mindset. One place this is seen is from the section comparing honors and regular students. When asked just about their abilities to be good at math if they put in the necessary work, 84% of teachers said both groups of students were equally capable, but when asked if their students could do homework without someone showing them similar examples, 76% of teachers said their honors students were better than their regular students. This shows that while 84% of teachers claim they know that in theory all their students are capable (they know about the principles of mindset), 76% of teachers did not know how it applied in their classrooms. This is also seen from 37% of teachers who did not know how to teach mindset, were not trying to teach mindset,

or were trying to teach mindset in ineffective ways. We see that teachers do not fully understand mindset because only 15% of teachers acknowledged that they have both growth and fixed mindsets at different times as everyone does (Dweck, 2010, 2016). This is also seen in the high school teachers who do not think they can make much of a difference in the mindset of their students. It is remarkable that 89% of teachers have heard about mindset, but just knowing about it is not enough. For a growth mindset to make a difference for our students, more work needs to be done to educate educators on how it can be taught.

Another implication for teachers is to realize that it is normal to have both fixed and growth mindset practices in your classroom, but to take time to recognize what messages your actions are sending. Many teachers indicated that they want their students to believe they can grow while also indicating that there are things that get in the way of that growth mindset. If teachers do not take the time to evaluate their practices to see what mindset messages they are sending, then the impact of those actions can never be realized. Acknowledging that there are things teachers do that send fixed mindset messages does not mean that those teachers are now lumped in the fixed mindset category and can never leave (that would be a fixed mindset way of thinking about things). Acknowledging areas of weakness allows room to grow and gives specific areas to focus progress.

A third implication of this study is that a survey is not enough to measure the intricacies of someone's mindset. Dweck (1996) mentioned that a simple Likert style survey could easily determine if a person has a growth or a fixed mindset. I expanded upon Dweck's classic survey and added free response questions which revealed teachers who have less of a growth mindset than their survey numbers had indicated. In person interviews and classroom observations could also be useful tools to determine a person's mindset. In the mindset studies that say teacher

mindset does not transfer to student mindset, there was an assumption that the way they were measuring mindset was accurate, but I have evidence that a teacher's mindset is deeper than the average of a few Likert-Scale questions. In comparing different pairs of statements about learning mathematics and intelligence, there was evidence that teachers had different mindsets in regard to each question. When comparing honors and regular students, teachers thought their honors students were more capable problem solvers showing that they do not see their honors and regular students with the same mindset. To better understand teachers' mindset, the analysis must move deeper than the original mindset survey.

Future Studies

While conducting this study, I found topics that would make for interesting studies in the future. One topic is how special needs teachers see the mindset of their students. The survey was sent to current math teachers (according to their school websites), but 15 of those teachers had degrees in special education. The teachers with a degree in special education had a lower average mindset score of 4.5955 as compared to the averages of the other majors at 4.8484. Because the special education majors made up such a small percent of the data, 3.7%, certain conclusions cannot be made at this time, but further study could yield interesting results. Another study that could be interesting is comparing teacher mindset scores of teachers in elementary, middle, and high school because some teachers mentioned that it was harder or not possible to change a fixed mindset of a high school student. Because the teachers did not report what grades they teach, this was not investigated thoroughly in this study. I would love to see a study that asks questions that are specifically designed to see which teachers have a false growth mindset and to see if teachers think effort is the only factor of mindset. It would also be

interesting to have a study that just investigates the obstacles teachers face in teaching growth mindset in their classrooms.

Conclusion

Mindset is such a relevant topic, as seen by Dweck being ranked at the top of the Edu-scholar public influence rankings in 2019 with Jo Boaler (mathematics education mindset specialist) ranking at number five. This show us that the teachings of Dweck and Boaler have reached many, and people do not need to be convinced that having a growth mindset is better than having a fixed mindset. 98% of teachers indicated that they believe mindset makes a difference in the lives of their students, but it has become clearer that teachers need more education on how to help their students develop a growth mindset.

I realized that nobody has a perfect growth mindset. As obvious as it may sound, recognizing our fixed mindset points can free us from those practices. Without acknowledging where we feel fixed, we can never grow in those areas. My biggest take away from this study is that growth happens from recognizing our shortcomings and then making a plan to change. Excellent teachers with great mindset scores still acknowledged their shortcomings and what they planned to grow from them. The goal is not to have perfect mindset; this is simply unachievable. The goal for teachers, students, researchers, all of us, is to be *growing*.

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APPENDIX A: Survey Questions

Figure 22

Survey Statements labeled by statement type and type of mindset.

#	Statement type*	Growth or fixed	Statement
1	1	F	Your intelligence is something about you that you can't change very much.
2	1	F	To be honest, you can't really change how intelligent you are
3	1	F	You have a certain amount of intelligence, and you can't really do much to change it.
4	1	F	You can learn new things, but you can't really change your basic intelligence.
5	1	G	No matter how much intelligence you have, you can always change it quite a bit.
6	1	G	No matter who you are, you can significantly change your intelligence level.
7	1	G	You can change your basic intelligence level considerably.
8	1	G	You can always substantially change how intelligent you are.
9	2	F	In math class there will always be some students who simply won’t ever "get it"
10	2	F	There are limits to how much people can improve their basic math ability
11	2	F	Some students are not going to make a lot of progress this year, no matter what I do.
12	2	F	Student success in middle school mathematics classes is a good indicator of their long-term success in mathematics
13	2	F	In my class(es), students who start the year low performing tend to stay relatively low performing at the end of the year
14	2	G	All of my students would be good at math if they worked hard at it
15	2	G	No matter where a student starts, they can continue to learn more math in my class this year.
16	3a	F	In my regular classes, students are not able to learn the mathematics
17	3a	F	Students who start middle school in a regular math class could not be successful in an honors class

18	3a	F	To teach my regular classes (not honors), I have to show my students examples in order for them to complete similar questions on their homework.
19	3a	F	Honors students are more capable of problem solving than my regular students.
20	3a	G	My regular students can change their basic intelligence in math quite a bit
21	3a	G	My regular students can be good at math if they put in the necessary work.
22	3a	G	My regular students have as much capability to learn mathematics as my honors students.
23	3a	G	All students (honors and regular) are capable of challenging problems.
24	3b	F	To teach my honors classes, I have to show my students examples in order for them to complete similar questions on their homework.
25	3b	F	In my honors classes, students are not able to learn the mathematics
26	3b	G	My honors students can change their basic intelligence in math quite a bi
27	3b	G	My honors students can be good at math if they put in the necessary work.
28	4		Have you heard about mindset before? If so, what does it mean to you?
29	4		Do you believe you have a growth or a fixed mindset in general? Explain.
30	4		Do you believe you have a growth or a fixed mindset towards your students' abilities to learn mathematics? Explain
31	4		Does a students' growth or fixed mindset influence how well they do in math class? Explain.
32	4		How do you think students develop a growth or fixed mindset? Explain.
33	4		How much do teachers influence student mindsets about mathematics? Explain
34	4		Do you do anything deliberately in your classroom to influence your students' mindsets about mathematics? Explain.
35	4		How many years have you been teaching?
36	FR		What degree(s) do you have and in what field?

Note: The order of these statements does not reflect the order of the statements were given. 1) general mindset statements 2) statements about mindset relative to students learning mathematics 3) statements about mindset relative to regular (a) and honors (b) students 4) statements about teacher understanding and application of mindset.

APPENDIX B: Survey Coding

Figure 23

Question 1: Have You Heard About Mindset Before? (yes/no) If So, What Does it Mean to You?

Do they understand mindset?	Category description	Evidence/examples
Correct understanding	They mention that intelligence can grow (growth) or not grow (fixed)	ex) "How much you believe you can learn or change"
Incorrect understanding	Did **NOT** explain what growth/fixed mindset meant No reference to growth	"Mindset is my meta-cognitive reflection." -Mindset is not always a conscious thing so does not require meta-cognition -Mindset is not equivalent to meta-cognition
Partial understanding	Mention a tenant of growth mindset without mentioning growth	"Yes, UTCM had breakout on this subject this year. Growth mindset emphasizes that it is ok to make mistakes and mistakes is where"
Can't tell	Not specific enough to say whether they understand or not They are speaking in generalities, not saying about growth or anything contrary to growth	ex) mindset refers to the power of the **way that you view the world** around you and you in it. It has an **effect on how you act, your beliefs and values, and your ability to then continue forward**. It's a **powerful thing**, in my opinion, that often gets overlooked - especially in education or professions. ex) Our mindset affects our **ability to improve**. → How does it help you improve?

Figure 24

Question 2: Do You Believe You Have a Growth or a Fixed Mindset in General? (yes/no/both)

Explain

Do they understand mindset?	Example of responses
Yes	"Some things are hard to learn, but **I feel capable of learning anything**" I know that I can **learn more** and **change my intelligence**" "I have the ability to grow and change" "People are going to develop and learn, always"
No	"I want to think I have a growth mindset, but have to remind myself to be **open to new ideas**"
In Part	"I believe if I work hard enough at something, I will eventually be successful at it." -- effort is part of having a growth mindset, but not what it's about entirely
Too vague to tell	"In general, I have a growth mindset. But **I know there are some things that I need to improve from fixed to growth.**"

Figure 25

Question 3: Do You Believe You Have a Growth or a Fixed Mindset Towards Your Students' Abilities to Learn Mathematics? Explain.

Does their answer/explanation say they have a growth mindset toward their students?	Example of responses
Growth	"Growth. All students can become better at anything they practice. Math is like free-throw shooting. If you practice it and are taught the correct way to practice, you will improve and become "good" at it."
Fixed	"Fixed: Some students simply cannot comprehend certain topics. I think there is a limit to what people can learn. All students can learn some mathematics for sure, not all students can learn every topic taught in high school - especially in the time allotted."
Both	"Growth but I do believe that it's hard not to fall in the trap of having a fixed mindset. This comes from long periods of time having to deal with students that refuse to want to learn and progress in math."

Figure 26

Question 4: Does a Students' Growth or Fixed Mindset Influence How Well They Do in Math Class?

Code	Example of responses
Yes	"I have a student in my class right now who might have been considered as "slower" or "behind", but he has been working very hard and has been succeeding."
Sometimes	"To a certain extent. But a student with a fixed mindset can also perform super well in class, but they might attribute that to their natural ability. But I believe that a student's mindset heavily influences how much a student will grow during the year."
No	"Not necessarily. I think for a lot of students it does, but there are some super smart people that memorize things really well that have a fixed mindset. Or people that have a growth mindset might have test anxiety or something else that inhibits their performance in math."

Figure 27

Question 5: How Do You Think Students Develop a Growth or Fixed Mindset?

Type of Influences	Other Examples that Would Fit in the Group
Friends	Classmates, peers
Family Members	Parents, grandparents, aunts/uncles
School/teachers	Coaches, principals
World	Society, outside influences
Innate Quality	"Natural tendencies"
Experience	"they do depending on their past"
Adults in general	"I think students develop mindsets from adults they interact with"
Other	Anything else that comes up

Figure 28

Question 6: How Much Do Teachers Influence Student Mindsets about Mathematics?

Code	Examples
A lot	"They influence students by how they show their mindset towards their students"
A little	Acknowledge that students are influenced a little by them, but that students are more by other factors like parents, friends, that student mindset is innate
Not at all	A teacher does not influence student mindset

Figure 29

Question 7: Do You Do Anything Deliberately in Your Classroom to Influence Your Students' Mindsets About Mathematics? (yes/no) Explain.

Category	Examples of what teachers do to deliberately influence mindset
explicitly teaching mindset	-sharing videos about mindset -reading books together about mindset -lessons teaching students their intelligence can grow
Indirectly teaching mindset through teaching practices	Anything the teacher does that is not directly teaching mindset, but sharing mindset messages through their actions (see Figure 30)
Posters	Sign, banner, bulletin boards on the walls or doors that share the message that they can grow and change
Relationship with students	-want the students to trust them -want to create a safe place for learning

Figure 30

Teaching Practices That Do or Do Not Send Growth Mindset Messages

Practice	Does it send a growth or fixed mindset?	Characteristics
Praise effort	Growth	-praise connected to the processes of learning -NOT praising outcomes
Student goal setting	Growth	-students measuring their progress -students working towards goals, and helping students reach them
Open ended problems	Growth	-tasks -opportunities to explore a problem
Celebrate mistakes	Growth	-make mistakes feel acceptable -using mistakes as learning opportunities
Teachers modeling mistakes	Growth	-teachers not covering up mistakes as "testing" the students -teachers demonstrating how to handle mistakes -teachers showing process of how to reason through mistakes
Not allowing negativity	Growth	-helping students reframe their negative thoughts -talking about the power of "not yet"
Retake policy	Growth	-allowing students chances to redo homework and correct tests -using corrections as a chance to continue learning
Labeling students	Fixed	-calling students negative titles (dumb, stupid, lazy, fixed minded) -calling students positive titles (math person, smart)
Focusing on results	Fixed	-focusing on grades over learning -emphasize getting good grades
Not related to mindset		-using technology -apply math to future careers -group work -ALEKS program
Too vague too tell what message it sends		-focus on the positive -celebrate success -don't give partial credit to encourage retakes