Growth Mindset in a Fourth-Grade Class

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Recommended Citation
Bennett, Sierra,"Growth Mindset in a Fourth-Grade Class" (2019). Masters of Education in Teaching and Learning. 27.
https://digitalcommons.acu.edu/metl/27
Growth Mindset in a Fourth-Grade Class

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Abstract

In this study the researcher examined growth mindset teaching and its effect on student performance as well as students’ perceptions of their math self-efficacy. The author was a preservice teacher completing her clinical teaching internship in a fourth-grade math and science departmentalized setting. The goal of the study was to implement growth mindset instruction and study its effects on student performance and self efficacy in the subject of mathematics. For this study, the author collected data in the form of pre- and post-surveys, student interviews, and pre- and post-math tests. The students engaged in growth mindset mini lessons throughout the study. Utilizing the constant comparative method, the author analyzed survey and interview data for major themes, which ultimately included students’ prior fixed mindset, growth mindset in math, student self-efficacy and student performance. Descriptive statistics were used to analyze the math test scores.
Growth Mindset in a Fourth-Grade Class

Ms. B (all names have been replaced with pseudonyms): “So, when you come to a hard problem (in math), what do you think in your head?”

Jessica: “I think that I’m never going to do this, I’m giving up, this is too hard (…)”

Ms. B: “How do you feel when you make a mistake in math?”

Jessica: “I feel really bad; I feel like the whole world is mad at me for some reason because I did something wrong”

My heart sank as this student continued to describe her mindset in math. As an educator, I long to help students change their mindset. I want students to not dislike math due to the uncomfortable struggle but have the mindset that they can learn and grow with hard work.

Imagine you stepped into a classroom and heard students boldly proclaiming things such as, “I’ll use a different strategy” rather than “I give up.” Or possibly, “Mistakes help me learn” rather than “I made a mistake.” For many teachers, this sounds like a dream, yet never a reality. Could it be though? Recently, there has been a rising awareness of how mental mindsets can affect student success in the classroom (Dweck, 2008). With an increased focus on teaching students the importance of their mindset, could classrooms start looking more like the one just described? If so, how would that alter students’ academic success? How would it change their self-efficacy? Researchers and educators alike have begun to realize the great importance of student mindset and the positive effects that follow.
Purpose

The purpose of the study was to understand how implementing growth mindset teaching in a fourth-grade math class affected students’ perceptions of their math self-efficacy and students’ math performance. Specifically, this study aimed to answer the following questions:

• What are the changes in students’ perceptions of their mathematical self efficacy when growth mindset teaching is practiced?

• Does math performance change when you implement teaching strategies involving growth mindset in a fourth-grade classroom? If so, in what ways?

All questions asked sought to better understand the benefits or drawbacks of implementing growth mindset teaching in a mathematics class. The hope was to identify ways in which growth mindset teaching could be used to better instruction, raise students’ levels of successes and increase student confidence in math.

As I did this research, I was completing a year-long clinical teaching placement as a graduate student conducting action research. I was placed at an elementary school in a mid-sized West Texas town with a population of around 117,000. My internship was in a fourth-grade math and science departmentalized setting at Beck Elementary. My cooperating teacher and I were responsible for teaching two groups of approximately 44 students, separated evenly into two classes with 22 in each class. Beck Elementary served around 600 students in grades K-5. Beck Elementary was a part of Travis Independent School District (TISD) which enrolled around 17,000 students. Travis ISD served various ethnicities of students. The largest groups included Caucasian, Hispanic and African American students. In addition, there were smaller populations of Asian, American Indian, Pacific Islander and students of two or more races. The student body of Beck Elementary had the same breakdown of ethnic representations. Almost half of Beck
Elementary’s population was economically disadvantaged. A small portion of the students had limited language proficiency, and a slightly higher percentage of students were considered at risk.

Throughout my time in this placement, I noticed that student mindset, specifically during math class, was poor. I saw a range of behaviors. I noticed that some students would come to a challenging problem and work at it for extended periods of time. They would try different strategies or work with a partner to try and solve the challenge. Others, however, seemed to give up before they even began the problem. It was as if they already felt like they were not going to succeed. As you can guess, the students who persisted longer and seemingly had a positive mindset in math did far better than those students whose mindset was negative. This study was the perfect way to look at growth mindset teaching and how it impacts student performance and self-efficacy in math.

**Literature Review**

With the release of Carol Dweck’s book titled *Mindset: The New Psychology of Success*, the idea of growth mindset was introduced. This book, along with other pieces by Dweck, explained that people either have a growth mindset or a fixed mindset (Blackwell, Trzesniewski, & Dweck, 2007). People with a fixed mindset believe that their intelligence is an inborn trait; they think you have an unchanging amount of intelligence (Dweck, 2010). On the other hand, people with a growth mindset believe that they can “develop their intelligence over time” (Dweck, 2010, p. 16). Put in other words, rather than believing “their intelligence is ‘set in stone’” students believe that talents and abilities are things you can develop through effort, practice and instruction (David, 2015, p.1).
David (2015) explained that “messages to children can influence their mindset” (p.1). This means that teachers can influence students’ learning behaviors by “promoting a community of growth mindset learners” through the three components of growth mindset learning: neuroplasticity, praise and framing mistakes as opportunities for learning (Robinson, 2017, p. 18). In the classroom, this consists of teachers who teach their students about the brain’s ability to make new connections allowing you to “get smarter by rewiring you brain” (Robinson, 2017, p. 18). Growth mindset instruction looks like teachers who emphasize challenge rather than success, allow students to see progress towards mastery and grade for growth (Dweck, 2010). A math teacher that instills a growth mindset into students says things such as, “When you learn how to do a new kind of problem, it grows your math brain” rather than “Not everybody is good at math so just do your best” (Dweck, 2015, p. 24). These classroom practices can begin to shift the classroom culture and most importantly the mindsets of the students in the classroom. Once growth mindset is encouraged in the classroom, research has revealed there are benefits.

Research has shown that implementation of growth mindset practices leads to increased student motivation and higher self-efficacy, which is students’ belief in their ability to achieve goals. Rhew, Piro, Goolkasan, and Cosentino (2018) conducted a study that looked at what happened to special education students’ motivation and self-efficacy if a growth mindset intervention was put in place. The study found that the growth mindset intervention raised the motivation of the sixth, seventh, and eighth grade special education students involved. Other studies have found that growth mindset aides in students’ abilities to persist in the face of challenges. Auten (2011) conducted a study that looked at the experiences of community college educators who used growth mindset in the classroom. She found that when educators fostered growth mindset in their class, it led to “higher student effort, motivation, achievement and
persistence” (Auten, 2011, p. 41). Esparza, Shumow, and Schmidt (2014) had similar findings; their research focused on gifted students and their tendency to develop fixed mindsets due to the “gifted” label and continual praise for natural intelligence. To counteract this, researchers implemented a growth mindset teaching intervention in a seventh grade science class (Esparza & Shumow, 2014). They found that the gifted students did in fact change the way they viewed their own intelligence and this had positive effects on motivation as well as steering students away from under-achievement or the opposite, perfectionism (Esparza & Shumow, 2014).

Other studies have found that growth mindset teaching leads to higher academic achievement specifically in math and science (Dweck, 2008). Blackwell, Trzesniewski, and Dweck (2007) researched how an intervention focused on theories of intelligence (such as growth mindset) would affect the trajectory of secondary students’ achievement. They found that the students who believed their intelligence was malleable led to an upward trajectory in grades over the two years of middle school; on the other hand, students who believed their intelligence was fixed led to a flat trajectory (Blackwell et al., 2007). Other research looked at the psychology behind mindset and motivation specifically in math and science courses (Khan, 2008). The research analysis showed that “growth mindset was the strongest predictor of grit”; the analysis found that a “student’s level of fixed mindset was the strongest predictor of math grades” (Khan, 2018, p. iii). Even among college students taking what is considered one of the most challenging courses, pre-med organic chemistry, research showed that those with a growth mindset had higher final grades and SAT scores in comparison to those with the fixed mindset (Grant & Dweck, 2003). These higher grades were associated with the growth mindset and students’ deeper use of learning strategies. Bostwick, Collie, Martin and Durkensen (2017) focused on secondary math students; they concluded that students with growth mindset or
growth-based goals were positively associated with higher engagement and academic achievement (Bostwick, Collie, Martin, & Durksen, 2017).

As seen, research has shown that there are many benefits to having a growth mindset. This is especially important in regard to students in the subject area of math. According to Khan (2018), “math courses are often perceived as difficult and challenging to students” (p. ii). If this is a subject that has a negative stigma, it is the perfect place to implement growth mindset practices and not only track student achievement but see how it positively effects students’ perceptions of their self-efficacy. Koyuncu and Dönmez (2018) conducted a study focused on the importance of students’ math self-efficacy. This study looked at the power self-efficacy has on math resistance and math attitude with high school students. Their findings showed that there was a correlation between students’ math self-efficacy and their resistance and attitude towards math (Koyuncu & Dönmez, 2018). Other studies also found that even in big transition periods, such as students’ first year in college, high self-efficacy was connected to high academic achievement and better adjustment (Chemers, Hu, & Garcia, 2001). With this in mind; I believe more research is needed connecting growth mindset to students’ perceptions of their self-efficacy in math class.

There is a clear need for more research to be done looking at how mindset intervention effects the classroom (Schmidt, Shumow and Kackar-Cam, 2017). If math courses are perceived as challenging and global reports have shown that student interest and achievement in mathematics is declining (Bostwick, Collie, Martin, & Durksen, 2017) then it is important to gain a deeper understanding on how to help students succeed in math. Many studies have looked at growth mindset and its positive effects in the college and secondary settings. Similarly, research has been done showing the importance of self-efficacy in math. However, hardly any
studies have looked at elementary level growth mindset interventions in direct correlation with mathematics performance and perceptions. My research brings this new and needed knowledge to the world of educators. The research, although focused in math, could end up giving educators of all subject areas better understanding of the effects of growth mindset practices. This could greatly improve the effectiveness of teaching and the success of student learning within our education system.

Methods

In the fourth-grade classroom where I was clinical teaching, I conducted my action research study to determine how instructional practices focused on growth mindset effected student achievement as well as how it changed students’ perceptions of their math self-efficacy. The following sections will explain how I selected participants as well as collected and analyzed my data.

Participant Selection

The participants in my study included 44 students from Mrs. Harry and Mrs. Cooper’s fourth grade classes at Beck Elementary. The class consisted of 22 boys and 22 girls. Demographically, the classes included 38 Caucasian students, one Hispanic student, two African American students, two African students and one multiracial student. A parent information letter and consent form were sent home, and the students were asked to sign an assent form. Of the 44 students, 33 returned the parent permission form and assent form and therefore participated. Students were selected for interviews using purposive sampling which allowed me to select participants who would best contribute to my research objectives (Patton, 1990).

Data Collection
My first source of data was pre- and post-surveys (see Appendix A and B). The survey questions included a mixture of likert scale questions and open-ended questions focused on students’ mathematical self-efficacy. I used visuals to make the Likert section of the survey more interactive for children. The Likert section included some of the following statements: If I try hard in math, I will succeed; I am good at math; I believe that I can improve in math; If I make a mistake in math then that means I am bad at math; When I come to a hard problem in math, I give up. The post survey presented the same Likert scale items and two open-ended questions, but an additional open-ended question was added that was geared towards students’ views on the growth mindset teaching and their math self-efficacy.

The second source of data collected was interviews (see Appendix C). I used purposive sampling (Patton, 1990) to select six students based on survey results. I looked at survey results and chose two students who had high mathematical self-efficacy, two students who had low mathematical self-efficacy and two students whose mathematical self-efficacy is in the middle. I conducted six 10-minute interviews towards the end of the research period during morning work time (8:00-9:00 or 11:00-12:00). The interviews were semi-structured, with pre-planned but open-ended questions (Hendricks, 2012). A series of direct questions were asked about students’ perceptions about mathematical self-efficacy. In addition, questions were asked about growth mindset teaching and how it has changed students’ perception in mathematics. Interviews were audio recorded and then transcribed.

My last source of data collection was math test grades (see Appendix D). All participating students were given a pre- and post-test (identical unit math tests). In math units throughout the year we collected pre-assessment data and, at the completion of the unit, gave a post assessment. Due to this ongoing data, I was able to examine if growth patterns were
different between the pre- and post-test during my growth mindset action research period as compared to students’ baseline data. The math pre-test was given as soon as consent forms had been collected so that no growth mindset teaching had occurred yet. Then, after three weeks of growth mindset teaching, the same test was given. Grades were recorded for each student and compared to baseline data looking for differences in patterns of improvement.

**Growth Mindset Intervention**

Throughout the three-week research period, I implemented growth mindset lessons daily prior to math content lessons. At the beginning of each lesson, there were person reveals. Although changed to fit my class, I was inspired to do person reveals from Randazzo’s (2017) famous failures content for growth mindset lessons. Prior to lessons, I had researched famous people from a variety of professions, including information about their life involving struggles as well as successes. To start, I gave students information surrounding the person, but nothing that would reveal who it was. Typically, the information given touched on their gender, age and a hard challenge the person had encountered. Then, students would guess who the person was, I’d reveal the name, and we would discuss how, despite the challenge described, the person became successful. Each conversation was directed to how the person’s mindset, particularly growth mindset, helped them overcome challenges. Next, I would introduce or review vocabulary words. The vocabulary included the following: fixed mindset, growth mindset, neuroplasticity, neurons, dendrites, grit, perseverance, resilience and setbacks. I then did a mini-lesson typically including a lesson focus statement, a video, a workbook activity and class discussion. Each student was given a growth mindset journal with the materials needed for the lessons as well as vocabulary and lesson focus statements. The journal as well as lesson inspirations originated from Watson’s (2018) growth mindset lesson bundle but were tweaked to fit my class. Some lesson focus
statements included the following: I can learn anything because I was born to learn; I can train my brain through practice; I take ownership of my mistakes and learn from them; I take charge of my own learning; I celebrate my own growth and progress. Each lesson, I intentionally embedded conversation or questions that dealt with how students could apply these ideas to math class. Lastly, my cooperating teacher and I tried our best to change our language during math class to use growth mindset vocabulary or challenge students to consider ways they could apply what we had learned that day about growth mindset to their current learning in math. Lessons were around 30 minutes in length and spanned over a three-week period.

Data Analysis

My data analysis was mixed methods because I asked both quantitative and qualitative research questions. My data analysis for the surveys and interviews was qualitative inductive coding (with some descriptive statistics after compiling responses from survey). NVivo was used to code the data. To do this, I took results and “common responses were looked for and listed” (Hubbard & Power, 2003, p. 23). I used the constant comparison method to look for recurring themes in the data collected and, according to what the findings showed, I created categories, or level 1 codes (Tracy, 2013) that focused on growth mindset, students’ math self-efficacy and student achievement (Hubbard & Power, 2003). The level 1 codes were developed in the first twenty percent of the data and were then used to code the remaining eighty percent of the data. Once my data had been coded using those level 1 code categories or initial themes, I moved to organizing my data into larger, more overarching codes called level 2 codes (Tracy, 2013). To keep my codes organized and well defined, I used a codebook (see Appendix E) to explain and provide examples of all my identified codes. In addition, I wrote short memos that included reflections on the overarching topics (level 2 codes). The memos additionally explained how the
codes represented the data I had found and the importance the findings were to my study. In summary, my constant comparative method included analyzing my data in terms of “categories and concepts,” integrating the conceptual categories and properties of these categories into the larger theme and defining and writing up these themes by describing and summarizing my data findings (Hubbard & Power, 2003, p. 115-116).

My quantitative data analysis, specifically for my math grades data, was analyzed using descriptive statistics. I collected numerical data from students’ math test grades before and after the implementation of growth mindset teaching. I recorded the scores in a research journal then put the grades from the pre- and post-test in a side-by-side table (see Appendix F) and compared changes and patterns (Hendricks, 2012).

**Findings**

As I coded both qualitative and quantitative data, I organized the findings into four level 2 codes: students’ prior fixed mindset, growth mindset in math, student self-efficacy and student performance. Within each of the following sections, I describe my findings from the student pre- and post-surveys, pre- and post-tests, and interviews that relate to the four codes.

**Students’ Prior Fixed Mindset**

I found that there were in fact changes to students’ perceptions of their mathematical self-efficacy when growth mindset teaching was practiced. As I coded my data, the realities of how some students viewed their ability to achieve their math goals, prior to growth mindset teaching, began to surface. This prior mindset, in comparison to what surfaced after the teaching, showed change in students’ perception of their ability to achieve mathematical goals. It is important to note that not all students, in fact, less than half of students showed low mathematical self-efficacy. However, I found that even if students had a positive outlook about math, by fourth
grade, many already had engrained fixed mindset ideas in their head when it came to their ability. When interviewed, students verbalized many of the thoughts they used to believe in math; they included things such as, “I was looking at the math problem and was like I couldn’t do this,” “I was so bad at math,” “I think I’m never going to do this, I’m giving up, this is too hard.” Several students mentioned that their main goal was to be perfect in math; for them, success in math meant never making mistakes. The following pre-survey response (see Figure 1) revealed that some students believe there are topics in math that cannot be learned with practice.

![Figure 1. Jessica’s survey.](image)

Prior to our growth mindset teaching, students expressed that mistakes in math would cause them frustration. One student, Jessica, in her interview regarding mistakes stated, “I feel really bad (when I make a mistake). I feel like the whole world is mad at me for some reason because I did something wrong.” As exemplified by this quote, some students felt this overwhelming pressure or disappointment when any type of mistake was made in math. Considering the vast amount of problems done within a math class, this leaves little to no room for stress and frustration to surface among students with this mindset. Students expressed they felt defeated and were unmotivated to keep going; Silas explained, “Sometimes I feel down, like
I don’t want to do it (math) anymore.” This lack of persistence and perseverance in mathematics at such a young age was surprising.

Although over 50% of the fourth-grade participants had positive views on the subject, there was a group of students who had negative feelings towards math. On the Likert Scale pre-survey question, when asked how they feel when it is time for math, various students circled, “a little upset.” When asked the reasoning behind this dislike, it was explained, “I don’t really like how sometimes I don’t get the right answer.” Again, many students had the mindset that any mistake was negative and therefore made them bad at math. The data did reveal, however, that much of students’ perceptions of their math self-efficacy or even their math performance was dependent on the concept or day. The survey responses revealed things such as “I am confident at multiplication,” “Long division is my favorite because I’m really good at it,” “2 by 2 multiplication comes to me instantly. No(t) turtle head. No(t) area method.” These student responses show the fixed mindset that you are innately good at a certain math skill and will always be and, on the flip side, that if you struggle with a math skill you always will. This idea caused students to have lower self-efficacy as they didn’t see how they could achieve their goals in certain subjects or topics of math.

Students’ prior fixed mindset, according to my data, led to lower mathematical self-efficacy and negative ideas toward the subject of mathematics. I was grateful to find that fixed mindset ideas were not widely spread among all students, but found that often students, even with high mathematical self-efficacy, held onto fixed mindset beliefs. The most common surfaced beliefs from the data included students believing they were innately bad at math, students believing that mistakes categorized them as bad at math or students having negative feelings towards math due to varying confidence dependent upon the math concept. This
perception of their abilities in mathematics therefore shaped the ways students found motivation, viewed mistakes, and learned in math. This was a good baseline to then compare students’ self-efficacy after the three weeks of growth mindset teaching.

**Growth Mindset in Math**

After growth mindset teaching had been implemented, students’ perception of their mathematical self-efficacy seemingly increased. It is important to note, however, that many students began with high mathematical self-efficacy. When looking at pre-survey responses, as shown in Figure 2, 24 out of the 33 participants expressed that they were good at math. 26 of the 33 agreed that if they tried hard in math, they would succeed.

![Pre-Survey Student Responses Chart](image)

Figure 2. Pre-survey student responses chart (Q 1-7).

Each of the six interviewed participants explained that they were good in math showing that, in some way, they felt they could achieve their math goals (high self-efficacy). However,
many of the fixed mindset ideas that can lower students’ self-efficacy such as those discussed prior, were shown to shift following the growth mindset teaching.

One of the biggest changes in student perceptions was the growth mindset idea that mistakes help you learn. In Alexandra’s post-survey she wrote: “Just because you make a mistake does not mean you can’t do it. Example: In the STAAR if I come to a hard question (…) (it) doesn’t mean I can’t do it.” Prior to growth mindset lessons students had consistently expressed negative feelings and frustration with mistakes. They had even explained the desire to make no mistakes (perfection) in math as they saw that as a sign of success. Alexandra’s response demonstrated how students began to see that if they make a mistake, it doesn’t mean that they can’t do it. Figures 3 and 4 show two students’ post survey responses that also demonstrate this change of mindset.

Figure 3. Casey’s post-survey.
This idea of mistakes as opportunities for learning automatically shifts the students’ mindset to have higher self-efficacy because every time they make a mistake, they won’t have lowered confidence in their ability. Students even showed that they were moving away from the idea that mistakes are bad; for example, Carly, in the post survey wrote, “Not everything I do wrong is bad.” This growth mindset idea that we can learn and grow from our mistakes helped students to change their perceptions of mistakes from negative to positive.

Similarly, I saw a shift in student perceptions of their mathematical self-efficacy regarding perseverance to achieve a goal. Prior to the growth mindset lessons, students showed an innate belief that they could achieve goals yet showed little grit or perseverance when discussing mathematical goals that may be more challenging. For example, in Christian’s interview he explained that he would not be good at something difficult such as pre-algebra. This fixed mindset that more challenging math material cannot be achieved was shown to change after growth mindset teaching. Student post-survey responses revealed comments such as, “never give
up, if you m(e)ss up or do a bad job, just keep trying.” Student vocabulary shifted as students began to use words such as grit, setback and perseverance. When asked on a post-survey what the growth mindset lessons had taught him, Carson wrote, “I have a growth mindset in math because I have grit. So i(f) I have a setback, when that setback is over, I will work harder.” Similarly, the post-survey response (see Figure 5) below demonstrated this change in student mindset and the students’ understanding of hard work and determination.

![Figure 5. Laura’s post survey.](image)

Throughout our growth mindset lessons there was an emphasis on hard work leading to success. We discussed how perseverance and hard work, even in the face of challenges (or setbacks), can lead to success. This newfound student perception that, with grit, they can achieve their math goals led to an overwhelmingly higher student self-efficacy than before.

Lastly, students’ perceptions of their mathematical self-efficacy shifted regarding their math improvement.
In the pre-survey twenty-six students circled yes to the statement, “I believe I can improve in math”; the post-survey responses increased to thirty students circling yes to the same statement. This twelve percent increase (see Figure 6), although seemingly small, showed the shift in student belief that they could improve. Students, prior to growth mindset teaching, expressed that they could get better in math if they practiced. They even connected this idea to their everyday lives as they stated that, as teachers, we make them practice every day so they will get better. Silas, when interviewed, described that the growth mindset teaching changed his perceptions by “a great deal” as he stated he now knows that his “brain can grow.” Students even expressed the concept of taking ownership for their learning as described by Christian in his interview when he stated, “Um, so if I do a mistake and I take ownership then I can work to get better.”
This code, students’ prior fixed mindset, in comparison with the previous, growth mindset in math, showed distinct growth in students’ perceptions of their mathematical self-efficacy after the growth mindset teaching. It showed that students, even those who already had high mathematical self-efficacy, had increased or newfound confidence specifically in the areas of mistakes, perseverance and ability to improve. While not drastic in nature, growth mindset practices did in fact help increase students’ mathematical self-efficacy.

**Student Self-Efficacy**

Self-efficacy is an individual’s belief in his or her innate ability to achieve goals. Specific to my research, I looked at fourth-graders’ self-efficacy in mathematics. I was surprised to find that, prior to any growth mindset teaching, most students had high math self-efficacy. My research question posed if there would be changes to students’ self-efficacy once growth mindset teaching was practiced; however, I hadn’t considered that student self-efficacy may not surface as a problem in need of a shift. Although many students expressed high math self-efficacy, I saw a wide range of students who also felt unsure or had low mathematical self-efficacy. In addition, students with high math self-efficacy seemed to have increased confidence prior to growth mindset teaching. Therefore, although low self-efficacy may not be a rampant issue within my specific fourth-grade setting, it was an area that growth mindset teaching brought improvement to. The changes, although small, are significant.

I was pleased to find that many students had high self-efficacy. This was apparent in the pre- and post-survey responses. The sixth survey question asked students to respond to the statement, “I believe I can learn any topic in math with practice.” Twenty-one students responded yes, eleven students responded maybe and only one student responded no. In comparison, on the post-survey (after growth mindset teaching), twenty-eight students responded
yes, five students responded maybe, and none responded no. This shows that although students came in with high math self-efficacy, there was an increased confidence in their ability to achieve goals in math.

I found it interesting that when comparing the pre-survey responses to the post-survey responses, students initially had high self-efficacy in direct correlation with their belief that they were good at math (or got good grades). However, after, the post-surveys showed that students more often correlated their high mathematical self-efficacy to their mindset. For example, Rebecca responded to the open-ended survey question “What is your confidence in math? Explain why” with “very high because I have a growth mindset.” When questioned during growth mindset lessons, students would identify that with a growth mindset you believe that innately you can do it with hard work and effort. The most obvious way this came through was during our growth mindset teaching “person reveals”. Each day, the start of the growth mindset lesson was a person reveal where students learned about real people who faced challenges and overcame them, most of whom are now famous. Jessica, when interviewed, mentioned this when she stated, “I learned more because, um, I didn’t know all those people were really bad at math and stuff but actually they grew up to be famous, so I don’t know, I didn’t know that.” Another participant, Carly, when interviewed explained that now she knew that everyone starts at 0. By students seeing that other people, whether that be peers or famous role models, overcame challenges they then attributed their success with hard work and a growth mindset. Prior, they seemingly only connected it with a person’s innate ability (if they were naturally good at it).

As explained, not all students had high math self-efficacy. In fact, this research was geared to help boost students with middle or low self-efficacy perceptions of their ability to achieve goals in math. Several students had moderate mathematical self-efficacy. For example,
when asked about her confidence in math, Carly explained, “it’s ok, but not all the time because I sometimes just don’t think I can do it.” Another student, Jude, when asked what his mindset was in math, explained “sort of in the middle.” Other students showed low self-efficacy. Students in this category expressed that they believed they were bad at math, couldn’t do it, or it was extremely hard for them. These students showed a lack of confidence to be able to achieve any goals in math. For example, Jessica on her pre-survey wrote, “I don’t feel like I understand math.” In fact, some even admitted that they would pretend they knew what they were doing in math, but they didn’t know. These students seemed to come to topics and problems in math already defeated as they did not ever believe they would be able to achieve their goals.

The students who demonstrated middle or low self-efficacy in the pre-survey showed increases in confidence following growth mindset lessons. The same student who wrote that she felt she didn’t understand math on her pre-survey, wrote on her post-survey that practice of math skills (she specifically referenced turtle head method) helped her know how to do it. She seemed to shift from the idea that she could not get math to a growth mindset viewpoint which emphasized that with hard work she could do it. Growth mindset teaching not only benefited those students who had low math self-efficacy, but also seemed to help those who already had high math self-efficacy. Mindset instruction allowed these students to see how mistakes help them learn and put language to the fact that they can do it even when there are challenges.

As seen, understanding students’ self-efficacy through the data helped emphasize changes in math self-efficacy prior to growth mindset teaching. Most students in the study had high math self-efficacy, yet there were students that were all along the spectrum. I was challenged to realize that the research question posed had been with an underlying assumption that students’ mathematical self-efficacy would begin at a low level therefore needing to be
increased. Most importantly, even though the results showed only slight changes, the growth mindset lessons were shown to help change or better the self-efficacy of the students in math.

**Student Performance**

My research sought to see if growth mindset teaching would change math performance in a fourth-grade setting. My results in this area were inconclusive for various reasons. First, due to the nature of my research period being three-weeks, I needed the pre and post-test to cover the three-week span. To do so, review material (from previous weeks) was used on the tests rather than new material. Typically, students would be given a pre-test that had material never seen by students; this, as expected, would result in low scores and therefore inform the areas to teach and emphasize in that unit. Then, an identical post-test would be given with the hope that student scores would increase showing learning. Due to the three-week layout of the research and review material used, data with other pre- and post-tests wasn’t as comparable. This was because pre-test scores were higher than usual, as students had been previously exposed to the material. There was still noticeable improvement between the pre- and post-test scores; however, it wasn’t as large of a difference in comparison to other pre- and post-tests in our math units. Table 1 shows part of the side by side comparison between the pre- and post-growth mindset grades versus the pre- and post-test grades from another unit.

Table 1

*Pre- and Post-Test Scores.* (Full table can be found in Appendix F)

<table>
<thead>
<tr>
<th>Previous Pre- and Post-Test</th>
<th>Growth Mindset Pre- and Post-Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>40%</td>
<td>83.8%</td>
</tr>
<tr>
<td></td>
<td>66.67%</td>
</tr>
<tr>
<td></td>
<td>82.72%</td>
</tr>
</tbody>
</table>

| Increased 43.8%             | Increased 16.05%                 |
As seen in Table 1, the pre- and post-test given before and after growth mindset teaching increased by 16.05% in comparison to a previous pre- and post-test that increased by 43.8%. The increase in score from the growth mindset tests does show that the students’ scores increased, however, it is inconclusive if the increase in test scores was in fact due to the growth mindset teaching or other factors.

I can, however, speak to the language I heard used by students during the test. During the pre-test, students asked many questions. Students made faces that suggested anxiety or confusion. Many students would give up and tell me they were just going to guess. However, after the growth mindset teaching, students seemed calmer. I didn’t have students saying they couldn’t do it or giving up during the post-test. Rather, whether it was challenging for them or not, they continued to work hard until it was done. Again, while this is seemingly encouraging, I cannot explicitly tie this behavior difference between the pre-test and the post-test to the growth mindset teaching.

Due to these results, in future research, I’d want to track more closely student grades over a longer period. It would be ideal to be able to compare multiple pre- and post-test scores prior to growth mindset teaching and then multiple pre- and post-test scores following growth mindset teaching, all of which followed the same span of time and introduction of material. In addition to test score comparison, it could be helpful to simply track student grades overall to look for patterns of change. Then, it could more clearly be stated whether the growth mindset teachings are strongly linked to increasing students’ mathematical performance.

**Implications for Teachers**

It is first crucial that teachers consider the nature of the subject of mathematics before diving into the realities of the research findings. This subject often includes problems that are
either right or wrong, allowing students to quickly develop fixed mindset beliefs. Students can very easily identify if they typically get answers right or typically get answers wrong in math and relate that directly with their self-efficacy, or belief in their ability to achieve mathematics. More than anything, I believe that acknowledging this reality could lead to educators investigating ways in which they can intentionally speak or teach students math with a growth mindset.

Secondly, it is helpful for teachers to identify the needs of their specific students. As found in my research, many students had high mathematical self-efficacy. This would’ve been helpful to know prior to my research as it could have served as a baseline for the practices and teachings that I implemented into my math classroom to meet the specific needs of the students I had. In my future practice, I think using quick pre-surveys such as the one I gave during the study, could allow for informative data on where my students are in terms of confidence and beliefs about their ability in mathematics. More encouraging than anything is the reality that this idea does not have to be contained to mathematics, but instead could be applied to any subject area.

Specifically tied with my first research question, teachers must recognize that growth mindset teaching demonstrated increases in students’ self-efficacy in mathematics. Students realized that mistakes no longer needed to be areas of frustration, but rather could be viewed as opportunities for learning. Students began to better understand how their brain functioned and realized that the brain was changeable and, through practice, could create new pathways or strengthen old pathways to allow them to find success in whatever skill they were trying to attain. Students realized that their belief about their ability in math was not tied to performance, but rather was tied to their mindset. If they could go into math class believing that they could do
it, despite the challenges or setbacks they may face, they would have the grit to push through and eventually succeed.

One of the most powerful growth mindset practices I implemented was the person reveals done daily with the students. I researched famous people who had faced large setbacks in life and overcome them. Each day, we would start our growth mindset teaching by discussing the person, their setback and who we know them to be today (typically a famous singer, president, athletic player, etc.). Students could quickly relate to real life people who faced hard things and see how, with a growth mindset, those people overcame challenges and are now incredibly successful. I believe that giving students tangible real-world examples helped to boost their understanding and memory that they too could be successful by changing their mindset.

Growth mindset teaching helps to increase student self-efficacy. If educators are searching for tools that can boost student confidence or shift their beliefs about mathematics (or really any subject), I think implementing growth mindset practices into the classroom is a great option. It is important to know that you can make growth mindset teaching personal to you. You could implement it as I did in direct connection to a certain subject in which you see students are lacking in confidence. On the other hand, you could incorporate the lessons into morning work time and encourage students in all areas to have a growth mindset. The lessons could be in depth with vocabulary review, brain structure discussions and learned songs, or could be brief with class phrases that are intentionally spoken or conversations when extra time allows. This flexibility allows teachers from all grade levels, in all subject areas with varying amounts of time and expectations to fit growth mindset practices into their classroom.

My second research question looked at math performance changes when you implement teaching strategies involving growth mindset in a fourth-grade classroom. I am disappointed that
there were not conclusive or concrete results in this area. I would have liked to be able to clearly see if growth mindset teaching increased math performance and in what ways or, vice versa, if it decreased math performance and in what ways. I felt confident in the accuracy of my data, but due to the three-week structure of my research, I could not clearly compare results. Future research is needed to better link growth mindset practices and students’ mathematical performance.

In conclusion, I have various lingering questions. I would still love to know with certainty if math performance is linked to growth mindset teaching and if so, in what ways? In addition, I’d love to explore the trends of student mindsets as they move throughout our education system? I am curious if, as students get older, they tend to take on more and more fixed mindset ideas or growth mindset ideas. I would be interested to know what factors affect students’ self-efficacy whether that be socioeconomic status, childhood, grades, or other factors. Finally, I would love to know if there is connection between students’ growth mindset and eventual adult success.
References


Appendix A

Student Pre-Survey

Name: ____________________

Math Pre-Survey

Directions: Circle the Garfield that accurately describes your feelings toward the following statements:

1. If I try hard in math, I will succeed.

   - Yes!
   - Maybe
   - No

2. I am good at math.

   - Yes!
   - Maybe
   - No

3. I believe I can improve in math.

   - Yes!
   - Maybe
   - No
4. If I make a mistake in math then that means I am bad at math.

Yes!  
Maybe  
No

5. When I come to a hard problem in math, I give up.

Yes!  
Maybe  
No

6. I believe I can learn any topic in math with practice.

Yes!  
Maybe  
No

7. I know failure is an important part of my success.

Yes!  
Maybe  
No
8. How do you feel when it is time for math?

Write your response to the following:

9. My mindset when it is time for math is........

10. What is your confidence in math? Explain WHY.
Appendix B

Student Post-Survey

Name: ________________________

Math Post-Survey

Directions: Circle the Garfield that accurately describes your feelings toward the following statements:

2. If I try hard in math, I will succeed.

[Garfield images with options: Yes!, Maybe, No]

2. I am good at math.

[Garfield images with options: Yes!, Maybe, No]

3. I believe I can improve in math.

[Garfield images with options: Yes!, Maybe, No]
4. If I make a mistake in math then that means I am bad at math.

5. When I come to a hard problem in math, I give up.

6. I believe I can learn any topic in math with practice.

7. I know failure is an important part of my success.

8. How do you feel when it is time for math?
Write your response to the following:

9. My mindset when it is time for math is........

10. What is your confidence in math? Explain WHY.

11. Talk about what the growth mindset lessons have taught you.
Appendix C

One-on-one Student Interview Protocol

1. How do you feel about math? Why do you like/dislike it?
2. When you get to a hard problem in math, what do you normally do? What do you think?
3. How do you feel when you make a mistake in math? Why?
4. Tell me about different things that motivate you to do well in math……
5. Do you believe you are good at math? Why?
6. Do you believe you could get better at math? Why?
7. How have our lessons about growth mindset changed the way you think about mistakes?
8. How have our lessons about growth mindset changed the way you think about learning?
9. Tell me your thoughts about your math grades……
10. Tell me a story about a time in math where you confidence in math increased……

Questions may vary and additional questions may be asked depending on the answers of the participants.
Appendix D

Student Pre- and Post-Test

Name: _______________________________

1. The population of 4 different cities in California are listed.

<table>
<thead>
<tr>
<th>City</th>
<th>Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>San Francisco</td>
<td>837,442</td>
</tr>
<tr>
<td>Fresno</td>
<td>509,925</td>
</tr>
<tr>
<td>San Jose</td>
<td>998,537</td>
</tr>
<tr>
<td>Sacramento</td>
<td>479,686</td>
</tr>
</tbody>
</table>

If the populations of the 4 cities are listed in order from greatest to least, which city would be second on the list?

A. San Jose, because 509,925 < 837,442 > 479,686
B. Sacramento, because 509,925 < 479,686 < 837,442
C. San Francisco, because 998,537 < 837,442 < 509,925 > 479,686
D. San Francisco, because 998,537 > 837,442 > 509,925 > 479,686

2. Which number is less than 18.69 and greater than 18.52? (Use the decimal number line to solve.)

A. 18.49
B. 18.71
C. 18.61
D. 18.50

3. Darwean decorated 3.6 cupcakes with butterscotch sprinkles. Which fraction is equivalent to this number?

F. 36/100
G. 360/100
H. 36/1000
J. 36/100
4. The model is shaded to represent a decimal less than 1.

Which of the following amounts of money is greater than the decimal number shown in the model?

A. $0.52  
B. $0.61  
C. $0.55  
D. $0.46

5. Carrie’s class ate 0.76 of her birthday cake. Which fraction represents the portion of the cake her class ate?

A. \(\frac{76}{10}\)  
B. \(\frac{76}{100}\)  
C. \(\frac{76}{10}\)  
D. \(\frac{76}{100}\)

6. Rico has a $10 bill to spend at a concession stand. He buys a soft drink for $1.65, two candy bars for $0.85 each, and a hot dog for $3.25. How much change should Rico receive from his $10 bill?

A. $3.40  
B. $6.60  
C. $4.25  
D. $4.60

7. The rule +27 is used to show the relationship between the position of a number in a pattern and the value of that number. Which table shows this relationship?
8. The table below shows the number of spiders and the number of legs on the spiders.

Which correctly describes the relationship in the table?

A. Number of spiders + 21 = number of legs
B. Number of spiders x 8 = number of legs
C. Number of spiders / 8 = number of legs
D. Number of spiders - 32 = number of legs
9. The weight of 3 different puppies are listed in the table below.

<table>
<thead>
<tr>
<th>Puppy</th>
<th>Weight (pounds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>4.75</td>
</tr>
<tr>
<td>B</td>
<td>4.9</td>
</tr>
<tr>
<td>C</td>
<td>5.03</td>
</tr>
</tbody>
</table>

What is the difference between the weight of puppy A and the weight of puppy C in pounds?
F. 0.13  
G. 1.06  
H. 0.28  
J. 2.25

10. Jackie packed 41 dozen cookies into 6 boxes. She packed an equal number of cookies into each box. How many cookies did Jackie pack into each box?

Record your answer in the boxes below. Then fill in the bubbles. Be sure to use the correct place value.
### Appendix E

#### Codebook

<table>
<thead>
<tr>
<th>Code Name</th>
<th>Level</th>
<th>Definition</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before vs. after growth mindset lesson change</td>
<td>1</td>
<td>The student, in comparison to before the growth mindset lessons, shows changed perception or understanding.</td>
<td>“Before…sometimes I don’t like hard things. After…But now I want to do hard things to challenge my brain.”</td>
</tr>
<tr>
<td>Goal of Perfection in math</td>
<td>1</td>
<td>Students expresses that their goal is to be perfect at math.</td>
<td>“Because I just don’t like messing up, I want to be perfect at math someday because that’s my goal; to be perfect at math.”</td>
</tr>
<tr>
<td>Grade or tangible motivation</td>
<td>1</td>
<td>Student explains that their motivation stems from either tangible things or grades.</td>
<td>“They give me money on how good my grades are, like A’s are three, three dollars, two or B’s are two dollars…”</td>
</tr>
<tr>
<td>Mistakes cause frustration</td>
<td>1</td>
<td>Student expresses that when making mistakes in math, they get angry or frustrated.</td>
<td>“Um, I get mad in my head…”</td>
</tr>
<tr>
<td>Encouraging other students to have a growth mindset</td>
<td>1</td>
<td>Students explaining how they will help and encourage others to have a growth mindset.</td>
<td>“I go about motivating them like, hey, you can do a better job next time just never give up.”</td>
</tr>
<tr>
<td>I can get better at math</td>
<td>1</td>
<td>Student expresses their belief that they could improve in math.</td>
<td>“…then I can work to get better.”</td>
</tr>
<tr>
<td>I can use grit to overcome setbacks</td>
<td>1</td>
<td>Student describes how they can overcome challenges or</td>
<td>“I have a growth mindset in math because I have grit. So (when) I have a”</td>
</tr>
<tr>
<td>GROWTH MINDSET</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------</td>
<td>-----------------</td>
<td>--------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td><strong>Mistakes help you learn</strong></td>
<td>1</td>
<td>Student explains that mistakes help them learn.</td>
<td>“You know I kind of feel happy because it’ll (mistakes) help me learn more.”</td>
</tr>
<tr>
<td><strong>Practice leads to improvement</strong></td>
<td>1</td>
<td>Student demonstrates the understanding that practice will lead to improvement.</td>
<td>“Because if I practice more and more, I’ll get better.”</td>
</tr>
<tr>
<td><strong>Helpful in future learning</strong></td>
<td>1</td>
<td>Student explains how growth mindset will be helpful to them in the future.</td>
<td>“I can use growth mindset for a lot of things like sports and math.”</td>
</tr>
<tr>
<td><strong>Math perseverance</strong></td>
<td>1</td>
<td>Student mentions doing math despite the difficulties to achieve success.</td>
<td>“I didn’t know how to do long division and I just worked so hard that I got it and knew how to do it.”</td>
</tr>
<tr>
<td><strong>Negative feelings toward math</strong></td>
<td>1</td>
<td>Student expresses negative feelings or dislike towards math.</td>
<td>(My mindset when it is time for math is…) “a little upset.”</td>
</tr>
<tr>
<td><strong>Parent or friend motivation</strong></td>
<td>1</td>
<td>Student explains that parents or friend motivate them to do well in math.</td>
<td>“And there are so many people like my friends and family say I can do it and I believe in that.”</td>
</tr>
<tr>
<td><strong>Positive Mindset during math</strong></td>
<td>1</td>
<td>Student expresses positive thinking when it comes to math.</td>
<td>“I like math a lot and it’s actually pretty fun to me.”</td>
</tr>
<tr>
<td><strong>Pulls from background knowledge</strong></td>
<td>1</td>
<td>When students explain that they pull from background knowledge when stuck in math.</td>
<td>“I’ll stop and think about what we learned in class.”</td>
</tr>
<tr>
<td><strong>High Math Self-Efficacy</strong></td>
<td>1</td>
<td>Student showing a high self-efficacy in math meaning they strongly believe they can achieve their math goals.</td>
<td>“I believe I am really good at math like I, I can do, I didn’t know how to do long division a month ago and now”</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------</td>
</tr>
<tr>
<td>In the middle math self-efficacy</td>
<td>Student showing a middle-ground self-efficacy in math meaning they sort-of believe they can achieve their math goals.</td>
<td>“My confidence in math is not 100% because there will be problems that will be hard and there will be problems that are easy too.”</td>
<td></td>
</tr>
<tr>
<td>Low math self-efficacy</td>
<td>Student showing low math self-efficacy meaning they don’t believe they can achieve their math goals.</td>
<td>“Sometimes I don’t think I can do this.”</td>
<td></td>
</tr>
<tr>
<td>Topic or day dependence determines feelings towards math</td>
<td>Student explains that the day or math topic determines how they feel about math.</td>
<td>“Really it just depends on what type of day I have.”</td>
<td></td>
</tr>
<tr>
<td>Try my best</td>
<td>Student explains that they try their best in math.</td>
<td>“…I will try hard and do my best.”</td>
<td></td>
</tr>
<tr>
<td>Student Performance</td>
<td>Students’ math grade comparisons before growth mindset practices versus after growth mindset practices.</td>
<td>Rachel got a 40 on the pre-test and an 80% on the post-test.</td>
<td></td>
</tr>
<tr>
<td>Student Self-Efficacy</td>
<td>Students’ comments regarding their belief about their innate ability to achieve goals.</td>
<td>“I believe I am good at math…”</td>
<td></td>
</tr>
<tr>
<td>Fixed mindset in math</td>
<td>Student expresses fixed mindset ideas or actions in relation to math.</td>
<td>“I felt like I wasn’t doing it right and that I was never going to be good at it.”</td>
<td></td>
</tr>
<tr>
<td>Growth Mindset in math</td>
<td>Student expresses growth mindset ideas or actions in relation to math.</td>
<td>“And then I finally knew that mistakes are good and that everyone has them and everyone starts”</td>
<td></td>
</tr>
</tbody>
</table>
at 0.”
### Appendix F

**Pre- and Post-Test Scores Table**

#### Math Pre- and Post-Test Scores

*All student names are pseudonyms*

<table>
<thead>
<tr>
<th>Student Name</th>
<th>Math Pre-test Score (percentage out of 100) Given: 1/28/19</th>
<th>Math Post-test Score Given: 2/27/19</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jerry</td>
<td>90</td>
<td>80</td>
</tr>
<tr>
<td>Alexandra</td>
<td>70</td>
<td>100</td>
</tr>
<tr>
<td>Allie</td>
<td>80</td>
<td>90</td>
</tr>
<tr>
<td>Ronald</td>
<td>90</td>
<td>100</td>
</tr>
<tr>
<td>Christian</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Kelsie</td>
<td>90</td>
<td>80</td>
</tr>
<tr>
<td>Marissa</td>
<td>70</td>
<td>90</td>
</tr>
<tr>
<td>Silas</td>
<td>90</td>
<td>100</td>
</tr>
<tr>
<td>Jude</td>
<td>70</td>
<td>80</td>
</tr>
<tr>
<td>Julius</td>
<td>70</td>
<td>90</td>
</tr>
<tr>
<td>Felicia</td>
<td>70</td>
<td>80</td>
</tr>
<tr>
<td>Eugene</td>
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<td>100</td>
</tr>
<tr>
<td>Rebecca</td>
<td>60</td>
<td>100</td>
</tr>
<tr>
<td>Collin</td>
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<td>80</td>
</tr>
<tr>
<td>Lillian</td>
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<td>70</td>
</tr>
<tr>
<td>Miles</td>
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<td>70</td>
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<tr>
<td>Catherine</td>
<td>90</td>
<td>100</td>
</tr>
<tr>
<td>Name</td>
<td>Pre-Score</td>
<td>Post-Score</td>
</tr>
<tr>
<td>----------</td>
<td>-----------</td>
<td>------------</td>
</tr>
<tr>
<td>Jessica</td>
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<td>90</td>
</tr>
<tr>
<td>Bonnie</td>
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<td>80</td>
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<tr>
<td>Carson</td>
<td>90</td>
<td>80</td>
</tr>
<tr>
<td>Brenda</td>
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<td>90</td>
</tr>
<tr>
<td>Ashley</td>
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<td>90</td>
</tr>
<tr>
<td>Courtney</td>
<td>20</td>
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</tr>
<tr>
<td>Mark</td>
<td>30</td>
<td>70</td>
</tr>
<tr>
<td>Laura</td>
<td>70</td>
<td>80</td>
</tr>
<tr>
<td>Stacy</td>
<td>50</td>
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</tr>
<tr>
<td>Colton</td>
<td>70</td>
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</tr>
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<td>Casey</td>
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<tr>
<td>David</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>Carly</td>
<td>60</td>
<td>70</td>
</tr>
<tr>
<td>Logan</td>
<td>60</td>
<td>80</td>
</tr>
<tr>
<td>Rachel</td>
<td>40</td>
<td>80</td>
</tr>
<tr>
<td>Braydon</td>
<td>70</td>
<td>80</td>
</tr>
</tbody>
</table>

**Average scores:**  

<table>
<thead>
<tr>
<th>Previous Pre- and Post-Test</th>
<th>Growth Mindset Pre-and Post-Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>40%</td>
<td>83.8%</td>
</tr>
<tr>
<td>66.67%</td>
<td>82.72%</td>
</tr>
<tr>
<td>Increased 43.8%</td>
<td>Increased 16.05%</td>
</tr>
</tbody>
</table>