How do Mindset Interventions Affect 6th Grade Students' Mindsets

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HOW GROWTH MINDSET INTERVENTIONS
AFFECT 6TH GRADE STUDENTS' MINDSETS

by
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A capstone submitted in partial fulfillment of the
requirements for the degree of Master of Arts in Education

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CHAPTER ONE

Introduction

Mindsets

Self-beliefs of students are a critical factor of student success. We all hold self-beliefs related to our intelligence and social belonging. These self-beliefs are called mindsets. I recently completed a class about math education and the power of mindset, and I identified with the power of mindsets. I reflected on how my mindset has impacted my life, and I wanted to help my students obtain a mindset that helps them reach their full potential. Through research I would like to know: How do growth mindset interventions affect 6th grade students' mindsets?

In forming my research question, I thought that it was critical to explore my own mindset and how it has developed and changed over the years. My mindset has both held me back and helped me achieve. I have experienced different mindsets based on many factors: expectations, praise, competition, and emotions are just a few of the many factors that have affected my mindset. More importantly, I have learned that it is desirable to have a growth mindset because it allows me to stretch my abilities, see my weaknesses as opportunities, and work through challenges.

My Personal Mindset Journey

It was May 7th, 2009, my youngest daughter’s 11th birthday. I had just spent the last three years in an education program, and this was graduation. I was thirty-seven years
old and had finally reached college graduation. My daughter, who had already given up so much, now had to give up her birthday for Mom’s school. I don’t think that she minded, but there was a twinge of guilt on my part. I had been sitting at the computer for the last several years while she and my oldest daughter would ask for me. My usual response was, “Just give me five more minutes…I am almost done.” Five more minutes always turned into fifty more minutes, and I was never almost done. The nice thing about this day was that I was done. I had made it to the end of the program. Not only had I graduated college, but my kids had their mom back, and I was finally done!

Graduating college was a major milestone in my life. It was something that I should have done long before I had started a family. In fact, it was something everyone expected me to do—including myself. In high school, I was smart. I scored high on the Iowa Basics, I took all of the advanced classes, and I was a top athlete. In general, things came easily for me. I rarely had homework, and I gleaned enough from listening that I never had to study. I earned a three year college scholarship. I even had a local college ask my gymnastics coach if I was interested in pursuing college athletics. I felt good about myself, and I was confident because I had experienced a lot of success.

My first attempt at college was in the fall of 1990. College was different than high school. I couldn’t keep up with the work load. I thought I understood math until I got my tests back, and I had done everything wrong. I thought that I all I had to do was listen to the lectures—the instructors told us everything, right? Why should I read? I never read my textbooks in high school and I still got A’s. I failed all my classes the first quarter and
was on academic probation. I didn't know how to advocate for myself, and I didn't share my situation with anyone because I was embarrassed. Big universities don't go chasing after students who are on academic probation. It's expected that some students will flunk out, and that’s what happened to me. I had potential to succeed, yet I failed. How did that happen?

Now, I know how it happened. Everything came too easily for me, and I did not have to work at school. I was good at a lot of things, and I was one of those kids who got everything right on the first try. Even in sports, I was good. I worked hard when I was doing something I really, really, liked. If I didn’t love it, or didn’t feel “good” at it, I didn’t try. I had enough “good” in reserves that I never really had to give it my all. I was usually in the top five of whatever I did—without really trying that hard. I was rarely first, but I could have been. My teachers never told me to try harder because I always got good grades, and my standardized tests were off the chart. The problem was that I never learned how to work through challenging situations. I never learned that it was okay to fail and try again. I never developed any learning stamina, and I had no resilience. I didn’t realize that other people had to work really hard to accomplish what I took for granted.

It took me quite a bit longer to graduate college than most of my teaching colleagues. I have learned from my journey, and I can see myself in many of my students. My experience with a limiting mindset helps me to be a better teacher.
I have had a wide range of teaching assignments. In 2009, I started my teaching career as middle school science teacher. Three years later, I took a kindergarten position in my hometown elementary school. The following year I was assigned to teach fifth grade, and now I am teaching my favorite grade and subject: sixth grade science.

Mindsets in education

I was introduced to the mindset terms in a summer math methods class. According to my class, people with a fixed mindset focus only on things at which they feel successful. In contrast, people with a growth mindset have a stamina for learning, and they view mistakes as opportunities to learn something new. The class explored the damage a fixed mindset can cause on math students and the power a growth mindset gives a person.

Student mindsets. I became intrigued with the concept of mindset. I began to observe my students more closely for their mindset. I noticed that many of my students were afraid to try. They always wanted to answer the question the “right” way. I noticed that they would leave test questions blank rather than try to put an answer down. In math, many students refused to wrestle with a problem for any length of time. Students tuned out of challenging lessons. Students came to me for directions after I had given the directions because they weren’t sure what to do. The more I looked, the more I saw a fixed mindset.

Mindsets of parents. The families of my students had fixed mindsets. Many parents told me, “I was never good at math, either.” Time and time again, I had parents
telling their children that the assignment was too hard. Yet there wasn’t a single mark on the homework paper. How can a parent say that a problem is too hard if they have not tried a single written strategy to solve the problem?

**Mindsets in schools.** Schools may be the biggest contributor to the problem of mindset. When I taught kindergarten, most students were not afraid to try. In my classroom, learning was set up as a game. Success was based on effort rather than the “right” answer. I especially liked doing art with the students because I enjoyed seeing their individuality emerge. For example, if we were making the “rainbow” fish, each student’s fish was different. Some fish might have more than one sparkly scale; or it might be blowing bubbles; or it might be swimming through pink water. I never demanded that their art look exactly like the example, and the children never asked if their artwork was “right.” What fun is it to look upon a wall of rainbow fish when they are all exactly alike?

Fifth grade was a different story. I felt like I was thrown into a room where thinking for one’s self was a crime. For example, when I asked social studies questions that began with, “What do you think,” students began looking for answers in the book. If I asked them to write one question they have about science, they came back with research information copied from the internet. If I asked them to make a poster for art, many preferred to print pictures off the computer and make a collage. My fifth graders requested to be micro-managed: Where should I put my gym shoes? Can I have a water
bottle (for the tenth time)? Can I sharpen my pencil? These students were afraid to make a decision.

When I was a first year fifth grade teacher, I expected students to be able to figure out where to put their gym shoes; understand that work time is a good time to sharpen a pencil; and know that if I allowed a water bottle each day for the last two weeks, I am always going to allow a water bottle. What I learned is that my fifth graders had a strong fixed mindset. They were desperately afraid to do something wrong. Each and every move had been controlled so much over their years in elementary school that they became nearly incapable of making simple decisions or allowing themselves to respond with, “I think.” They had only been praised when they were following directions or had answered all the questions on the worksheet “right.” These fifth graders were certainly victims of fixed mindset—their own mindsets, their parents’ mindsets, and their teachers’ mindsets.

Research question

A growth mindset is one of the most powerful tools we can give our students. In my capstone project, I would like to find out: How do growth mindset interventions affect 6th grade students’ mindsets? The purpose of this study is to help students understand that intelligence is not predetermined, and that intelligence can be developed through practice and learning. Through my research, I hope to identify methods that help students understand and value a growth mindset.
Chapter Summary

A person who allows themselves to remain in a fixed mindset will most definitely never reach their full potential. This is something I have personally struggled with, and have a deep commitment to learning more about. In my introduction I reflected on how my personal mindset has changed over time, and I examined damaging mindsets that I have witnessed in educational settings. I stated that the purpose of my research was to help students understand that their intelligence is not predetermined; it can be developed through practice and learning. Finally, I presented my research question: How do growth mindset interventions affect 6th grade students’ mindsets?

Introduction to Chapter Two

Chapter Two is a review of literature for the research study. It is important to explore research concerning intelligence because mindset relates to a person's self-beliefs about intelligence. Because the study will take place in a 6th grade classroom, adolescent development and motivation will be discussed. The theories of mindset will be outlined, and a review of mindset interventions will describe the most effective methods in which to carry out mindset interventions in the context of a 6th grade classroom.
CHAPTER TWO

Literature Review

Introduction

"Student learning success is more assured within a growth mindset culture," (Davies, 2011 p. 20). If student success hinges on growth mindset, then it is crucial that students engage in opportunities that cultivate a growth mindset. My research question is: How do growth mindset interventions affect 6th grade students’ mindsets?

Mindset refers to the beliefs a person holds about their abilities. A person with a growth mindset believes that their intelligence can be developed with effort, and a person with a fixed mindset believes that their intelligence level is predetermined (Dweck, 2006). Research shows that adolescent motivation is deeply connected to social and emotional well-being (Ryan & Patrick, 2001). Mindset is deeply connected to motivation. In addition, mindset is determined by how a person reflects on and processes their mistakes and failures. It is necessary to understand the connections between theories of intelligence, adolescent development and motivation, and mindset in order to administer psychological interventions that will help adolescents to adopt a growth mindset. The research will explore instructional strategies aimed to cultivate growth mindsets in the context of an adolescent classroom that is emotionally and socially supportive.
Overview

Chapter Two is a review of literature for the research study. It is important to explore research concerning intelligence, motivation, adolescent development, fixed and growth mindset, and mindset interventions in order to fully understand the problem of mindset in students in the context of adolescent education.

First, three theories of intelligence will be presented. The fixed theory of intelligence as described by Charles Spearman will be discussed. Charles Spearman argues that intelligence is a biological factor that cannot be changed (Ackerman, 2014). This relates to a fixed mindset. People with a fixed mindset believe that intelligence is fixed (Dweck, 2006), so it is important to explore a fixed theory of intelligence and weigh its validity in light of theories of intelligence that claim that intelligence is not fixed. In contrast, Alfred Binet and Howard Gardner argue that intelligence can present itself in multiple ways. These theories do not claim that everyone holds the same intelligence capacity; instead, they claim that intelligence is influenced by biological, social, environmental, and cultural factors (Ackerman, 2014; Brualdi, 1998). This view of intelligence aligns with growth mindset. According to Dweck (2006), people with a growth mindset believe that they can increase their intelligence with practice.

Second, the link between motivation, adolescent development, and intelligence will be discussed. In order for students to benefit from academic tasks, they must be motivated and engaged (Mastopieri & Scruggs, 2004). Students must be motivated to exert effort in order to be in a growth mindset (Dweck, 2006). Middle school students are
at an especially vulnerable state in development because they are forming perceptions about themselves socially and academically (Ryan & Patrick, 2001). Because students’ self-perceptions affect mindset, it is important to understand student motivation and adolescent development as it relates to mindset.

Third, the theories of growth and fixed mindset will be discussed. People with a fixed mindset believe that every person has a fixed amount of intelligence, while people with a growth mindset believe that people can get smarter with practice. Research supports the idea that intelligence is malleable, and people can grow their intelligence through effort. Symptoms of a fixed mindset include: fear of challenging tasks, unwilling to expose deficiencies, blaming others for failure, and low effort. Qualities of a growth mindset include: cooperative, accepting of feedback, putting forth effort to improve, and willing to try in spite of risk (Dweck, 2006). It is important to understand mindsets because students in the adolescent stage are particularly vulnerable to falling into fixed mindset during the middle school transition (Ryan & Patrick, 2001).

Fourth, a summary of psychologically wise interventions and reliable mindset interventions that have proven to be successful will be presented. The purpose of wise interventions is to help people create specific positive thoughts and feelings. Wise psychological interventions, such as mindset interventions, have shown to be effective and to have an enduring effect (Walton, 2014). Research has shown that people can shift into a growth mindset through interventions that teach intelligence malleability (Blackwell, Trzesniewski, & Dweck, 2007). In addition, a brief survey of neuroscience
that links certain attitudes to learning will be discussed. Brain research has shown that
growth mindset interventions can have a biological effect, which proves that intelligence
is not fixed. Neuroscientists have linked brain activity to intelligence and self-beliefs
(Mangels, Butterfield, Good, & Dweck, 2006). Self-beliefs are the core of mindsets.

Fifth, I discuss the lack of research against growth mindset interventions. Finally,
I will conclude by drawing connections across the literature review to support my
research question: How do growth mindset interventions affect 6th grade students’
mindsets?

Intelligence

Intelligence is a measure of one's cognitive abilities, and it is important factor of
individual success. A person's level of intelligence affects their education, health, and
financial state (Deary, 2014). Research in intelligence may help to identify factors that
help develop intelligence or obstruct intelligence. The first part of this section will
provide an overview of intelligence theories that substantiate ideas of fixed and growth
intelligence. The second part of this section will provide information concerning
longitudinal intelligence studies and a description of how intelligence is shaped over
time. It is important to understand factors that may positively or negatively affect
intelligence in the context of scientific theories.

Intelligence theorists. Two important intelligence theorists from the early part of
the twentieth century are Charles Spearman and Alfred Binet. Charles Spearman had a
fixed view of intelligence, while Binet held a developmentally progressive view of
intelligence. Spearman believed intelligence was fixed and defined by a single general factor. Conversely, Binet argued that there were three methods to measure intelligence: physiological markers, pedagogical knowledge, and psychological processes such as memory and reasoning (Ackerman, 2014). Spearman's view of intelligence is very narrow, while Binet's view is much wider and oriented towards growth.

Another important modern intelligence theorist is Howard Gardner. Howard Gardner proposes that intelligence is not limited to cognitive abilities. Rather, Gardner suggests that humans have various intellectually discrete capacities within many domains (Double Exposure/Flashback TV, 2006). Gardner's list of intelligences include: kinesthetic, logical, musical, linguistic, spatial, intrapersonal, intrapersonal. Gardner believes that intelligence is influenced by biological and cultural factors. For example, a person can suffer an injury, such as hearing loss, but the person retains the ability to understand and learn language visually. Gardner asserts that cultural factors influence intelligence. If a culture places a certain value on a particular task, people from that culture are motivated to develop that skill, which leads to highly evolved skills in certain cultures. Gardner proposes that all people are born with varying capacities for multiple intelligences, and it is these varying capacities that people become labeled with strengths and weaknesses (Brualdi, 1998). Gardner's theory of intelligence implies that human intelligence is influenced by both genetic and environmental factors.

Alfred Binet and Howard Gardner are similar in many ways. Their theories indicate that intelligence is not fixed. Binet's view is that intelligence is demonstrated
physiologically, pedagogically, and psychologically (Ackerman, 2014). Gardner's multiple intelligences have several possible physiological representations. Kinesthetic learning refers to a person's ability to purposefully control their body movements. For example, the ability for a person to transfer their mental knowledge to carry out a physical task. Gardner's linguistic intelligence a correlates to Binet's pedagogical view. Linguistic knowledge includes the ability to recall information from knowledge. Gardner's spatial, logical, and personal intelligences (Brualdi, 1998) correspond to Binet's psychological processes of memory and reasoning (Ackerman, 2014). Binet's and Gardner's theories of intelligence indicate that human intelligence can progress over time.

Longitudinal intelligence studies. One longitudinal intelligence study was conducted by Ian J. Deary from the University of Edinburgh in the United Kingdom. Deary located people who had participated in the Scottish Mental Surveys of 1932 and 1947 and asked them to participate in a follow-up intelligence survey. Deary was trying to determine the stability of intelligence over time, discover risk factors that reduced intelligence stability, and identify factors that mitigate cognitive decline. Deary found that about half of the participants maintained stable intellectual abilities over their lifetime. Deary was not able to identify any risk or mitigating factors that influenced intellectual stability. However, he found that brighter children tend to become brighter adults, and people with higher intelligence tend to engage in more intellectual activities (Deary, 2014). Investigating intelligence differences in adults and adolescents may help identify factors that alter intelligence.
It is a common perception that intelligence declines after an individual enters adulthood (Ackerman, 2014). Deary's (2014) longitudinal study lends some support to this argument. However, Deary's studies were limited to intelligence tests that were a narrow window of primarily verbal-reasoning items. Beginning in the 1990s, Ackerman (2014) performed a series of intelligence studies on young and middle-age adults to test the idea that young adults have an intellectual advantage over middle aged adults. Ackerman used domain knowledge tests that measured knowledge in the fields of humanities, civics, business and law, and the physical sciences. Ackerman's tests also measured intelligence as a process (fluid intelligence), crystallized intelligence, occupational knowledge, and vocational knowledge. The Ackerman tests provide a large window to view intelligence. Ackerman's results showed that middle-aged adults demonstrated higher levels of intellect in most domain areas. Young adults demonstrated higher processing skills (fluid intelligence). However, when all domains and intelligences were weighted equally, middle-aged adults demonstrated intellect levels at or above the intellect levels of young adults (Ackerman, 2014). Deary (2014) suggests that there needs to be follow-up in the field of intelligence stability to identify factors that influence intelligence over a life-span. These studies indicate that intelligence in not fixed, rather it can be influenced by many factors. Intellect can grow or diminish over time.

**Summary.** Many people are able to increase their capacity for learning through effort and perseverance (Dweck, 2006). Ackerman's (2014) studies indicate that intelligence across domains increases with age and fluid intelligence decreases with age. Deary's longitudinal study does not identify factors that alter intelligence; however, his
studies indicate that intelligence can remain stable throughout adulthood. Spearman's theory does not account for the ability to increase intelligence through effort. Binet's and Gardner's theories suggest that intelligence can be developed (Ackerman 2014; Brualdi, 1998). However, the theories and studies do not explain why some people seem to shut down in the face of challenge, while others are driven by challenge. The theories and studies provide explanations for capacities of intelligence, but they do not adequately explain why some people are motivated to learn and others are not. In order to better understand intelligence, it is important to understand motivation.

Adolescent Motivation and Development

Research in adolescent development will provide information on special factors relating to adolescent needs that contribute to motivation and engagement in an educational context. It is important to understand factors that may positively or negatively affect adolescent motivation. The first part of this section will discuss factors that motivate adolescents, the social environment of adolescents, the importance of positive adult and peer relationships to adolescents, and cooperative learning as a strategy to enhance adolescent motivation. The second section will survey reward sensitivity, and appropriate tasks. The third section will explain how adolescent self-beliefs are shaped by the aforementioned factors.

Factors that motivate adolescents. Adolescents desire peer acceptance, autonomy, and supportive adult relationships; therefore, adolescents are motivated by activities and environments that meet these needs (Ryan & Patrick, 2001). This type of motivation is
important to adolescents because even when teachers provide rich learning experiences, students won't engage unless their affect is positive. Motivation and affect can be nourished by creating a classroom environment that is supportive and organized, using instructional materials that are at an appropriate level of difficulty, and engaging students in meaningful and relevant instructional tasks (Mastropieri & Scruggs, 2004). In order to create a 6th grade classroom that meets these criteria, it is important to understand the unique needs of adolescent learners.

Social environment. The social environment of the classroom is particularly important to motivation and engagement for adolescents (Ryan & Patrick, 2001). Adolescents are at a transitional stage where they are moving from emotionally supported elementary classrooms to more academically demanding courses. Adolescents want to be treated like adults yet they yearn to be nurtured like young children. It is important for teachers to address the social and emotional needs of adolescents in both an academic and peer context, especially when considering the developmental changes that occur during adolescence (Hebert, Corcoran, Cote, Ene, Leighton, Holmes & Padula, 2014). In addition, research shows that when adolescents perceive that their teachers care, they are academically motivated (Ryan & Patrick, 2001). In order to motivate students, it is crucial for teachers to develop emotionally safe and nurturing classrooms where adolescent development is considered.

Importance of peer and adult relationships to adolescents. According to Ryan and Patrick (2001), adolescents are highly motivated by peer acceptance and positive adult
relationships, so it is important that teachers provide opportunities for students to work together and develop respectful relationships with each other. Peer relationships that are emotionally supportive and provide companionship are crucial for social and academic development. When teachers provide these opportunities, teachers are implying that trust and respect exists between the teacher and the learner. To help students feel a greater sense of belonging, teachers need to engage adolescents in real responsibility such as tutoring, food drives, and service; furthermore, adolescents need to feel trusted and involved in decision making (Hicks, 1997). Teachers can build supportive relationships with students by setting clear expectations for work and behavior; providing opportunities to develop a sense of trust; and giving students responsibility to carry out decision making tasks. One example of considering adolescent development is to provide collaborative learning experiences.

Enhancing adolescent motivation with cooperative learning. A supportive and organized teacher provides learning experiences that have clear expectations and opportunities to develop positive relationships through collaborative activities. Adolescents benefit socially and emotionally from cooperative learning experiences (Ryan & Patrick, 2001). Because learning in cooperative groups depends on the interaction between adolescent peers, it is a legitimate context for adolescents to interact with each other. Collaborative tasks help students to work on common goals and meaningful tasks in the framework of a shared experience that contributes to positive social development (Hicks, 1997). Cooperative learning motivates students to complete
learning tasks because they relish in opportunities to engage in social connections with their peers.

**Reward sensitivity in adolescents.** Adolescents are extremely motivated by rewards (Galvan, 2013). Praise for effort rather than intelligence provides reward and motivation for students to work through challenging tasks (Dweck, 2006). When students are rewarded by praise for their persistent effort and attitude towards learning, students of all intelligence levels understand that success is attributed to a sincere effort to learn, which leads to positive affect among all students (Mastropieri & Scruggs, 2004).

**Appropriate tasks as they relate to positive self-beliefs.** To keep students motivated, teachers must use instructional strategies that are at an appropriate difficulty level and tasks that are meaningful (Mastropieri & Scruggs, 2004). It is important that students are appropriately challenged. Students learn the most when they engage in challenging tasks that are just beyond their comfort zone, but can achieve with support (Masters, 2014). According to Eccles and Wigfield (1995), adolescents are most successful on a task when they have positive self-beliefs. However, if students are always given tasks that have a high probability of success, then learning is minimized and students do not learn the relationship between effort and success (Masters, 2014). If tasks are too easy, students do not learn how to cope with setbacks or put forth effort (Dweck, 2006). Students may associate effort with failure and slip into self-beliefs that they are not smart enough to complete the task. It is critical that teachers provide challenging learning opportunities that contribute to positive self-beliefs, but do not frustrate the child
so much that students devalue the activity because it is difficult. Students are motivated to complete learning tasks when tasks neither too easy nor too hard.

Summary. School is a major component of adolescents’ lives. Adolescents need to have a strong sense of belonging in order for them to be adequately motivated to engage in academic activities. Peer and adult relationships, sense of purpose, and rewards are highly motivating to adolescents. If students lack support in these areas, they become vulnerable to negative feedback that contribute to damaging self-beliefs and mindsets. It is important to consider adolescent development and motivation when planning activities for 6th grade students.

Mindsets

Mindset is a set of personal beliefs and is a way of thinking that influences behavior and attitude towards oneself and others (Ricci, 2013). It is important that people have realistic self-beliefs that reflect traits of persistence and the ability to improve one's situation. The first part of this section will provide an overview of growth mindset and fixed mindset as they relate to an academic context and a brief description of how neuroscience is linked to mindset. The second part of this section will discuss the growth and fixed mindsets of more advanced and less advanced adolescents. Adolescents are affected by mindset in both an academic and social context. The last part of this section will discuss growth mindset interventions to develop positive social/emotional results and increased academic engagement.
Definition of mindsets. Carol Dweck is the author of Mindset: The New Psychology of Success, the Lewis and Eaton Professor of Psychology at Stanford University, and a leading researcher in the area of student motivation (Trei, 2007). Dweck links student motivation to perception of intelligence, or mindset (Sparks, 2013). Growth mindset is the belief that a person's brain can grow and that intelligence can be developed with practice (Dweck, 2008). Students with a growth mindset work and learn more effectively because they embrace challenge and are not discouraged by failure (Boaler, 2013). Fixed mindset is the belief that a person has a certain amount of intelligence (Dweck, 2008). Students with a fixed mindset give up when they make a mistake or fail, and they often avoid challenges because they believe that their intelligence dictates their success or failure (Boaler, 2013). According to research conducted by Dweck and others, students with a growth mindset show more academic growth, better academic skills, and more social engagement (Sparks, 2013).

Growth mindset. Another name for growth mindset is incremental theory, and students with a growth mindset are sometimes called incremental theorists. Incremental theory is a consciousness about growth and development. Challenges are seen as opportunities to develop further understanding; effort is viewed as the energy needed to make progress; and set backs are appreciated for helping to develop new strategies that can be transferred to future situations (Yeager & Dweck, 2012). Incremental theory is a door to the world of opportunities.
Fixed Mindsets. Fixed mindset is known as entity theory. Students with fixed mindsets are known as entity theorists. Entity theorists are concerned with their image. When they feel threatened, they disengage from learning. This is problematic because entity theorists will not engage with material that may be important for future learning. Entity theorists are so concerned with self-image that they will not remediate their learning when necessary. Therefore, they do not learn how to work through academic difficulties (Mangels et al., 2006).

Incremental theorists are more resilient when they encounter challenges presented by rigorous academic tasks. When students believe that intellectual ability can be developed through effort, strategies, and collaboration, they develop academic resiliency. Incremental theorists are able to work through challenging situations because they understand that their success is determined by their effort and strategies. Incremental theorists seek help when they encounter roadblocks. Incremental theorists do not worry about their image, and they are determined to work through challenging tasks. Incremental theorists are eager to learn and shape their goals in light of potential (Yeager & Dweck, 2012). Neuroscience has confirmed through patterns brain activity that self-beliefs impact learning success in academic settings (Mangels et al. 2006).

The link between mindset and neuroscience. A study by Mangels et al. (2006) established that students with growth mindsets yield considerable gains in knowledge compared to students with fixed mindsets. The highest gains in knowledge take place with semantic processing (Barton, 2010). Semantic processing involves effort, and
requires analytical processes, and yields better memory results (Barton, 2010). The study by Mangels et al. (2006) demonstrated that students with fixed mindsets appeared less likely to engage in semantic processing. Students with growth mindsets engaged in a greater degree of continued semantic thinking which likely contributed to their ability to deal with academic challenges. Students with growth mindsets used errors to correct their thinking, and students with fixed mindsets disengaged. Students of all abilities can suffer from a fixed mindset and disengage from learning.

**Fixed mindset in less advanced students.** In the context of standards based education, less advanced students get caught in a cycle of receiving low grades year after year. Students are told that they are academically lower in comparison to other students and there is no feedback that indicates the amount of growth that takes place over the year. Furthermore, grades are based on completion of tasks and year level expectations rather than growth in learning. Students receiving low grades may be making significant academic progress each year when their achievement is put into the context of their starting and ending points; however, their academic growth is not acknowledged (Masters, 2014). This type of feedback may trigger students to believe that their efforts will never lead to success and contribute to a negative self-belief. Standards-based education promotes a fixed mindset. Tasks are evaluated on fixed content, and students are not evaluated based on academic growth. Teaching fixed content can be just as harmful to advanced students.
**Fixed mindsets in advanced students.** Fixed mindsets in advanced students are problematic. Advanced students may not experience the level of academic challenge that less advanced students must work through in standards based education. Because standardized tests stress the importance of meeting standards, the focus is not on academic growth. Teachers focus on guiding all students to meet the standard rather than academic growth. If advanced students have already met the standards, there is no growth. This means that advanced students receive little to no critical academic feedback and rarely need to work through academic challenges. Advanced students are susceptible to fall into a fixed mindset because they become accustomed to academic success with little effort. Advanced students may refuse to take on challenging tasks for fear of failure or for fear that their social image may diminish (Dweck, 2006). Fear leads to a fixed mindset.

**Fixed mindset messages in education.** Standards-based education can fail to challenge advanced students for several reasons. First, common expectations are more difficult to differentiate (Masters, 14). When advanced students meet the expectation, teachers reward the students with a high grade even if there was little effort put forth. This sends the message that success is more valuable that effort. Students who achieve high grades without effort are vulnerable to a fixed mindset. These students may come to believe that engaging in tasks in which they are successful at are the only tasks worth taking on (Dweck, 2006). Furthermore, students who achieve high grades without effort may become disengaged during challenging situations instead of learning how to work through and overcome challenges (Masters, 2014). When advanced students experience
success time after time, it sends the message that being smart does not require effort (Dweck, 2010).

High grades indicate completion of tasks rather than growth in learning, which means that advanced students and less advanced students are not being evaluated based on academic growth. Students who receive high grades for completing a task may learn responsibility, but they don't learn how to cope with challenging situations. Students who receive low grades even when they have put forth effort equate effort with failure.

Fixed mindset messages at home and school. Praise is one type of mindset message. Praise can send a growth mindset message when used to acknowledge effort, or it can be a fixed mindset message when acknowledging talent or success. Many parents believe that praising their child's intelligence is necessary to build confidence and self-esteem. In fact, Dweck (2007) has found that praising intelligence is damaging to mindset because it sends the message that intelligence is more important than learning. Teachers send fixed mindset messages when they assign tasks that guarantee success with little learning (Masters, 2014). Experiencing rewards or success with minimal effort contributes to a fixed mindset because students do not have to work through challenging tasks or build knowledge from misunderstandings. In fact, rewards are useless in cultivating critical thinking or self-directed learning (Kohn, 1999).

Mindsets about personality. Mindsets about personality are particularly important during adolescence. Adolescents are vulnerable to social and emotional stress during middle and high school. Similar to intelligence mindsets, personality mindsets set the
stage for emotional and social judgments related to social labels and behaviors. People with fixed mindsets about personalities believe that negative behaviors stem from personal deficiencies. People with growth mindsets about personalities believe that people's behaviors and traits are malleable and have the potential to change (Yeager & Dweck, 2012). It is important to note that implicit theories of intelligence and of personality are distinct. It is possible for a student to believe that intelligence can be changed but personality cannot, or personality can change and intelligence cannot.

**Summary.** Growth mindsets allow students to increase their intelligence and stamina for learning. Students with growth mindsets see opportunities in their mistakes. Fixed mindsets confine students to feelings of frustration, failure, and inadequacy. Adolescents are vulnerable to fixed mindsets because they have a heightened sense of emotions and great need for peer acceptance (Ryan & Patrick, 2001). Adolescents are bombarded with fixed mindset messages. Standards-based education sends the message that everyone should have the same capacity of intelligence. Well-meaning messages of praise can send messages that intelligence is fixed. It is important that students understand that intelligence can increase with practice. It is important for teachers and parents to send mindset messages that promote effort and offer strategies to work through challenging tasks. Interventions that shift students from fixed mindsets to growth mindsets have been shown to be successful when administered effectively (Dweck, 2006; Walton, 2014).
Wise Interventions

This section will discuss psychologically wise interventions. Wise interventions are precise psychological interventions that target specific thoughts and feelings that help people thrive (Walton, 2014). "A wise intervention begins with a specific, well-founded psychological theory" (Walton, 2014 p.74). The first part of this section will provide an overview of important points to remember when establishing wise interventions and explain how the environment of the wise intervention impacts the intervention. The second part of the section will discuss mindset interventions that have been successful in shifting students from a fixed mindset to a growth mindset.

Establishing wise interventions. According to Walton (2014), wise interventions must be adaptable to the situation, target psychological problems, and use active exercises such as reading and writing. There have been many studies that link wise interventions to lasting psychological change. When establishing a wise intervention, it is important to understand the subject's psychological reality; that is, it is important to know how they see themselves internally and within their social context (Walton, 2014). In the case of mindset interventions for 6th graders, it is important to understand their lives in a social and emotional context. Because adolescents experience a profound sense of vulnerability due to developmental changes and heightened emotions, it is critical that wise interventions are administered in a way that limits their feeling of vulnerability. Schools need to feel like a safe place, and students need to feel a sense of social belonging (Hebert et al., 2014).
Context of wise interventions. When school feels like a safe community, it becomes a prime environment to implement wise interventions because long-term gains are most likely to happen if interventions are applied in an everyday context. If a positive experience occurs in a recurring context, it will fuel positive outcomes in the future. Wise interventions target self-reinforcing processes with short and precise psychological interventions. These interventions aim to alter people's self-beliefs and improve people's long-term experiences and attitudes in diverse circumstances (Walton, 2014).

In creating wise interventions, researchers identify an aspect of people's psychology that is harmful. The psychological intervention is designed to change the harmful process (Walton, 2014). In the case of adolescents, a fixed mindset is harmful to their academic, social, and emotional well-being. A fixed mindset can lead to self-beliefs that are self-destructive.

Growth mindset interventions. A growth mindset intervention is a type of wise intervention. The goal of a growth mindset intervention is to shift a person from a fixed mindset to a growth mindset. A wise intervention is a good solution to a fixed mindset because it can be administered in an everyday context and is designed to change a harmful process (Walton, 2014). Growth mindset messages and specific intervention activities have proven to be effective in shifting people from fixed mindsets to growth mindsets.

Factors to consider when creating mindset interventions. The mindset intervention begins with the well-researched theory of growth and fixed mindset. Growth mindset
interventions are specific interventions that are adapted to educational contexts. Because growth mindset deals with the ideas of intelligence and academics, mindset interventions target the specific psychological problem of students' self-beliefs that their intelligence is fixed. Students' relationships with academics is in the context of school. Therefore, it is important that the intervention is carried out in school. Students who hold fixed mindsets are not able reach their academic potential and may be especially vulnerable to negative social and emotional self-beliefs (Walton, 2014; Yeager et al., 2013). A growth mindset intelligence intervention teaches students that intelligence can expand with effort and help from others in an authentic context. These interventions have been shown to help students perform better in school for months after the interventions (Yeager & Walton, 2011).

**Academic growth mindset messages.** Growth mindset messages praise effort. Praising students' strategies sends the message that problem-solving can take time, and it is worth the time and effort to work through challenging situations. Praising focus sends a growth mindset message because it allows students to think critically about situations they find important. Praising effort sends a growth mindset message by equating success with effort. Praising persistence and improvement sends a growth mindset message because it shows students that they can grow their intelligence through practice. When messages focus on problem-solving, critical thinking, persistence, and progress, students are not trapped in a fixed mindset, rather they are free to stretch and improve their learning (Dweck, 2007).
Feedback for students who don't perform well should help them see that they need better strategies. Teachers can communicate a growth mindset by making suggestions that convey the idea that their teacher sees potential in their abilities. For example, advising a student to meet with a tutor sends the message that the teacher thinks that the student can learn the material with extra effort and practice. It is important that students understand that their teacher sees potential in their abilities (Yeager & Dweck, 2012).

Growth mindset messages reinforce specific mindset interventions.

Explicit instruction on the science of learning. Some growth mindset interventions are lessons that teach students how the brain grows and develops during learning experiences. When students are explicitly taught that a person can get smarter with hard work and help from others, they perform better in school for months after the intelligence intervention. These types of interventions require the students to learn and reflect on how the brain builds neural pathways as a response to learning. Research shows that growth mindset interventions are psychologically wise interventions that have been proven to have long-lasting positive effects. Mindset interventions are carried out in every day contexts and can make profound differences in students' self-beliefs (Walton, 2014).

Critics of growth mindset interventions. An extensive internet and library search was conducted to examine critics of growth mindset interventions. I could not find any credible published research that indicated that mindset interventions were harmful or unsuccessful.
Chapter Summary

Theories of intelligence give credibility to the idea that intelligence is not predetermined. It is crucial that students and teachers understand that intelligence is not fixed, and that it can be developed through learning. It is important that both students and teachers function in a growth mindset. In order to help students reach a growth mindset, teachers must understand how their actions affect mindsets. In the case of adolescents, it is critical that peer and adult relationships are strong so that adolescents' motivation is not inhibited by social or emotional factors. Mindset interventions are short, precise, psychological interventions that help move people from a fixed mindset to a growth mindset. These interventions should be adapted to the population in which they intend to serve. In the case of adolescents, mindset interventions may affect adolescents' self-beliefs in regards to academics and social belonging.

Introduction to Chapter Three

Chapter Three describes the action research methods that were used to explore the purpose of the study. The purpose of this study was to help students understand that intelligence is not predetermined, and that intelligence can be developed through practice and learning. The research took place at a 6-12 public school with sixty-six 6th grade students. The action research began with students completing a pre-assessment, taking mindset surveys and goal achievement surveys, and identifying strategies they used to solve problems. The variable that was introduced was mindset interventions. Then students participated in a sequence of eight mindset interventions. The interventions were
lessons that taught students about the biological process of learning, as well as strategies to develop a growth mindset. Students created posters, concept maps, and illustrations as a method of practicing their strategies and explaining their learning. Students kept a journal to record their thoughts and feelings about the mindset interventions. I used the journals along with pre and post assessments, students’ self-identified problem-solving strategies and student work as a longitudinal qualitative measure of mindset growth. I used surveys before and after the interventions as a quantitative measure of mindset. The data was collected and analyzed to answer the research question: How do growth mindset interventions affect 6th grade students’ mindsets?
CHAPTER THREE

Methodology

Introduction

In the literature review, I explored theories of intelligence, mindset, and adolescent development. There is an abundance of research that supports the idea that growth mindset interventions are highly effective in shifting students to growth mindsets. My literature review identified many of the causes of fixed mindsets in adolescents and effective methods for carrying out mindset interventions. I used action research to study the effect of mindset interventions on 6th grade students' mindsets. My research question was: How do growth mindset interventions affect 6th grade students’ mindsets? The purpose of my study was to help students understand that intelligence is not predetermined, and that intelligence can be developed through practice and learning. The goal of my research was to find out if mindset interventions carried out in a 6th grade classroom achieve this purpose.

Methodology

Action research. I used action research to conduct my research. Action research is conducted by teachers in their classrooms within their locus of control. Action research is used to make positive changes that improve educational practices, the school environment, and student outcomes (Mills, 2011).

Exploratory mixed methods. I relied on an explanatory mixed methods approach. I conducted surveys that relied primarily on quantitative measures. I used work samples, lesson reflections, and anecdotal notes as qualitative measures. The qualitative measures
helped to identify unanticipated variables, such as the lack of students' problem-solving strategies. The qualitative measures helped to interpret the quantitative data and support the quantitative results.

**Surveys.** I relied heavily on surveys because previous researchers who have studied this topic used surveys. Dweck (2007) created and used surveys in her research on mindsets. I used similar surveys in my research.

**Students' self-identified problem-solving strategies.** Students were asked to identify three strategies they used to solve problems. This was a qualitative measure of the number of strategies students used and the types of strategies students used. The students' strategies were evaluated for mindset orientation.

**Anecdotal notes.** I used anecdotal notes in my study as a qualitative measure. I took anecdotal notes during the research period. I reflected on the lessons I taught, and I noted any behaviors that stood out as fixed mindset or growth mindset.

**Student work examples.** Student work samples were used in my research as a qualitative measure. The student work samples were analyzed for evidence of mindset orientation and compared against the anecdotal notes and surveys to determine validity.

**Surveys as Research Tools**

Surveys were the quantitative research tool used to measure a change in the students' mindsets and goal orientations. This section discusses the structure of the surveys and the rationale for using surveys.

**Survey description and rationale.** I used two surveys in my research. Growth mindset surveys and achievement goal surveys. The surveys were administered online.
and were used to measure attitudes about learning and self-beliefs. The growth mindset and achievement goal surveys contained introductions that asked demographic information such as gender, classroom teacher, and age. Students took the online surveys at school, so there was 100% participation of the consenting students who were present at school on the days that the surveys were administered. The quantitative measures were based on Dweck's (2007) mindset survey and Meece and Miller's (2001) achievement goal survey. These surveys were used in previous research on mindset.

Previous research in the area of mindset was conducted using surveys. I administered the surveys using a 6-point Likert scale for all of the quantitative questions. Students were asked a series of questions with the options to (1) strongly disagree (2) disagree (3) somewhat disagree (4) somewhat agree (5) agree (6) strongly agree. I used the 6 point Likert scale because it has a higher trend of discrimination and reliability (Chomeya, 2010).

Setting and Participants

School setting. The setting of the action research was at a 6-12 school with an enrollment of about 700 students. The school operates on a four day school week. The school is located in a small city of about 4,000 people located in upper central United States. Ninety-three percent of the student population is white. The remaining percentage is predominately bi-racial. The household median income is $38,680 per year. The free and reduced population of the school is nearly 40%.

Sixth grade setting. The research took place in my classroom with sixty-six 6th grade students. There were five children of color and five children that received special
education services during the language arts block. There were eight students with Individualized Education Plans (IEPs). The subjects of the study rotated between three teachers throughout the day. Sixth grade was their first experience with rotating classes. They saw a male teacher for reading and social, a male teacher for math, and a female teacher for science and language arts. Students spent 55 minutes in the core classes of science, reading, and math. They spent 30 minutes each school day in social studies and language arts. Students participated in an extra 30 minute block of math each day for skills reinforcement and math games. They had one study hall and one elective period of 55 minutes each day. Students attended three electives a week. Students went to music once a week for the entire year. Students went to physical education twice a week for the entire year. Students had a third elective that they attended once a week. This elective changed every quarter. The first quarter of the year they attended art, the second quarter was computers, the third quarter was Family and Consumer Sciences, and the fourth quarter was Industrial Arts. Students had the option of joining band. Twenty-five students were in band. These students used a shared study hall time for band once a week. Each band student was pulled from a core class for 25 minutes once each week for an individual or group lesson. The 6th graders shared a locker bay with the rest of the 6-12 student population. At lunch, the 6th graders were the only students in the cafeteria. Students had 30 minutes of recess each day and a 25 minute lunch.

**Sixth grade science setting.** Students met in a regular classroom. The classroom had desks and chairs that were in rowed pairs or pods of 4 to 5 desks. The classroom had tall windows which provided natural light. The classroom was equipped with two large
white boards, a ceiling-mounted projector, vcr, dvd player, teacher computer, and document camera. There was a portable science table located in the front of the room. The classroom had cupboards, a sink, and a counter. The classroom door was usually kept shut and locked during instructional time.

**Human Subjects Review**

A human subject review was completed after my proposal was approved. I completed a Human Subject Committee (HSC) long form and submitted it to the Institutional Review Board (IRB) with a letter of consent from my school district. I provided the IRB with information concerning the potential participants. In addition, I provided the (IRB) with a description of my study. The description included information about the purpose, participants, setting, and research methods in the study. I identified the potential risks and benefits of the study.

**Student and guardian consent.** Students and their guardians agreed to be participants in human research. The consent form [See Appendix D] contained information about the study, its potential risks and benefits, assurance of confidentiality, and assurance of voluntary participation. Students or their guardians had the option to opt-out of the study survey and questionnaires by returning the opt-out form. In addition, the students could withdraw from the study at any time without penalty.

**Potential risks and benefits.** Participant confidentiality was a potential risk. This risk was mitigated by the use of anonymous surveys. Names were removed from student work samples. The names of the students were not associated with surveys or work
samples. Students were advised not to sign their surveys. Potential benefits of the study were an increase in positive self-beliefs and sense of belonging.

Research Methods

This section discusses the implementation process and research methods used to answer the question, *How do growth mindset interventions affect students’ mindsets?* The action research took place each week during science class over a period of eight weeks. First, the students completed pre-assessments and took mindset surveys. Second, students identified specific strategies they used to solve problems. Third, students participated in mindset interventions. Fourth, the students completed the mindset surveys a second time. Fifth, the students completed a post assessment and identified specific strategies they used to solve problems.

Implementation. Mindset assessments, lessons, and surveys were delivered during science class or an available computer lab time each week over eight consecutive weeks [See Appendix C]. Each 6th grade class attended science for 55 minutes each school day. Science classes were scheduled in the morning from 8:00 to 8:57; 9:01-10:01; and 10:05-11:02. Science classes met in a regular 6th grade classroom.

Pre-assessments and initial surveys. The first step in the research methods was for students to complete a pre-assessment. The pre-assessment was an activity in which the students were given an outline of a human head. The students drew their ideas of what the brain looked like. The students' assessments were categorized into three groups: moderately accurate representation, somewhat accurate, limited understanding. A moderately accurate sample would show that the brain takes up the portion of the skull
above and behind the eyes, a brain stem or spinal cord, and an illustration of folds or regions in the brain. A somewhat accurate representation would show an undersized brain, additional parts of the nervous system, and/or folds. A limited understanding sample would show a brain that occupies a very small space at the top or middle of the head.

After the pre-assessment, students took two online surveys. The first survey was adapted from Dweck's (2007) mindset survey [See Appendix A]. The Growth Mindset Survey measured students' self-beliefs regarding their intelligence using a 6 point Likert scale in which students chose a level of agreement or disagreement. The Growth Mindset Survey is a survey tool that has been used in previous research and has been proven to be reliable. The survey was administered on Survey Monkey®. Students completed second survey that measured achievement goals. The Achievement Goals Survey [See Appendix B] was adapted from a literacy study conducted by Meece and Miller (2001). This survey measures task mastery orientation and performance goal orientation. Task mastery is closely related to growth mindset and performance goal orientation is closely related to fixed mindset. The achievement goals survey was administered on Survey Monkey®. Students attitudes about tasks and performances were measured using a 6-point Likert Scale in which students chose a level of agreement of disagreement.

Next, students were asked to identify the three main strategies they used to solve problems. Students wrote down three main strategies that they used. The responses were collected and categorized as a strategy to find the answer (fixed mindset) or a strategy to help understand concepts (growth mindset).
Mindset interventions. The second step of the research methods was a series of mindset interventions [See Appendix C]. Students participated in brief, targeted mindset interventions and lessons each week for eight weeks. The mindset interventions took place each week during science. Students wrote weekly reflections in their mindset journals and were asked to create posters, concept maps, and pictures as part of the mindset intervention. Samples of student work were used as a qualitative measure of mindset.

Anecdotal notes. During the course of the study, I was a participant observer and used anecdotal notes and lesson reflections to measure student behaviors that related to mindset. Indications of a growth mindset were noted in behaviors such as working through challenging tasks and extending learning beyond the required assignments.

Closing surveys. In the third part of the study, students completed the Mindset Survey [See Appendix A] and the Goal Achievement Survey [See Appendix B]. The results of the surveys were compared to the initial surveys to see if there was a change in mindset or achievement goal orientation. Then students were asked to identify three strategies they used to solve a problem. The strategies which the students identified were compared to the initial collection of strategies.

Post assessment. After the mindset interventions and surveys, students were given an outline of a human head. They were asked to draw what they thought their brain looked like inside the head. The post assessments were categorized and compared to the pre-assessment.
Data collection and analysis. The quantitative data was analyzed using tools in Survey Monkey® and Microsoft Excel®. I compared my pre-intervention data to my post-intervention data. I evaluated the student work samples and analyzed how they were related to the quantitative data that I collected. I used the qualitative data from my field notes, student work samples, and students’ self-identified problem-solving strategies to measure changes in mindset over time. I searched for trends in mindset changes and compared the qualitative data to the quantitative data. The results are in Chapter Four.

Chapter Three Summary

I chose mixed methods action research that relies data from surveys, observations, and student work samples. First, I surveyed my students about their mindsets, measured their orientation in task and performance goal achievement, administered a pre-assessment, and collected information on their preferred problem-solving strategies. Second, students participated in lessons and activities over a period of eight weeks. The objectives of the lessons and activities were to teach students how the brain works, how to keep the brain healthy, the difference between a fixed and growth mindset, and how to identify a growth mindset. I analyzed work samples and observed my students for specific behaviors that related to mindsets. Then I surveyed the students, and evaluated the quantitative and qualitative data to find out how mindset interventions affect 6th grade students' mindsets.

Introduction to Chapter Four

Chapter Four presents and analyzes the quantitative data collected from surveys and the qualitative data collected from observations, students' self-identified problem-
solving strategies, anecdotal notes, and student work samples to answer the question: How do growth mindset interventions affect 6th grade students’ mindsets? I discuss themes and patterns that emerged from the data analysis to themes and patterns in the literature review.
CHAPTER FOUR

Results

Introduction

Chapter Four presents the results of the action research that was used to answer the question: How do growth mindset interventions affect 6th grade students’ mindsets? Research was carried out over eight weeks with 6th grade students. Mindset interventions were delivered each week as classroom lessons. The results of the research include data analysis from pre and post student work sample assessments, initial and closing surveys, student identified problem-solving strategies, student work samples, and lesson reflections.

First, qualitative data from pre and post assessments will be compared and contrasted. Second, data from mindset and achievement goal surveys will be presented and analyzed. Third, inventories of students' self-identified problem-solving strategies will be presented and analyzed as they relate to mindset orientations. Fourth, data from anecdotal notes and mindset interventions will be presented. Fifth, the findings will be summarized, and the themes and patterns that emerged from the quantitative and qualitative data will be discussed. The findings will be related to the themes and patterns of the literature review as the results are presented.

Qualitative Data from Pre and Post Assessments about Brain Structure

Assessments overview. This section presents the results of qualitative data from pre and post assessments that measured knowledge about brain structure and function. The assessments are described and student examples are presented. Data from the
assessments indicates that mindset interventions changed students' knowledge about the function and structure of the brain and increased their use of learning strategies.

**Description of assessments.** The purpose of the pre and post assessment was to measure change in students' knowledge about the function and structure of the brain. Students were given an outline of a human head and were asked to draw their brain inside the head. The students' assessments were categorized into three groups: moderately accurate representation, somewhat accurate, and limited understanding. A moderately accurate sample would show that the brain takes up the portion of the skull above and behind the eyes, a brain stem or spinal cord, and an illustration of folds or regions in the brain. A somewhat accurate representation would show an undersized brain, additional parts of the nervous system, and/or folds. A limited understanding sample would show a brain that occupies a very small space at the top or middle of the head.

**Pre-assessment data.** Sixty-six 6th graders participated in the pre-assessment. In the pre-assessment 51.5% of the students demonstrated a limited understanding; 41% of students demonstrated a somewhat accurate representation; and 7.5% of students demonstrated a moderately accurate representation. The pre-assessments indicated that more than half of the students had limited ideas about the structure of the brain, and very few students had moderately accurate ideas about the structure of the brain.

**Post assessment data.** After the mindset interventions, 55 students participated in a post assessment. The task was the same as the pre-assessment. In the post assessment, 5.5% of students demonstrated a limited understanding of brain structure; 36.4% of students demonstrated a somewhat accurate representation of brain structure; and 58.2%
of students demonstrated a moderately accurate representation of brain structure. The post assessments indicate that mindset interventions changed students’ understanding of the structure of the brain. See Figure 4.1. An understanding of brain structure and function correlates with a growth mindset (Yeager & Dweck, 2012).

![Figure 4.1. 6th graders understanding of the structure of the brain. This figure compares students' ideas about the structure of the brain before and after mindset interventions.](image)

Comparison of pre and post assessments. There were two major findings in the assessments. First, the participants' representations increased in accuracy, quality, and use of learning strategies. Second, the illustrations demonstrated that the participants had new ideas about the brain. This is important because mindset interventions are more effective when students understand how the brain works (Yeager & Dweck, 2012).

The first student sample demonstrates a shift from a limited understanding to a somewhat accurate representation. The comparison of Student A’s pre and post assessments reveal an increase in understanding about the brain. See Figure 4.2 and Figure 4.3. The post assessment shows that the student has a better understanding of the
cerebral cortex, cerebellum, and blood vessels leading to the brain. The pre-assessment did not include any of these structural pieces of the brain. The post assessment illustrates that the student has new ideas about the brain. The pre-assessment suggests that the student links the brain primarily to personality because the brain has a face and a baseball cap. The post assessment suggests that the student links the brain to thinking and ideas because there is a bright light bulb above the brain. The mindset interventions helped the student to understand the structure and function of their brain.

Students who had initially created a moderately accurate brain representation demonstrated a growth in knowledge about brain structure and new ideas about brain
function. Student B created a pre-assessment that was moderately accurate. See Figure 4.4. The student illustrated a brain that had brain folds, a brain stem, and a brain that extended behind the eyes. The post assessment demonstrates an increase in understanding of brain structure and new ideas about brain function. The student's post assessment adds the cerebral cortex, cerebellum, and spinal cord. The illustration also demonstrates new ideas about the function of the brain because the student has drawn in an eye and connected the eye to the brain. The student links her perceptions to the brain. This infers that the student believes that learning can shape the brain, which is evidence of a growth mindset.

Student C demonstrated an increase in knowledge about the brain, new ideas about function, and an enthusiasm for learning about the brain. In the pre-assessment, the
student demonstrated a somewhat accurate representation of the brain. *See Figure 4.6.*

The pre-assessment illustration showed the brain in a relatively large region that extended into the upper skull and behind the eye. The post assessment illustrates a shift to a moderately accurate understanding of brain structure and new ideas about how the brain functions. *See Figure 4.7.* The student has a similar idea to the size, but a more accurate idea of the structure. The student identified separate processing regions for thoughts, learning, memories, and bodily functions. The student connected the eye to the brain, which demonstrates that the student links perceptions to learning. An important detail about this illustration is that the student has separated the process of learning from the
storage of memories. This is important because students with a growth mindset know that it is possible to learn something and then forget it. This student has demonstrated the idea that learning must be practiced in order to put new skills into memory storage.

Additionally, the student demonstrates an increase in enthusiasm and motivation for the subject because the illustration is colorful and labeled.

Student D shifted from a limited understanding of the brain to a moderately accurate representation of the brain. Student D’s pre-assessment shows a brain in the upper area of the skull. Because the brain is divided into regions for family, fishing, school, home, four-wheeling, hunting, and smart, the student associates the brain with
daily activities. The student placed the smart region between the hunting and fishing regions. This may indicate that the student only feels smart when fishing or hunting. *See Figure 4.8.* The post assessment indicates a shift to a moderate understanding of the brain. *See Figure 4.9.* In the post assessment, the student illustrated the cerebral cortex, cerebellum, brain stem, and spinal cord. The student labeled parts of the head including the mouth and nose, which indicates that the student now associates the brain with senses and functions such as smell, taste, and digestion. The post assessment shows a larger inventory of learning strategies because there are more details, labels, and arrows. The student’s increased knowledge about the brain and increased use of strategies indicates a stronger orientation toward a growth mindset.

*Figure 4.10. Student E pre-assessment drawing of the brain.*

*Figure 4.11. Student E post assessment drawing of the brain. Notice that the brain is larger, has brain folds, a cerebellum, and a brain stem.*
The illustrations by Student E are an example of one the least changed views of the structure of the brain. See Figure 4.10 and Figure 4.11. The pre-assessment brain is very small and only takes up a small part of the upper skull. In the post assessment illustration, the brain has increased in size, there are brain folds, a brain stem, and a cerebellum. Because the student has added folds, a brain stem, and a cerebellum, it demonstrates that the student has new ideas about the function of the brain and how it is linked to other jobs in the body and mind. This evidence demonstrates that even in students with the least changed views, there is a shift in perception about the structure and function of the brain.

The pre-assessment and post assessment illustrations by Student F demonstrate a large shift in the understanding of the structure and function of the brain. See Figure 4.12 and Figure 4.13. The pre-assessment brain has folds and is limited to the upper region of
the skull. The post assessment demonstrates a shift to a moderately accurate understanding. The student illustrated the cerebral cortex, cerebellum, brain stem, and spinal cord. The student added additional features such as nasal passage, mouth, and throat. It is likely that the student links their brain function to other senses and functions. The eye is connected to the brain, which indicates that the student understands that our experiences shape our brain. This is a trait of people who have a growth mindset.

**Analysis of themes and patterns.** Some of the mindset interventions carried out in the research taught about the function and structure of the brain as well as how the brain changes when learning occurs. The evidence from the pre and post assessments indicate that the interventions increased students' knowledge about brain structure and function. Evidence from the assessments indicate that students link perception with the brain. This is important because the goal of the study was teach children that intelligence was not fixed. Students who linked perception with the brain demonstrated the understanding that intelligence is not fixed, and that their intelligence is shaped by their experiences.

The pre-assessments indicated a wide range of knowledge about the brain. The pre-assessment illustrations ranged from a small cloud in the brain to a moderately accurate representation that included major structures such as the cerebral cortex and brain stem. The illustrations greatly varied in quality. Some illustrations were messy and others were neat and detailed.

The post intervention illustrations confirm an increase in knowledge about the brain as well as a positive attitude toward the brain. The post intervention illustrations are
evidence to students' increased use of learning strategies. Most of the post intervention illustrations showed the parts of the brain in more detail; moreover, the illustrations had more information such as labels, notes, and arrows. The use of labels, notes, and arrows was taught as a learning strategy in content reading during the span of the mindset interventions. In addition, the overall quality of the post assessments greatly increased, which demonstrates a positive attitude about the brain. The drawings had new information that included sensory organs, which reveals that students understand that there is a link between perception and learning. Additionally, the post assessments had specific details added to the drawings, such as light bulbs (ideas). These details point to an increase in understanding about how learning takes place in the brain and that learning increases intelligence. These findings indicate an increase in growth mindset orientation.

Data from Mindset Surveys and Achievement Goal Surveys

Overview of mindset surveys. Students took pre and post intervention surveys that measured fixed mindset orientation and growth mindset orientation. The surveys were administered online, and 100% of consenting students who were present on the day of the survey participated. The mindset survey asked six questions that evaluated mindset. Three questions were written in the context of a growth mindset, and three questions were written in the context of a fixed mindset. Data from the pre and post intervention surveys were compared. The evidence shows that mindset interventions caused an increase in growth mindset orientation and a decrease in fixed mindset orientation.
Fixed mindset orientation. The first three questions measured students' fixed mindset orientation. See Figure 4.14. According to the initial survey, 6th grade students had a low measure of fixed mindset with an average orientation rating of 2.67, which indicates that, on average, students somewhat disagreed with fixed mindset orientation questions before any intervention took place. The survey taken after the intervention shows that fixed mindset orientation dropped to an average orientation rating of 2.43, which indicates that, on average, students disagreed with fixed mindset questions after the mindset interventions took place. See Figure 4.15. The survey data is evidence that the mindset interventions lessen 6th grade students' orientation toward a fixed mindset.

![Fixed Mindset Orientation](image)

*Figure 4.15. Fixed mindset orientation. This graph compares fixed mindset orientation before and after the mindset interventions. Notice that there was a decrease in fixed mindset orientation.*
Survey Questions that Measure Fixed Mindset Orientation

5.1 You have a certain amount of intelligence, and you really can't do much to change it.

<table>
<thead>
<tr>
<th>Initial Survey</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Somewhat Disagree</th>
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answered question 61

5.2 You have a certain amount of intelligence, and you really can't do much to change it.

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answered question 62

6.1 Your intelligence is something about you that you can't change very much.

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answered question 61

6.2 Your intelligence is something about you that you can't change very much.

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answered question 62

7.1 You can learn new things, but you can't really change your basic intelligence.

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answered question 61

7.2 You can learn new things, but you can't really change your basic intelligence.

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answered question 62

Figure 4.14. Survey questions that measure fixed mindset orientation. This figure illustrates the students' levels of agreement or disagreement with fixed mindset.
Growth mindset orientation. Next, students answered three questions that measured their growth mindset orientation. See Figure 4.16. According to the initial survey, 6th grade students had a strong growth mindset orientation with an average rating of 4.78. This indicates that, on average, students agreed with growth mindset orientation questions before any intervention took place. The survey taken after the intervention shows that growth mindset orientation rose to an average rating of 5.03, which indicates that, on average, more students agreed with growth mindset questions after the mindset interventions took place. See Figure 4.17. The survey data is evidence that the mindset interventions strengthen the orientation toward a growth mindset.

Summary of mindset survey data analysis. Mindset interventions lessen orientations toward a fixed mindset and strengthen orientations toward a growth mindset. The data collected from the mindset surveys is one piece of evidence which demonstrates
### Survey Questions that Measure Growth Mindset Orientation

**8.1 No matter who you are, you can change your intelligence a lot.**

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**8.2 No matter who you are, you can change your intelligence a lot.**

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**9.1 You can always greatly change how intelligent you are.**

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**9.2 You can always greatly change how intelligent you are.**

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**10.1 No matter how much intelligence you have, you can always change it quite a bit.**

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**10.2 No matter how much intelligence you have, you can always change it quite a bit.**

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Figure 4.16. Survey questions that measure growth mindset orientation. This figure illustrates the students’ levels of agreement or disagreement with growth mindset.
that growth mindset interventions lower fixed mindset orientation and increase growth mindset orientation.

**Overview of achievement goal surveys.** Students took pre and post intervention surveys that measured their task orientation and their performance goal orientation. The purpose of the achievement goal survey was to substantiate evidence from the mindset surveys. The survey identifies task mastery orientation and performance orientation traits. People with task mastery orientation tend to have a growth mindset because they seek out challenges and set goals to increase their competence. People with performance orientation tend to have a fixed mindset and are more concerned with their image and whether or not others judge them to be competent (Dweck & Leggett, 1988).

The surveys were administered online, and 100% of consenting students who were present on the day the survey participated. The achievement goal survey asked eight questions that evaluated task or performance goals. Four questions measured task orientation (growth mindset) and four questions measured performance goal orientation (fixed mindset). Data from the pre and post intervention surveys were compared. See *Figure 4.18.*

**Task mastery orientation.** Students demonstrated a high level of task mastery orientation before the mindset interventions. After the mindset interventions, task mastery orientation increased. The average task mastery orientation rating before the intervention was 5.20, and the average task orientation rating after the intervention was 5.30. See
<table>
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Figure 4.18. Task Mastery Survey Questions. Data from the pre and post intervention surveys show a slight increase in task mastery.
Figure 4.19. This data correlates to the mindset survey. Prior to the mindset interventions, students had a strong growth mindset orientation. After the mindset interventions, students' growth mindset orientation increased. Task mastery orientation has a strong relationship to growth mindset. People who are task oriented seek out challenging situations and are able to work through problems. Similarly, people with a growth mindset are not afraid to take on challenging tasks (Dweck & Legget, 1988; Dweck 2006).

**Task Mastery Orientation**

<table>
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<th>Likert Measure</th>
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<th>Post Intervention</th>
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<td>Average</td>
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</table>

Figure 4.19. Task mastery orientation. This graph shows an increase in task mastery orientation.

Performance goal orientation. Students demonstrated a strong performance goal orientation which means that the students are concerned with how others perceive them. See Figure 4.19. This is a fixed mindset trait. People with strong performance goal orientation often avoid challenging situations because they are afraid of damaging their image (Dweck & Legget, 1988). This is typical of adolescents because adolescents are highly motivated by peer and adult acceptance (Ryan & Patrick, 2001). Before the
## Performance Goal Orientation Survey Questions

### 9.1 I want to do well in my classes so my parents will think I am smart.

<table>
<thead>
<tr>
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<th>Somewhat Agree</th>
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### 11.1 I want my teachers to think I do a good job on my assignments.

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</table>

### 12.1 I want others to think I am smart.

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### 13.1 I want to do better in my classes than other students.

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### 13. Closing Survey

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Figure 4.20. Performance goal orientation survey questions. This chart shows that students have a strong performance goal orientation. There was a decline in average performance goal orientation after the mindset interventions.
mindset interventions, students demonstrated an average Likert rating of 4.91, which means that 6th graders were concerned about how they were being judged by others. After the mindset interventions, students demonstrated a Likert rating of 4.74, which means that even though the average performance orientation dropped, students were still concerned with how others perceive them. See Figure 4.21.

![Performance Goal Orientation](image)

*Figure 4.21. Performance Goal Orientation. Performance goal orientation decreased after the intervention. Question 12 and 13 had the most dramatic decreases. Questions 12 and 13 relate to peer acceptance.*

Summary of survey data. The survey data indicates that mindset interventions increase growth mindset orientation and decrease fixed mindset orientation. The mindset survey and the achievement goal survey yielded similar results, which validates the findings. The performance goal survey showed the greatest decrease in performance goal orientation as it related to students’ peer relationships. This is significant because it lends evidence to the idea that the mindset interventions help students understand that they are in charge of their own learning by the choices they make. The performance goal orientation showed very little change in performance goal orientation as students relate to
their parents and teachers, which may imply that adult acceptance is more important than peer acceptance.

**Survey of Students' Self-identified Problem-solving Strategies**

This section discusses the purpose of the survey and the results of qualitative data collected from students' self-identified problem-solving strategies. Students were surveyed before and after the mindset interventions to determine how they approach problems in their school work. The results indicate that mindset interventions cause students to increase their use of problem-solving strategies that increase understanding of academic content.

**Purpose.** The purpose of identifying students' problem-solving strategies was to find out how students were approaching challenging academic situations. The initial mindset survey showed that students had a strong growth mindset orientation and a weak fixed mindset orientation. The initial goal achievement survey showed that students believed that they worked hard to understand their assignments and that they used strategies to help them work through problems. I was surprised by this data. In my experience, I noticed that students frequently left a problem blank instead of risking a wrong answer, or they asked for help before they even read the directions. These behaviors did not match the survey results, so I asked for more information by asking the students to write down three strategies they used to help themselves solve a problem.

The responses indicated that students used two types of strategies, one to find answers and one to understand concepts. A fixed mindset strategy is one used to find
answers, and a growth mindset strategy is one used to understand content (Adams, 2013). If the student's response had key words such as look or find, the response was categorized as a strategy used to find an answer. If the response had key words such as read, visualize, or compare, the response was categorized as a strategy to understand content. See Figure 4.22. This data helped me to determine that 61% of the strategies students were using prior to the mindset interventions were fixed in orientation because students were using strategies primarily to find answers. According to the data, students were employing fixed minded strategies even though their mindset survey responses indicated a growth mindset. A fundamental part of growth mindset is the ability to be persistent, use strategies, and cope with failure (Dweck, 2006). In order for students to approach situations from a growth mindset they needed to learn and use more strategies that focused on understanding rather than finding answers.

**Comparison of Student Identified Problem-solving Strategies**

<table>
<thead>
<tr>
<th>Strategies for finding the answer</th>
<th>Strategies for understanding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ask someone (teacher, parent, or classmate)</td>
<td>Look back at problem/reread</td>
</tr>
<tr>
<td>Look in notebook/resources</td>
<td>Write facts or questions/brainstorm/compare to something I know/</td>
</tr>
<tr>
<td>Guess and check</td>
<td>find clues/figure out words</td>
</tr>
<tr>
<td>Research/study/look on internet</td>
<td>Make a diagram or picture/visualize</td>
</tr>
<tr>
<td></td>
<td>Break down the question/dissect problem/do it backwards</td>
</tr>
<tr>
<td></td>
<td>Staying calm/take time/don't give up/take a break &amp; walk around</td>
</tr>
<tr>
<td></td>
<td>Read the question aloud</td>
</tr>
<tr>
<td></td>
<td>Talk to others about it/help others</td>
</tr>
</tbody>
</table>

*Figure 4.22. Comparison of student identified learning strategies. Some strategies are used primarily to find an answer and other strategies are used to help students understand content.*
**Student Identified Problem-solving Strategies**

<table>
<thead>
<tr>
<th>Pre-intervention</th>
<th>Post intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ask someone (teacher, parent, classmate, etc.)</td>
<td>60</td>
</tr>
<tr>
<td>Look in notebook/resources</td>
<td>24</td>
</tr>
<tr>
<td>Look back at problem/rethink/reread</td>
<td>21</td>
</tr>
<tr>
<td>Write facts or questions/brainstorm/compare to something I know/find clues/figure out words</td>
<td>21</td>
</tr>
<tr>
<td>Guess and check</td>
<td>6</td>
</tr>
<tr>
<td>Make a diagram or picture/visualize</td>
<td>6</td>
</tr>
<tr>
<td>Break down the question/dissect problem/do it backwards</td>
<td>8</td>
</tr>
<tr>
<td>Research/study/look on internet</td>
<td>8</td>
</tr>
<tr>
<td>Staying calm/take time/don't give up/take a break &amp; walk around</td>
<td>5</td>
</tr>
<tr>
<td>Read the question aloud</td>
<td>1</td>
</tr>
<tr>
<td>Talk to others about it/help others</td>
<td>0</td>
</tr>
</tbody>
</table>

*Figure 4.23. Student identified problem-solving strategies. This figure shows that students increased the variety of strategies they used to solve problems after the mindset interventions.*

**Effect of mindset interventions on problem-solving strategies.** Mindset interventions caused an increase in problem-solving strategies that 6th graders used to understand problems. Before the mindset interventions, students relied heavily on finding answers rather than solving problems. After the mindset interventions, students identified a larger number of strategies, and there was a significant shift in students' use of strategies for understanding. Before the mindset interventions, 39% of students' strategies had a growth mindset orientation. After the mindset interventions, 60% of students' strategies had a growth mindset orientation. *See Figure 4.23 and Figure 4.24. This data indicates that mindset interventions increase students' motivation to understand content and employ problem-solving strategies that seek understanding, which are characteristics of a growth mindset.*
Mindset Interventions and Evidence from Anecdotal Notes

This section presents the mindset interventions and reflections from the teaching experiences associated with each mindset intervention lesson. A brief narrative of each lesson will be presented and connections to the research data and literature review will be noted as the themes and patterns emerge.

After the initial data was collected from the surveys, and prior to any formal lesson, students were given the outline of a human head and asked to draw their ideas of what their brain looked like inside it. Knowledge about how the structure of the brain changes with learning is associated with growth mindset (Dweck, 2006). Next, the mindset interventions were delivered as classroom lessons over eight weeks. Because the initial surveys indicated that students needed to develop their problem-solving strategies for understanding, I purposely included direct instruction regarding strategies into my lessons.
Narrative of lessons. The first lesson was called My Brain is a Sponge. I introduced the concept of inductive and deductive reasoning by hiding a sponge in a closed container. Students asked questions to determine what was in the container. After using their reasoning skills, students were able to determine that a sponge was in the container. Next, I used moist and dry sponges to demonstrate that a brain can be compared to a sponge in several ways. First, a brain soaks up knowledge like a sponge soaks up water. If a brain isn't used often enough, it will become like a hard, dry sponge, which is difficult to use. Then we talked about strategies we could use to help us remember the lesson.

Students shared that they use deductive reasoning when taking tests by crossing out choices they know to be wrong. This comment was interesting because it relates to a performance goal and fixed mindset. Next we talked about using visualization as a way to remember important topics and how we could use the sponge as a visual for remembering. The students were given time to draw pictures and reflect on the lesson. Students noted that learning keeps their brain in good condition and that asking questions is a good way to learn new things. Both of these ideas relate to a growth mindset because they are ideas that promote understanding (Adams, 2013).

The second mindset lesson was called Building a Neural Network. Students learned that it takes a lot of practice to build neural pathways. It is like building learning bridges. First, we learned the four basic parts of a neuron, and we watched a video of two men building a rope bridge. This demonstrated that learning something new is difficult.
The first time we learn something, there is not a bridge or pathway. Our brain needs to build one between our neurons. We call those pathways *not yet connections*. On the other hand, when we have a lot of experience, we have solid pathways and call those pathways *strong connections*. Next, we had a discussion about different strategies that can be used to build connections in our brain. We concluded the lesson by identifying our *not yet connections*, and our *strong connections*.

The third mindset lesson was called *The Brain is like a Muscle*. Students participated in a demonstration with weights and muscle strength. We had a class discussion about our strong and not yet connections. Students watched videos demonstrating how persistence helps to strengthen our brain. Then I asked students to tell me what the four parts of a neuron were. The students were surprised that none of them could remember. Why? They had not practiced enough to build a lasting connection. Even though they had already learned about the neuron, their brains had not put the information into their memory yet. Next, students played a game that helped them remember the four basic parts of a neuron. By the end of the class, everyone could remember the parts of the neuron. Last, students created pictures and identified strategies to help them build the connections in their brains. *See Figure 4.25.*

The fourth mindset lesson was called *Failure, the Secret to Success*. We reviewed the brain is like a muscle, students did well with comparing exercise and building muscle to learning in the brain. Then I asked if they knew the four parts of the neuron. Almost all
of the students remembered. I asked why they thought that they could remember and many remarked that they had built new connections and made the connections strong by practicing. Students identified strong, medium, and not yet connections and demonstrated their neural pathways. After the review, students watched a motivational video about how failures can lead to new learning. Students picked out a quote and created an illustration that demonstrated how they were going to increase their not yet connections. One student went online after the lesson to find more motivational videos. She found one about spreading random acts of kindness and asked me to show it to the class, which I did.
The students demonstrated several characteristics of growth mindset orientation during this lesson. First, students demonstrated an understanding of how the learning process occurs in the brain. Second, students did not feel at risk for revealing their *not yet* connections, which means that they were less concerned with how others perceived them. Third, students demonstrated a thirst for knowledge by seeking out additional motivational videos. Fourth, students' work samples demonstrated that students were making connections between their current knowledge and new learning. *See Figure 4.26.* Scientific understanding of how the brain works, taking risks, seeking knowledge, and making connections are all characteristics of a growth mindset.
The fifth mindset lesson was called 5 Healthy Brain Habits. Students learned about five healthy brain habits. As a learning strategy, we practiced 4 of the 5 habits. First, we took a walk around the school. Second, we stopped for water. Third, we ate some healthy snacks and talked about adequate sleep. Fourth, we practiced meditating. After the short meditating time, a couple of students shared that they were thankful for school and family. These two students have expressed difficulties in these areas in the past, so for them to express appreciation tells me that they are seeking to understand situations rather than judge situations. Seeking to understand is a growth mindset characteristic. Between the fifth and sixth mindset lessons, I taught a lesson on how to draw a portrait. One student was having a difficult time and was threatening to give up and complaining that he was not good at art. After a little while, the student said, "I am going to have to keep practicing so that I can get good at this." The student recognized his artistic ability as a not yet connection and made a choice to keep trying. This is evidence that mindset interventions help students recognize that challenging tasks can be accomplished through effort and practice.

The sixth mindset lesson was called Ask 3 Questions. This lesson taught students to recognize specific characteristics of a growth mindset and a fixed mindset in themselves by asking three questions: (1) What do I want? (the answer? or to understand?) (2) Am I judging? (3) Am I trying to understand? Students learned how to recognize the characteristics involved with each question, then students drew a picture to demonstrate their learning. See Figure 4.27. Students made many connections between emotions and the three questions. In addition, students displayed a strong desire to learn
rather than simply get an answer. The students' examples demonstrated that they were more interested in learning than finding an answer. This shows that mindset interventions help students to identify characteristics of a growth mindset and use self-questioning techniques to increase learning.

Figure 4.27. Student sample from the lesson: Ask 3 Questions. Students demonstrate how to use self-questioning techniques to increase learning.

The seventh mindset lesson was a review of all of the lessons. We charted out the objectives of each lesson as a class and then the students worked in groups to create posters and develop presentations. The students requested extra time to work on the project because they wanted to add artistic details and take time to practice their presentations. These requests are evidence that the mindset interventions increased
students' interest in developing their understanding rather than finding the answer, which is a growth mindset trait.

The final lesson occurred during Brain Awareness week. A neuroscientist from a nearby university came to our class and reinforced many of the same lessons that the students had learned from the previous weeks. She taught the students that our brains are constantly changing; that learning and memory are two separate brain functions; and that it takes a lot of practice in order to learn something new. The neuroscientist also brought in a mouse brain and a human brain for students look at. She explained the parts of the brain and their functions. She encourage the students to ask questions.

Many of the students stayed through their recess time to ask the scientist more questions. Because they had foundational knowledge of how learning takes place, they were able to ask very good questions such as, "How does the brain translate electrical pulses into thoughts and images?" This is evidence that students were connecting the new information from the scientist to previous mindset lessons to learn and understand new concepts, which is a growth mindset characteristic.

Relationship between quantifiable data and lesson reflections. The anecdotal notes and teaching reflections provide evidence that mindset interventions increased students' orientation toward a growth mindset. Students displayed characteristics of a growth mindset such as effort, practicing, using new strategies, taking risks, and understanding their emotions in relation to learning. The evidence from the anecdotal notes and teaching reflections agrees with the evidence from the surveys and the inventory of problem-
solving strategies. Students identified problem-solving strategies during the mindset interventions, and the inventory of strategies used to develop understanding increased after the mindset interventions. According to the surveys, students orientation to a growth mindset increased and their orientation to fixed mindset decreased. The anecdotal notes showed that students displayed growth mindset characteristics such as the desire to practice an activity even though it was initially discouraging. There is strong agreement between the anecdotal evidence, qualitative data, and quantitative data.

Summary of Findings.

My research question was: How do growth mindset interventions affect 6th grade students' mindsets? My research indicates that mindset interventions increase 6th grade students' growth mindset orientation and decrease their fixed mindset orientation. The mindset interventions had other unexpected effects. First, students dramatically increased their knowledge of the structure and function of the human brain. Second, students increased their inventory and quality of problem-solving strategies. Third, students became less concerned with how their peers perceived them.

Changes in mindset orientation. Quantitative evidence from pre and post intervention surveys together with anecdotal evidence from lesson reflections reveal that growth mindset interventions lower fixed mindset orientation and increase growth mindset orientation. Student surveys are evidence of a change in mindset orientation. Students' fixed mindset orientations decreased and their growth mindset orientations increased. This evidence is substantiated by the achievement goal orientation survey. The
achievement goal survey revealed an increase in task mastery orientation, which is a characteristic of growth mindset. The survey revealed a decrease in performance goal orientation, which is a characteristic of fixed mindset. Furthermore, the qualitative data from student work samples, problem-solving strategy inventories, and anecdotal notes show an increase in growth mindset orientation. Mindset interventions increase growth mindset.

**Students increased knowledge about brain structure and function.** Qualitative evidence from student work samples illustrates a dramatic increase in students' knowledge about the structure and function of the brain. This was an unexpected result. In regards to the function and structure of the brain, most of the mindset interventions focused on learning the parts of a neuron and how connections and pathways are developed. The formal instruction students received about the structure of the brain was delivered by a neuroscientist. The scientist brought in a human brain and showed the students the brain's major parts. She emphasized that sensory organs help the brain make sense of the world through perception. The neuroscientist had a profound effect on the impact of the mindset interventions by providing compelling scientific data that supported the ideas that the brain changes with experiences. Mindset interventions help students understand the function and structure of the brain.

**Students increased their inventory of problem-solving strategies.** Qualitative evidence from students' inventories of self-identified learning strategies demonstrated that mindset interventions help students increase the number and quality of their problem-
solving strategies. This was an unexpected result; however, the types of strategies used correlate to the shift in mindset. Before the mindset interventions, the majority of problem-solving strategies that students identified related to finding an answer. Strategies that relate to finding an answer have a fixed mindset orientation. After the mindset interventions, the majority of the problem-solving strategies that students identified related to understanding a concept. Strategies that relate to understanding have a growth mindset orientation. Mindset interventions help students to identify and use problem-solving strategies for learning and understanding.

Students’ concern about peer perception lessened. Mindset interventions help students overcome their concern with how their peers perceive them. The performance goal orientation survey indicated that students became less concerned with how others, especially their peers, perceived them. Other evidence validates this drop. For example, before the mindset interventions, students had not identified talking to others/helping others as a learning strategy. After the interventions, this strategy was identified five times. In addition, student work samples indicate an awareness that worrying about what others think can be damaging. See Figure 4.26. Students' concerns about what others think is a fundamental aspect of adolescent development; therefore, any measurable change is significant. Mindset interventions help students overcome their concern with how others perceive them.

Conclusion
This chapter presented the results of action research on how mindset interventions affected 6th grade students' mindsets. Mindset interventions strengthen growth mindset orientation, increase knowledge about the brain, increase the use of problem-solving strategies that support understanding, and lessen the concern with peer perception. I used a mixed methods approach and provided quantitative and qualitative data that supported my findings.

Introduction to Chapter Five

In Chapter Five, I will draw conclusions about the research results based on the literature review. I will review the limitations and implications of the study. I will propose areas of future research that relate to growth mindset. Finally I will reflect on how this action research project has impacted my professional practice and how I will use it in the future.
CHAPTER FIVE

Conclusion

Introduction

How do growth mindset interventions affect 6th grade students' mindsets? This was the question I set out to answer at the beginning of my capstone journey. In Chapter One, I explained that I chose to ask a question about mindsets because I had learned through my own experiences that it is desirable to have a growth mindset. The action research process has helped me as a teacher and as an individual. I have learned that growth mindset interventions not only strengthen 6th graders' growth mindsets, but the interventions have many other benefits, too.

In Chapter Four, I presented the results of my research and the supporting quantitative and qualitative data. In Chapter Five, I draw conclusions from the major findings. The first section will discuss major findings as they relate to the literature review and future researchers. The second section identifies and explains the limitations and implications of the research as well as my personal plan for future use.

Major Findings

This section will review the major findings of the research that was conducted to answer the question: How do growth mindset interventions affect 6th grade students' mindsets? Then the conclusions from the major findings will be explained as they relate to the literature review, and a proposal for future researchers will be described.
Changes in mindset orientation. As discussed in Chapter Two, mindset is a set of personal beliefs and is a way of thinking that influences behavior and attitude towards oneself and others (Ricci, 2013). Growth mindset is the belief that a person’s brain can grow and that intelligence can be developed with practice (Dweck, 2008). Research in growth mindset and wise interventions indicate that mindset orientation can be shifted with mindset interventions (Yeager & Dweck, 2012; Walton, 2014). The action research carried out in my classroom yielded similar findings. Mindset interventions carried out in a 6th grade classroom strengthened growth mindset orientation in 6th grade students.

At first glance, mindset interventions appear to be a fix-all strategy for adolescents. However, teachers need to be cautious when taking on mindset interventions because they are psychologically wise interventions. Wise interventions are approached differently than content-based lessons. Because the goal of wise interventions is to change a way of thinking and feeling, it is important that the intervention is strategic, brief, and non-repetitive (Yeager et al., 2013). Because of this information, I did not use drill and practice to teach about mindsets to my students. I developed a strategic progression of lessons that aligned with the knowledge and attitudes that growth mindset-oriented people have.

In researching how to teach growth mindset, I learned that people with a growth mindset understand that intelligence can be developed with practice (Dweck, 2006). This is a scientifically based idea which can be explicitly taught as a science concept. In other words, this can be taught in science class. So, I researched and developed a series of
seven lessons. Five lessons focused primarily on brain structure, function, and health. One lesson focused on the value of mistakes and how making mistakes changes the brain. One lesson taught explicitly about mindsets. The eighth lesson was a presentation from a neuroscientist.

This series of lessons fit well with my research on wise interventions. Research indicates that wise interventions are most effective when carried out in the context which they are intended to shape (Yeager et al., 2013; Walton 2014). Therefore, I designed mindset interventions that could be carried out at school in the context of my regular science class. The lessons were designed to teach about the brain first and growth mindset second. This progression would give students scientific knowledge of how the brain works. This scientific knowledge would reinforce the growth mindset messages that were delivered in two of the lessons. I took this approach because psychological arguments are more convincing with scientific support; moreover, previous research has shown that presenting scientific data about the brain together with growth mindset interventions increases growth mindset (Yeager & Dweck, 2012). The data from my research results aligned with previous researchers who used mindset interventions.

Future researchers may want to explore different settings in which to increase growth mindset. While growth mindset is important in academic situations, it is also important in social and emotional situations. It would be interesting to find out the effects of growth mindset interventions when carried out to strengthen social and emotional well-being.
Students increased knowledge about brain structure and function. Students only formal lesson about brain structure was delivered by a neuroscientist during Brain Awareness week, which was the last week of the research period. The presentation aligned with the mindset interventions, and the psychological argument became very compelling. Because wise interventions are effective when psychological claims are supported by scientific evidence (Yeager & Dweck, 2012), the neuroscientist was a powerful piece of the mindset intervention. The neuroscientist had a major impact on students' knowledge about the structure and function of the brain.

This finding is unique because it validates the idea that students' knowledge about brain structure and function supports growth mindset orientation. At the same time, it brings forth the conclusion that mindset interventions increase knowledge about brain structure and function. This finding was not identified or considered in my literature review; however, the results from my action research indicate a substantial growth in students’ knowledge about the brain.

Future researchers may want to compare the effects of mindset interventions between sets of students who have had instruction from only a classroom teacher and sets of students who have received instruction from a classroom teacher and a neuroscientist. It would be interesting to find how much an expert influences knowledge about the brain and mindset.

Students increased inventory of problem-solving strategies. Before beginning my action research, I had only considered problem-solving strategies in one light. I believed
that students either used strategies or didn't use strategies. In researching mindsets, I learned that students who have a growth mindset exert effort and use strategies to work through challenging situations (Yeager & Dweck, 2012, Dweck 2010; Dweck 2007; Dweck 2006). I did not consider whether or not students were using strategies that helped them understand.

When I conducted my first surveys and reviewed the results, I was surprised to find that the results indicated that my students had a strong growth mindset orientation. In addition, my students indicated that they worked hard to understand assignments, and they used strategies to solve problems. I knew from experience that students could potentially exert much more effort to understand their assignments. Since students often asked me for help on their math and science assignments, I questioned what type of strategies they were using. So, I asked the students to write down their top three problem-solving strategies. I found that students' most frequently cited strategy was ask someone. I analyzed all of the strategies. I found that most of the strategies that students used were oriented toward finding an answer rather than understanding a problem. Even though the survey had indicated a high use of strategies, most of the strategies did not involve exerting effort to overcome challenging situations.

Using strategies to understand problems is an important component of a growth mindset (Adams, 2013). If students do not have effective strategies, then their effort is fruitless. In order to increase growth mindset, I needed to teach my students how to use strategies that helped them increase their understanding. Over the research period, I made
students aware of when I was using a learning strategy and why it was important. I did not add any extra lessons. I only modeled the behavior as opportunities arose. This structure aligned with the rest of my mindset interventions because the interventions were brief and in the proper context.

The increase in using problem-solving strategies for understanding may be associated with the way I asked students to approach problems. Approaching problems with the goal of getting a good grade or finding an answer is a fixed mindset approach to solving problems. Grades and correct answers are rewards, and rewards are not effective in motivating students to learn (Dweck, 2006; Kohn, 1999). Instead, I asked students why they wanted my help. I based my question on the idea that there was more value in learning rather than just knowing an answer. Each time I worked with students, I asked them whether they wanted to understand how to do a problem, or if they wanted the answer to a problem. Most of the time, students' responses indicated that they wanted to understand. It is my opinion that asking this question, together with the formal mindset interventions, helped students to increase their use of problem-solving strategies to understand. My conclusion is that in order for students to employ strategies to understand, students must feel that their teachers are more concerned with learning than answers.

Future researchers may want to compare the types of strategies students use to solve problems on high stakes tests and academic work to the types of strategies that students use to solve problems that they find in real life. It would be interesting to know
if the context in which we are testing students is a good measure of the strategies students need in order to work through challenging situations that arise in real life.

Students’ concern about peer perception lessened. Students demonstrated a lessened concern with their peers’ perceptions. This was an unexpected result. Adolescents’ ideas about how others perceive them is intimately linked to development. Adolescents simultaneously desire acceptance and autonomy (Hebert et. al., 2014). Since this is a trait of adolescent emotional and social development, it seems reasonable to believe that this trait would be difficult to change. I propose that students' shift in growth mindset orientation made them aware that they are highly responsible for their own situations. My conclusion is that the mindset interventions made students understand that they have a great deal of control over their individual situations, and this lessened their concern about their peers' perceptions. Future researchers may want to find out how mindset interventions affect students' abilities to take personal responsibility for their own situations.

In this section, I discussed the conclusions that were drawn from the research findings and literature review. I concluded that mindset interventions strengthen growth mindset. I believe that my interventions were successful because I used what I had learned from my literature review when creating and delivering the interventions. In addition, the interventions proved to have other effects I had not anticipated. Students demonstrated an increase in understanding about the brain; an increase in quality problem-solving strategies; and a decrease in concern of peer perception. I connected my
conclusions to major themes in the literature review and proposed ideas for future researchers.

**Limitations and Implications of Research.**

This section will explain the limitations and implications of the research. The first section will explain the three main limitations in the research: surveys, limited research about problem-solving strategies, and initial data that indicated strong growth mindset orientations. The second part of the section will explain the implications of the study as they relate to middle school teachers and policy makers. The third part of the section will explain my personal plan for future use.

**Surveys.** Surveys have been used in previous research with mindset, and they are a good quantifiable source of information. Since mindset is related to self-beliefs, it is reasonable that mindset surveys measure perceptions of mindset. However, mindset surveys are limited to the perceptions of students and do not measure the mindset orientation of behaviors. I found that students displayed mindset orientations in their behaviors that did not match the mindset orientations identified in the surveys. For example, the surveys indicated a growth mindset orientation because students claimed to use strategies to work through problems. However, when students were asked to identify the specific strategies that they used, the inventory indicated that the strategies that students used to solve problems were fixed mindset strategies. Future researchers may want to gather more qualitative data that relates to specific behaviors that indicate
mindset orientation. For example, ask students to explain, in their words, what it means to work hard to understand assignments or use strategies to solve problems.

**Initial growth mindset orientation.** The mindset surveys revealed that students began the intervention with a growth mindset. After the interventions, there was a consistent and measurable increase in growth mindset orientation. Because the surveys were only 8 weeks apart, it is unknown if students' mindsets will remain so strongly oriented towards growth. If administered properly, wise interventions should yield results that can be measured long after the intervention (Walton, 2014). Future researchers may want to survey participants several months or years after the interventions to find out if mindset interventions yield long term results.

**Limited research about problem-solving strategies.** The research indicated a measurable link between problem-solving strategies and mindset. The literature review provided little background on how to measure mindset in relation to the types of problem-solving strategies students use. Effort is often identified as a growth mindset trait (Dweck, 2006); however, it may be more valuable to identify how effort is used to achieve a goal. Future researchers may want to dig deeper into the quantifiable behaviors, such as how students use strategies, to identify mindset orientation.

**Implications for educational policy.** If having a growth mindset is desirable, then the structure of our education system is flawed. Success in our education system is based on ratings and rewards. Teachers and schools focus on test preparation and alignment of curriculum in order to obtain favorable ratings (Amrein & Berliner, 2002). Ratings and
rewards are elements of a fixed mindset and are not effective in motivating students to
learn (Dweck, 2006; Kohn, 1999). This means that our current educational system
promotes a fixed mindset. If policy makers want to develop an educational system in
which the goal of education is to learn, then policy makers need to devise a way to
measure and promote learning. This method should be free of rewards and consequences,
so that teachers and students can use the results as a tool to promote understanding.

Implications for middle school teachers. The results of this study have direct
implications for middle school teachers. Middle school students are at a transitional stage
where they are moving from emotionally supported elementary classrooms to more
academically demanding courses, and they need their teachers to address their social and
emotional needs in both an academic and peer context (Hebert et. al., 2014). Mindset
interventions improve mindset, learning strategies, and peer perception; therefore,
mindset interventions can help students with their social, emotional, and academic needs.
Teachers of middle school students may find mindset research and interventions useful in
helping middle school students develop positive self-beliefs and learning strategies that
support independence. Middle school teachers need to keep in mind that wise
interventions must be delivered carefully in order to produce positive results. Therefore,
it is important that teachers have a solid plan for delivering mindset interventions that are
consistent with best practices for administering wise interventions. Using mindset
interventions in the classroom should not be taken lightly.
**Personal plan for future use.** In the future, I will use the mindset unit, model the use of problem-solving strategies, and bring in more experts. The mindset unit was successful. Not only did the research yield positive, measurable results, but I observed that my students were engaged and motivated. As an ongoing process, I plan to help students increase their inventory of problem-solving strategies. Even though students are exposed to many strategies through classroom and homework assignments, they may view these assigned strategies as tasks rather than skills that can be transferred to many situations. In the future, I want students to feel that learning is more important than finding the right answer. I hope to help students develop strategies that support their learning in academic and real life situations. Finally, I will invite more experts into my classroom. It is my opinion that the neuroscientist had a major impact on the success of my research. Bringing in an expert brought the lessons to life. The expert demonstrated that brain science was important. Students were able to see how classroom lessons could be translated into real life. Using mindset lessons, modeling problem-solving strategies, and inviting experts into my classrooms are three things that I plan to do in the future.

This section discussed the limitations of the study and offered suggestions on how future researchers may overcome the limitations. I reviewed possible implications for educational policy makers and middle school teachers. I explained my personal plan for future use, which includes using the mindset interventions in the future, helping students develop quality problem solving strategies, and inviting more experts into my classroom.
Chapter Summary

I learned that action research helps teachers to understand the depth and complexity of educational issues. My research made me reflect on how my results might be extended into broader educational contexts such as high stakes testing, classroom management, and pedagogy. My research question was narrow. I wanted to know, *How do mindset interventions affect 6th grade students' mindsets?* I learned that mindset interventions strengthen growth mindsets in 6th graders. However, I believe that the most important lesson I learned was that effort does not equate a growth mindset unless students have an arsenal of strategies and a problem-solving approach that seeks to understand. Even though individual teachers can make a difference in promoting growth mindset beliefs and behaviors, students will only reap the full benefits of a growth mindset when the foundation of our educational system becomes rooted in a quest for learning rather than the measuring.
APPENDIX A

Growth Mindset Survey
Measuring Students' Mindsets

Students rate each questionnaire item on a 6-point Likert scale ranging from Strongly agree (1) to Strongly disagree (6).

1. You have a certain amount of intelligence, and you really can't do much to change it.
2. Your intelligence is something about you that you can't change very much.
3. You can learn new things, but you can't really change your basic intelligence.
4. No matter who you are, you can change your intelligence a lot.
5. You can always greatly change how intelligent you are.
6. No matter how much intelligence you have, you can always change it quite a bit.

Qualitative Question:

Tell me what makes a person intelligent and why you think a person can or cannot change their intelligence.

APPENDIX B

Achievement Goal Orientation Survey
Achievement Goal Orientation

Students rate each questionnaire item on a 6-point Likert scale ranging from Not at all True (1) to Very True (6).

Task-Mastery Goal Orientation

1. I work hard to understand my assignments.
2. I use strategies to improve my understanding of assignments.
3. I want to learn as much as possible.
4. I look for new ways to understand my assignments and I always do my best work.
5. I am always trying to learn something new.

Performance Goal Orientation

1. I want to do well in my classes so my parents will think I am smart.
2. I want to get a good grades in my classes.
3. I want my teachers to think I do a good job on my assignments.
4. I want others to think I am smart.
5. I want to do better in my classes than other students.

Adapted From: *A Longitudinal Analysis of Elementary School Students’ Achievement Goals in Literacy Activities*, Judith L. Meece and Samuel D. Miller, 2001, p. 463

Retrieved from:
APPENDIX C

Mindset Intervention
Mindset Interventions

Mindset Interventions are adapted *Mindsets in the Classroom* by Mary Cay Ricci and *Teaching that Changes Lives* by Marilee Adams.

The mindset interventions are a series of lessons. The lessons are meant to be flexible and the teacher should take advantage of teachable moments if they occur.

**Ongoing Mindset Interventions:**
1. The teacher will strive to use growth mindset language. The teacher will use praise such as, "excellent strategy," "your effort is paying off,""I appreciate your hard work." Ask for "ideas" instead of answers.

**Pre-assessment: 20-30 Minutes**
From Ricci page 98-101
Activate Prior Knowledge: Show pictures of the brain. Use the pictures as a discussion prompt to find out what students know.

Pre-assessment: Give students the outline of a human head. Instruct the students to draw what they think their brains look like inside their heads. Have students write down any ideas they have about the human brain.

Students will create a mindset journal to write their reflections after each lesson. Mindset journals are 10 pieces of computer paper folded in half and stapled.
Week 1: Mindset Intervention #1: The Brain is Like a Sponge
Adapted from Ricci pages 109-110
30-40 minutes

Objectives:
1. Students will be able to define and practice inductive and deductive thinking.
2. Students will understand that their brain works better when we practice learning.
3. Students will compare an expanding sponge to their brain.

Vocabulary:
Inductive: working from very specific evidence to broader ideas that support a conclusion
Deductive: broad evidence or facts that can be narrowed to support a conclusion.

Materials: A sponge inside a small box.

Anticipatory Set: What do you think is in this box?

Procedure:
- Have students try to determine what is in the box by asking yes or no questions and chart their responses.
- Example Questions:
  - Is it heavy? (Inductive)
  - Is it solid? (Inductive)
  - Is it compressible? (Inductive)
  - Is it an animal? (Deductive)
  - Is it man-made? (Deductive)
- Students should be able to use inductive and deductive reasoning to determine that the sponge is in the box.

Have the students explain their thinking process and how they made their determination. Explain that inductive and deductive reasoning is a strategy that we use to help us learn. Have students come up with ideas of how their brain is like a sponge.

Demonstrate: Add water to the sponge, explain that the sponge works better when it expands with water. Relate this to the human brain. Then ask the students to predict what will happen if they leave the sponge out. Compare this what happens when you do not challenge your brain.

Give students 3 minutes to reflect on the activities.
Week 2: Mindset Intervention #2
Building a Neural Network Activity 1
Adapted from Ricci pages 110-112
50 Minutes

Objectives:
1. Students participate in conceptual activities that demonstrate the formation of neurons.
2. Students identify weak and "not yet" neurons that they wish to grow in their own brain.

Materials:
- Pictures of neurons
- Thread
- String
- Rope

Hook:
Show the video: https://www.youtube.com/watch?v=BEwg8TeipfQ
Show the students a picture of a neuron.

http://www.memorylossonline.com/glossary/neurons.html
http://www.chaz.org/Courses/Sapir_Whorf/Brain_language/Language_in_the_brain.html

Explain that a neuron is a brain cell. Tell the students that some neurons are connected and some are sort of floating around. Ask students to give ideas as to why neurons might or might not connect.

Activity: Students become neurons.
1. 5 students hang a neuron picture around their neck
2. Ask a student to share something new they have learned recently
3. The 5 students will represent a learning brain
4. Illustrate the neuron connection by having two student hold a piece of thin thread
5. The thin piece of thread demonstrates that new learning is fragile
7. Ask if there is something students are learning that they are getting better at, but not yet mastered (or provide an example)

8. Now the connection will grow stronger and a piece of yarn will be added to the connection.

9. Propose that the student is persistent with the learning task and the student becomes an expert. A thick rope is now added to the connection.

10. Now propose that the student gets frustrated and decides that the learning task is too hard. What happens to the neuron connections? They will become weaker. Demonstrate by removing the stronger connections.

11. Tell students to think about challenging learning experiences. Tell them to visualize their neurons making stronger connections when they are able to work through a challenging task.

12. Building strong connections adds density to your brain and you grow your intelligence.

Show: https://www.youtube.com/watch?v=qy6E-CVNFg (Neurons and challenge)

In their mindset journals, have students draw their strong, weak, and/or "not yet" connections, and then have the students identify the connections they wish to grow. Give students 3 minutes to reflect on the activities.
Mindset Intervention #3 The Brain is Like a Muscle (Ricci, pgs. 118-119)
Introduction to Growth Mindset (Ricci, pg. 123)
50 Minutes
Objectives:

1. Your brain can grow and get stronger
2. Neurons in your brain make new pathways or connections when you learn
3. Your brain is like a muscle and needs exercise
4. When you learn something that is challenging at first, keep practicing. It helps your brain get stronger.
5. 

Vocabulary: Growth mindset: The understanding that intelligence is not predetermined and that we can all grow our intelligence with practice.

Materials: Hand weights (3, 10, & 20 lb.)

Hook: Show one or more of the following videos
- Ability of the brain to change: https://www.youtube.com/watch?v=g7FdMi03CzI
- Growth mindset video: https://www.youtube.com/watch?v=ElVUqv0v1EE
- Will Smith growth mindset: https://www.youtube.com/watch?v=XkziAM_ZyDM
- https://www.youtube.com/watch?v=OTyN0upf8Ws

Activity 1: Demonstrate that the brain is like a muscle. It gets stronger with exercise.

- Show the students a small hand weight
  - Ask one of the students to demonstrate on how to use it
  - Ask "What will happen if _______ uses this weight every day?"
- Next, do the same with a heavier weight
  - Ask "Is this more challenging?"
  - Will it become easier with practice?
- Explain: Practicing with different sized weights is like a brain. We need to keep trying to learn new things to help our brain get strong. The neurons make more connections and our brain grows stronger, just like when we use weights to make our muscles stronger.

Ask students to recall all they have learned. Main ideas to bring forth are:
- Your brain can grow and get stronger
- Neurons in your brain make new pathways or connections when you learn
- Your brain is like a muscle and needs exercise
- When you learn something that is challenging at first, keep practicing. It helps your brain get stronger.
Introduce to growth mindset terminology and relate it to the weight demonstration. Ask the students: Do you believe that you could lift heavier and heavier weights if you practiced? Is this like learning? Think about these questions:

- Can persistence and effort help us to learn new things?
- What happens when we are learning new things?
- What makes our connections stronger?
- If we always believe that with effort and persistence we can learn and become smarter, then we will have a growth mindset.

Close by having students write a reflection in their journal.
Mindset Intervention #4: Failure: The Secret to Success
Adapted from Ricci, page 125)

50 Minutes

Objectives:
1. Students will identify ways that failures/mistakes can increase learning.
2. Students will identify the advantages of failures/mistakes.
3. Students will relate working through difficult situations to the building of neural pathways.
4. Students will identify and discuss analytical strategies.

Failure: The Secret to Success - Honda Documentary
https://www.youtube.com/watch?v=xOVig5H7UbM

Have a large group discussion about the Honda documentary
Use these quotes from the documentary as prompts

- On the brink of crashing
- You can fail 100 times if you succeed once
- We can only make fantastic advances in technology through many failures
- I was asked to do more in one week at Honda than 4 years in my previous job
- Be willing to take a chance
- I never failed, it just took me 10,000 times --Thomas Edison

Discuss strategies to overcome challenges
- Identify known/unknown
- Examine what does and does not work

Discuss some difficult challenges that the students have had to work through during the school year.

Ask them to explain how they worked through the problems. Help them see how they have used strategies.

Revisit the objectives from previous mindset lessons. Help students to relate working through difficult challenges to the building of neural pathways.

Closing: Students write a reflection about a time they were able to learn from a mistake.
Mindset Intervention #5 Taking Care of Your Brain
Adapted from Ricci page 120
50 Minutes

Objectives:
1. Students will identify healthy habits that contribute to a healthy brain.
2. Students will identify the specific benefits of super brain foods.
3. Students will identify the specific benefits of exercise for the brain.
4. Students will relate healthy brain habits and neural pathways

Materials: The lesson should be conducted in the computer lab

Hook: Show pictures of people sleeping, eating healthy foods, drinking water and exercising. Ask: What do all of these things have in common? They are ways that you can take care of your brain.

Have students do a web quest and
(1) research foods that are considered super brain foods
   • students should identify why the foods are considered super brain foods
(2) research how exercise helps the brain
   • students should identify specific benefits

Have students find 4 to 5 items for each category

Students should create a concept map that shows how sleeping, eating healthy food, drinking water, and exercising helps the brain.

Next students should add pictures/drawings of neurons and neural pathways.

Reflection: Students will write or draw pictures of how our daily habits affect our brain health.

End the lesson with brain food snacks and exercise.
Mindset Intervention #6 Ask Three Questions
Adapted from Adams page 196-197
50 Minutes

Objectives:
1. Students will learn how to identify if they are in a growth mindset by asking themselves three questions.
2. Students will understand that having a growth mindset helps them to reach their full potential.
3. Students will create a poster that will help people understand what they want, if they are trying to understand, or if they are judging.
4. Students will understand that people who are trying to understand are in a growth mindset.

Hook: Does anyone remember what it means to have a growth mindset?

A growth mindset is when a person has a positive self-belief. They believe that they are capable of reaching a higher potential.

Why is a growth-mindset important? It helps you reach your full potential, helps to develop and refine strategies, etc.

Here are two questions that will help you ask yourself if you are in a growth mindset:

1. What do I want?
2. Am I trying to understand?
3. Am I judging?

What are some ways we can honestly answer these questions ourselves?

What do I want?
- Do I want to learn or do I just want the answer?

Discuss characteristics of a person who is trying to understand.
- listening & curious
- persistent
- receptive to feedback
- challenging previous ideas
- making connections to previous knowledge
- asking specific questions

Discuss characteristics of a person who is judging.
- makes assumptions
- disengaged
- defensive/angry
• feels defeated

Have students create a Three Questions Poster to Hang in the Classroom. Students should create illustrations to match the characteristics of each question.

Reflection: Ask students to write about how they might use the three questions to help keep them in a growth mindset.
Mindset Intervention # 7 Review of Learning
(Uremovich)
50 Minutes

Objectives:
1. Students will understand that our brains grow when we learn.
2. Students will understand that new learning is fragile and practice helps to strengthen pathways and connections.
3. Students will understand that mistakes and failures are valuable learning experiences.
4. Students will understand that healthy eating and exercise habits contribute to a healthy brain.
5. Students will learn how to analyze their thinking for understanding or judging.

Lesson 1: The Brain is Like a Sponge: grows with learning
Lesson 2: Building a Neural Network: strategies help to strengthen connections
Lesson 3: The Brain is Like a Muscle: Using our brain makes it stronger
Lesson 4: Failure: The Secret to Success: Use mistakes as a learning strategy
Lesson 5: Taking Care of Your Brain: Healthy habits like getting enough sleep, drinking plenty of water, eating healthy food, exercising, and meditating, help your brain function
Lesson 6: Ask Three Questions: What do I want? (to learn or the answer); Am I trying to understand?; Am I judging?

Hook: Have some props (sponge, string, map, weight, toy care, brain food, 3 question marks) at the front of the room that represent each lesson. Ask students what each prop reminds them of.

Divide the students into 7 groups.
Each group will get a large piece of paper.

The purpose of this review is to quickly think of the lessons learned in the mindset interventions.

1 prop will be given to each group. Each group will have 2 minutes to write down everything they can remember about the lesson associated with the prop. When the two minutes is over, each group will get a new prop. This will continue until all of the groups have had 7 props.

Closing: Discuss the group work
Reflection: Have students write a reflection about the lessons they have learned and how this information might help them in the future
APPENDIX D

Letter to Parents/Guardians
January 12, 2015

Dear Parents/Guardians:

I am your child's science teacher and a graduate student at Hamline University. To fulfill the requirements for my master's degree in education, I am conducting research on the effects of growth mindset lessons. The purpose of this study is to help students understand that intelligence is not predetermined, and that intelligence can be developed through practice and learning.

Growth mindset lessons are classroom lessons that teach students that our intelligence is not fixed and that we get smarter with practice. Growth mindset lessons teach the scientific explanation of how we learn. In addition, students will learn new problem-solving strategies. All students will receive the instruction and participate in the lesson activities during science class once a week for 8 consecutive weeks. Consenting participants will complete anonymous surveys before and after the growth mindset lessons. Reflective writing and work samples from consenting participants will be collected, analyzed, and evaluated. Observations of consenting participants' classroom behaviors will be documented and analyzed. The potential benefits of these lessons are improved self-beliefs and problem-solving strategies.

My research has been approved by the [Lake Superior School District, Two Harbors High School, and Hamline University's Human Subjects Review Committee. My research is public scholarship and the abstract and final product will be cataloged in Hamline's Bush Library Digital Commons, a searchable electronic repository. My research may be published or used in other scholarly ways.

There is little to no risk for your child to participate. The identities of the participating students will be kept confidential. Surveys will be anonymous, and all identifying information will be removed from observation notes and students' work samples. The name of our high school and its location will not appear in the research results. These precautions eliminate privacy risks.

Participation is voluntary. If you prefer that your child not participate in the study, they do not need to, and your child can opt out of any questionnaire or survey associated with the study at any time without negative consequences.

The [Lake Superior School District and Two Harbors High School] have approved the passive consent option. If you do not return a signed form, you give consent to participate in the study.

If you or your child do not wish to participate in the study, please sign and return the attached opt-out form by January 19, 2015. You may withdraw from the study at any time without negative consequences. If you have questions, you may contact me at [nuremovich@isd381.k12.mn.us, 218-834-8201 ext 8216, or 218-269-2761].

Sincerely,

Nadine Uremovich
Opt Out of Growth Mindset Study

I have received your letter about the growth mindset study you plan to conduct. I have read the request letter, and I do not grant permission for my child, ___________________, to participate in the growth mindset study.

Date:__________________________

____________________________________  ___________________________________
Parent Signature  Student Signature

Participant Copy
Opt Out of Growth Mindset Study

I have received your letter about the growth mindset study you plan to conduct. I have read the request letter, and I do not grant permission for my child, __________________________, to participate in the growth mindset study.

Date: ___________________________

____________________________________  ___________________________________
Parent Signature  Student Signature

Researcher Copy
APPENDIX E

Implementation Timeline
Implementation Timeline

Week 1: Administer Mindset Survey and Achievement Goal Survey & Mindset Preassessment

Week 1: Mindset Lesson 1 "The Brain is Like a Sponge"

Week 2: Mindset Lesson 2: "Building a Neural Network Activity 1"

Week 3: Mindset Lesson 4: "The Brain is Like a Muscle"

Week 4: Mindset Lesson 5: "Failure: The Secret to Success"

Week 5: Mindset Lesson 6: "Taking Care of your Brain"

Week 6: Mindset Lesson 7: "Ask Three Questions"

Week 7: Mindset Lesson 8: "Review of Learning".

Week 8: Brain Awareness Presentation and Administer Growth Mindset Survey & Achievement Goal Survey
REFERENCES


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