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**The Academic Impact of a Growth Mindset on Fourth Grade Math  
Achievement.**

By

Renee Harper

A Research Paper  
Submitted in Partial Fulfillment of the  
Requirements for the  
Master of Arts Degree  
In

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### **Thesis Abstract**

Mindset is an established set of attitudes held by someone to identify with their own personal intelligence. Research shows there are two types of intelligence, a fixed mindset (entity theory) and growth mindset (incremental theory of intelligence). Obtaining a growth mindset has been researched to be preferable and is linked to several studies that document academic growth in learners (Donohoe, Topping, & Hannah 2012; Guay, Litalien, Ratelle, & Roy 2010).

The purpose of this research study is to examine students' mindset to determine if academic achievement gains will be made when students identify with a growth mindset. Research by social psychologist, developmental psychologists, cognitive psychologist, and neuroscientists asserts that intelligence is malleable (Dweck, 2010) and with teaching and intervention students can make brain connections to alter their academic achievement. The findings in this study demonstrate an increase in academic achievement when students identify with a growth mindset.

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## Chapter 1: Definition of Problem

I am the past principal of a high achieving Title I elementary school, with an Academic Performance Index of 890. The Academic Performance Index (API) is an accountability measurement used to gage the academic performance in individual California schools. The school had come to a plateau in terms of academic growth and had exhausted growth with all of our known academic interventions. Academic Yearly Progress (AYP) target goals for the 2012-2013 school year were not met, and the school entered the first year of program improvement, evidence that something was not working for the students. In addition, the school district implemented Common Core in the content area of math and writing this school year. I started to read existing research in hopes of finding a new intervention model. Developing a growth mindset has become a common language in our school district and I started to research the concept further. Carol Dweck introduced the concept of the growth mindset (incremental view of intelligence), which has demonstrated to have a positive effect on academic performance (Ablard, 2002; Aronson, Fired, & Good, 2001; Blackwell, Trzesniewski, & Dweck, 2007; Dweck, 2000). Researching further, I found the computer program, Brainology, which builds incrementally to encourage a growth mindset through online activities. During the summer of 2014, the San Marin Unified School District held two Summer Math Institutes leading 82% of elementary school teachers through a series of math modules that were part of Common Core, a newly adopted set of academic standards to unify the nation and produce career and college ready students. One of the modules focused on Growth Mindset and provided a PowerPoint presentation, video clip, and short article to the attendees about the strength of a growth mindset. This kick-started a revolution among the elementary teaching staff, with the need to know more and a desire to learn how they could implement teaching strategies within their instruction to

help their students obtain a growth mindset. My interest in developing a growth mindset intervention at my school was to assist with students' perception of intelligence and overall academic growth.

### **Purpose of the Study**

Through my research I hoped to find the answer to the question, Does a growth mindset impact a fourth grade student's perception of his or her intelligence and overall academic performance in the content area of math? The research supports short-term academic growth when a growth mindset is developed in students. All students display one of two theories of intelligence, a fixed mindset or a growth mindset. A fixed mindset is one of static growth, where students believe they are born with their intelligence and it cannot be grown over time (Dweck, 2010; Miller, 2013). A growth mindset is the opposite: it is a belief that one's intelligence is malleable and can be learned and grow over time (Dweck, 2007). The theory of a growth mindset has been linked to numerous studies that support academic growth in learners (Donohoe, Topping, & Hannah 2012; Guay, Litalien, Ratelle, & Roy 2010). This research study adds to the current research, as there is very limited research available on elementary age students. Most of the available research shows the perception and academic growth of middle school, high school, and college age students, but it neglects significant research on elementary age students. This study builds upon current research and adds substantial data about upper elementary age students.

### **Preview of the Literature**

There are several different concepts of intelligence, with the most common known as holding a fixed mindset or a growth mindset. Most of the students in our education system hold one or the other with few having a mixture of both (Boaler, 2012). Students often value looking

smart over learning (Dweck, 2009), and frequently they do not care to engage in critical thinking or to explore topics in depth. Instead of trying to recognize their weaknesses, some students run from them, conceal them, and even lie about them (Dweck, 2009). Students with a fixed mindset intelligence view will need to acquire the knowledge needed for future success as they have a limited view of success. On the other hand, students with a growth mindset believe that their intelligence can be developed and can grow over time (Dweck, 2009; Dweck, 2010). They believe that their intelligence is malleable and research indicates short-term academic gains (Donohoe, Topping, & Hannah 2012). Current research by social psychologist, developmental psychologists, cognitive psychologist, and neuroscientists asserts that intelligence is malleable; this view has gained much prominence in recent years (Dweck, 2010). While limitations of this view of intelligence are acknowledged, uncovering the new theories behind intelligence could lead to improved student success and well being.

### **Preview Methodology**

Survey data I completed to determine both the pre and post intervention mindset data of 111 fourth grade students. The study participants were four, fourth grade classrooms: two classrooms were an experimental group of 55 students, and two were a control group of 56 students. All fourth grade students were given an initial “mindset” perception survey (how do they perceive their own intelligence?). The survey used was adapted from Dweck’s Implicit Theory of Intelligence Survey (Dweck, 2000). After the initial survey, the experimental group participated in Brainology, a growth mindset intervention program. The experimental group was provided access to the Brainology program because they are designated as one-to-one pilot classrooms, where all students have access to their own personal computer devices. Every student in the classroom has a personal Chrome Book to be used during his or her daily

instruction. The two control group classrooms did not have access to this intervention and received their growth mindset intervention from learned teacher strategies. At the close of the four weeks, I surveyed all four classrooms for their post intervention mindset perceptions. Additionally, the Unit 1 math assessment achievement data, which was given pre intervention for all current fourth grade students was compared to the Unit 2 math assessment results, which was given post intervention. This research was considered "normal educational practice" because no additional research outside of normal educational programs and teaching strategies currently in place were added. All classroom activities and data analyzed would have been completed regardless of this study. Grade level lead teachers collected grade level data as a whole. No student names were attached to the data. This is a current on-going process in the San Marin Unified School District to gage the effectiveness of teaching strategies and current math units in place. This methodology directly aligns with my research question, Does a growth mindset impact a fourth grade student's perception of his or her own intelligence and academic performance in the content area of math? The results will be significant in determining the effectiveness of obtaining a growth mindset in relation to academic achievement.

### **Significance of Study**

Very little research has been conducted on elementary age students as adolescence appears to be the time when intelligence begins to crystalize (Dewar, 2010; Blackwell et al., 2007; Lehmann, 2002; Freedman-Doan et al., 2000). Studies have indicated that having a growth mindset directly impacts academic achievement of students studied in middle school, high school, and college. This study could significantly impact upper grade elementary age student achievement, the look of intervention programs, and overall student achievement.

### **Conclusion**

This study could prove to be instrumental in changing the look of elementary instruction and teaching. By answering the question, Does a growth mindset impact a fourth grade student's perception of his or her intelligence and overall academic achievement in the content area of math, my hypothesis is that it does. My research findings will show gains in the areas of students' overall perception of his or her own intelligence and in their math achievement data. A literature review on current research findings on mindset can be found in Chapter 2. In the Age of Accountability, researching a mindset intervention that could directly impact student achievement and intervention programs could significantly impact elementary education.

### **Definitions**

- a. Mindset
  - i. The established set of attitudes held by someone. A self-theory someone holds about himself or herself.
- b. Fixed mindset (entity theory)
  - i. Students believe their basic abilities, their intelligence, their talents are 'static' traits, traits they are born with.
- c. Growth mindset (Incremental theory of Intelligence)
  - i. The belief that intelligence can be learned over time, grown, or taught with learned strategies.
- d. Academic achievement
  - i. The outcome of education. The extent in which students or teachers have achieved their academic goals.
- e. Common Core

- i. is a rigorous set of standards for the English Language Arts and mathematics curriculum that has been developed based on the best practices of schools and organizations around the country and the world.
- f. Adequate Yearly Progress (AYP)
  - i. is a measurement defined by the United States federal No Child Left Behind Act that allows the U.S. Department of Education to determine how every public school and school district in the country is performing academically according to results on standardized tests.
- g. Socio-economic status (SES)
  - i. is an economic and sociological combined total measure of a person's work experience and of an individual's or family's economic and social position in relation to others, based on income, education, and occupation.
- h. Short term academic growth
  - i. Academic gains, which are proven to be sustained for a short period of time, typically under 12 months.

## **Chapter Two: Review of Literature**

There are many conceptions of intelligence. One theory of intelligence is that we each possess general information, processing, or a problem solving capacity that remains stable throughout our lives and is associated with traditional intelligence (Niesser et al 1996). Research indicates that many factors contribute to our intelligence and some of these factors may be under our control. This literature review addresses the intellectual theory of a growth mindset, while including research on those who have a fixed mindset. The review goes on to discuss current research designed to create environments through teacher-led instruction and intervention programs that will promote students to develop a growth mindset. It considers aspects of student motivation, the culture of a risk-taking classroom, intervention programs and teacher praise of effort over intellectual ability. This literature review helps to support the research question: Does having a growth mindset impact a fourth grade student's perception of his or her own intelligence and academic achievement in the content area of math? Having a growth mindset and the review of existing literature will impact academic achievement through one's perception of their intelligence.

### **Mindset**

For over 30 years Dweck has studied students' intellectual mindsets and motivation in the hope of uncovering what makes students academically successful. It is her long-standing theory that it matters greatly what students believe about their own intelligence (Dweck, 2007). Students in an academic setting display one of the two perceptions of intelligence a fixed mindset (entity theory) or growth mindset (incremental theory of intelligence). It is the continued research belief that having a growth mindset (positive self concept) will lead to gains

in academic performance. The theory of growth mindset has been linked to several studies that document improved academic performance in learners (Donohoe, Topping, & Hannah 2012; Guay, Litalien, Ratelle, & Roy 2010). As we move towards 21<sup>st</sup> century learners in an academic setting, educators look for signs that indicate their students will be successful learners. In the document, *Standards for the 21<sup>st</sup>-Century Learner* the authors define skills, dispositions, responsibilities, and self-assessment strategies that are necessary for 21<sup>st</sup> Century Learners (American Association of School Librarians, 2007). A series of questions are asked to determine if most students obtain these skills and if the students can recognize strengths and weaknesses over time to become stronger and independent learners. Through her research, Dweck maintains that for many of our students the answer to this question is “no” because they have a fixed mindset.

### **Fixed Mindset**

A fixed mindset presents itself as a static view of intelligence (Dweck, 2010; Miller, 2013). In this view, people are born with their intelligence and it cannot be grown over time or with learned strategies. Students who hold a fixed mindset see ability as something inherent that needs to be demonstrated. They believe that intelligence is static and that they only have a certain amount (Miller, 2013). It is this mindset that limits student achievement because it is associated with defined ‘rules’. Those rules say: you look smart at all costs, don’t make mistakes, don’t work hard, and if you make a mistake don’t try to repair it (Dweck 2007). In a study of seventh grade students, when given a choice between learning something new and doing a task that would make them look smart, they overwhelmingly chose looking smart (Dweck 2007). The research also found the seventh-grade students felt mistakes meant that they lacked

ability, hard work signaled low intelligence, and if they performed poorly on a test they would study less next time and consider cheating (Dweck, 2007).

Looking at student achievement in a classroom setting educators are confronted with this problem. All students, regardless of intellectual ability, fear looking ‘dumb’ in front of their peers and in addition they do not want to be placed in a remedial grouping. Identified gifted students often display this mindset and fear taking risks. They like to appear ‘smart’ and that tasks are easy for them. Dweck’s studies show that 40 percent of students in the United States display a fixed mindset (Boaler, 2012). When you look at this statistic it becomes clear how this belief could affect the overall academic achievement of our youth. Students with a fixed mindset do not like extended effort or unknown challenges. They believe that if you have ability everything should come naturally (Dweck, 2010).

Studies of this nature are often conducted on middle school and high school students, as this is a time when most youth are going through life transitions that may impact their learning and social stigma is high. Students are fearful of putting forth extreme amounts of effort because this makes them feel dumb: Those with natural ability shouldn’t need to put in so much effort. Students who have a fixed mindset during this transition have proven to have less academic success with a decrease in grades. In comparison, students who have demonstrated a growth mindset have shown increased grades over this transitional time (Dweck, 2010). For individuals with a fixed mindset failure signals low intelligence therefore, few want to take on challenges. Students assume that if our intelligence is fixed, there is no point of trying to improve (Dweck, 2006).

### **Growth mindset**

Just as Dweck accounted for 40% of the students in the United States holding a fixed mindset, 40% of students hold a growth mindset, with 20% are a mix of both mindsets (Boaler, 2013). Students who hold a growth mindset believe that their intelligence is malleable, which means that it can grow over time and this growth can be learned. In students with a growth mindset their belief is that their abilities can be developed and their major goal is to learn (Dweck, 2007). With this developed mindset, students are motivated to earn the best grades they can, but the most importance is placed on learning over achieving. Dweck describes the cardinal rule of a growth mindset is to learn (2010). She continues with three rules to support this mindset; take on challenges, work hard, and confront your deficiencies and correct them (2010). It is not hard to imagine why having a growth mindset promotes academic achievement and research shows time and time again an increase in performance. When one of student's main motivators is to learn, how could that not increase performance?

Many put value on the IQ (intelligence quotient) believing that it determines one's static intellectual ability. Alfred Binet, the inventor of the IQ test, had a strong growth mindset. He believed that education could transform the basic capacity to learn. His intended use for the IQ measure was to identify students who were not profiting from public school and then show he could foster intellectual growth (Dweck, 2007). It is interesting to see how the use of this measurement tool has transformed over time and is used to identify students for gifted programs with primarily static intelligence.

More and more research supports the benefits of a growth mindset and the plasticity the brain. The field of neuroscience has extensive research on brain plasticity and how one's intelligence can be enhanced through learning and new connections created from making

mistakes (Boaler, 2013; Doge 2007; Sternberg, 2005). Making mistakes and learning from them is the basis behind holding a growth mindset. Students who hold a more flexible, 'incremental' theory of intelligence (growth mindset) respond much differently to errors (Dewar, 2010). With a growth mindset students are proven to recover from setbacks (mistakes) and apply it to their new learning or brain connections. Overall, a growth mindset can be described as a determination to learn. Doubt, an irritating and uncomfortable state, provokes inquiry or investigation (Miller, 2013). It is no surprise that Blackwell and associates found that when students who are in a grade level school transition are followed, those with a growth mindset outperform their classmates with a fixed mindset. A growth mindset fosters the growth of learned ability over time (2007).

When looking at the achievement data and students performing below grade level, a common theme to look for is if the student is making reasonable growth. When a student has a growth mindset that is not saying they are academically gifted, but it is saying they have the mindset to value learning and progress made. The long-term effects of a growth mindset are still to be determined. Just believing intelligence is expandable does not imply everyone has the same academic potential or will learn everything with equal ease, but it is the belief that each student's intellectual ability can be developed further (Dweck, 2010; Blackwell et al., 2007). There have been no correlations made between types of mindsets students have and their gender, ethnicity, or prior achievement data (Atwood, 2010; Dweck, 2007). However, a student's perception on his or her own intelligence and having a growth mindset appears to decrease or close the achievement gap (Blazer, 2011). Studies have shown that with a growth mindset Black and Hispanic students test scores are closer to those of White students and female students' math scores are closer to those of their male classmates (Dweck, 2010). When looking at mindset, the

age of students has been brought into question. Most youth tend to crystallize their intelligence around the age of adolescence, which suggests why most studies have been completed on middle school and high school aged students.

Students aren't born to believe in a mindset and the thought that their intelligence may be fixed or unchangeable (Dewar, 2010; Blackwell et al., 2007; Lehman, 2002; Freedman-Doan et al., 2000) which is how the thought to use a growth mindset as an academic intervention has been gaining more prominence. In this study, I have explored using a mindset intervention for both at risk students and students involved in the gifted and talented program. Interventions that promote a growth mindset are abundant and consist of looking at student motivation, building a culture of a risk-taking classroom, intervention programs and teacher praise of effort over intellectual ability. Research evidence from over the last decade supports the implications the brain, ability, and learning has on schools (Dweck, 2010). Some of the most academically successful countries in the world practice growth mindsets, beliefs, and fostering one with in their school systems (Boaler, 2012). Developing a growth mindset will become especially critical with the implementation of Common Core State Standards (Miller, 2013). These standards require students to take more intellectual risks and engage in problem solving activities. Achievement levels would rise if more students and teachers believed in the value of an error (Miller, 2013), this concept will be addressed in the next section. Learning is a gradual process that takes time and is not immediate. If teachers were confident with the message of developing a growth mindset, this process could be easily fostered within the classroom-learning environment.

### **Developing a Growth Mindset in Schools**

Jo Boaler has worked extensively with several schools across the United States to determine how to develop a growth mindset in classrooms and how to help teachers develop growth mindset messages for their students. In this world of accountability most teachers are excited about the prospect of academic gains from promoting a growth mindset, but are unsure of how to proceed. The awareness that ability is malleable and students need to develop a growth mindset has many implications on teaching practice and overall classroom achievement. Research findings on middle school, high school, and college age students show students with growth mindsets significantly outperform their classmates. In addition, teaching students to have a growth mindset leads to significant increases in their achievement levels (Atwood, 2010; Dweck, 2010; Curry et al., 2008; Blackwell et al., 2007). Researchers believe achievement will increase if teachers encourage student to develop a growth mindset, the bigger question remains to be, what can schools do to foster growth mindsets?

#### **Create a Culture of Risk Taking**

The first step to establishing a growth mindset message in a classroom is to create a classroom culture of risk-taking, where students know it is okay to make mistakes and are encouraged to make mistakes. Creating a culture of risk-taking includes teachers who design classroom curriculum to be challenging and meaningful learning tasks (Dweck, 2010). To create a culture where students obtain a growth mindset, much emphasis needs to be placed on the right kind of praise and encouragement from the teacher. Teachers also need to acknowledge the importance of students making mistakes. The majority of mindset research supports that making mistakes is an important opportunity for learning and growth. When students think about a mistake and why something is wrong, new synaptic connections are sparked that cause the brain

to grow (Boaler, 2012). This is a vital component to establishing a culture of risk taking in your classroom to promote a growth mindset. Teachers need to communicate to their students that making mistakes is a natural part of the classroom and something that is necessary for brain development. Having had the unique opportunity to work with teachers this past academic year on this concept as Common Core is implemented has shown a noticeable amount of student growth and motivation in students' demeanor. Effort and motivation play a large part in what people can achieve (Dewar, 2008). Some teachers choose to directly teach their students about the different theories on mindset (Dweck, 2010), encouraging their students to take on a proactive role by writing about something they are good at and something they used to be poor at and are now good at. This can help to encourage students not to be ashamed to struggle with something until they become good at it. Creating a culture of a risk-taking classroom is the first step to developing a growth mindset for teachers in schools and the classrooms. A lot of setting up a risk-taking culture is dependent on teacher praise to students, praising student efforts as they are applied yields more long term benefits than telling them they are 'smart' when they succeed (Dweck, 2010).

### **Teacher Praise**

The wrong kind of praise can create self-defeating behavior. The right kind motivates students to learn. Through the development of growth mindset research shows student praise can have a detrimental impact on student's personal intellectual beliefs (Dweck, 2007). Most educators have the best of intentions when they praise students for being 'smart' for their overall abilities versus they enjoyment of learning and effort. Studies have been conducted on praise in children from as young as age four. Students of different ethnicities, socio-economic status, and in different setting have been researched, all finding the same thing: praising students'

intelligence gives them a short burst of pride followed by a long string of negative consequences (Dweck, 2007). In a study completed by Mueller and Dweck (1998), fifth grade students were asked to work on a task. After the completion of the first task the teacher praised some of them for their intelligence (“You must be smart at these problems” p.36) and others for their effort (“You must have worked hard on these problems” p.36), they were then asked to answer a questionnaire about mindset (Dweck, 2007). The majority of the students praised for their intelligence identified with a fixed mindset, while those praised for their effort identified with a growth mindset. The study went on to ask students to work on a challenging task or an easy one, the praised intelligence students overwhelmingly chose an easy task while the praised effort students chose the challenging task with an opportunity to learn (Dweck, 2007). This study suggests the importance of student praise when developing a growth mindset in students and in an environment where overall classroom achievement will increase in relation to a growth mindset. Finally, students were asked to report out their scores from the work they completed, approximately 40 percent of students who identified with a fixed mindset lied while only 10 percent of the students who were praised for their effort felt the need to lie. Praise is closely connected to how students view their intelligence (Blazer, 2011). Study after study shows that when students are praised for their intellect they lose their motivation and their enjoyment with tasks when they start to struggle. In the end, students praised for their efforts tend to remain engaged and eager even when tasks become challenging (Blazer, 2011). Altering praise is a simple step teachers can take when starting to develop a growth mindset culture in their classroom.

### **Intervention Programs and Curriculum**

In the past decade research has pinpointed intervention models to promote developing a growth mindset in the classroom with the outcome of holding a growth mindset leading to raised student achievement. Three recent studies by Joshua Aronson, Catherine Good, and Carol Dweck have shown that teaching students a growth mindset resulted in increased motivation, better grades and higher achievement in test scores (Dweck, 2010). Over a series of classroom sessions student were taught that their brains form new connections every time they learn, and with time they can become smarter. Students were motivated by the message that they could influence their brain. Students in both a junior high school and a university setting who received this message out-performed students in the control group (Dweck, 2010). Additionally, the students reported a greater investment in their learning and teachers noticed a stronger desire in the students to work hard and learn. Another study was done in a New York City high school where many students were showing a decline in their grades. Dweck and her team developed an eight-session workshop with both an experimental group and a control group. Both groups learned study skills, time management techniques, and memory strategies (Blackwell et al., 2007). In the growth mindset group, students also learned about their brain and how they could make their intelligence grow. They learned the brain is a muscle and the more you exercise it, the more it will grow. The more they tried hard to learn something new; connections were formed in their brain, which with time, will make them smarter. This message and module sessions motivated struggling students to show a significant rebound with their academic scores (Dweck, 2007). Other researchers have obtained similar findings with growth mindset interventions. Whether there is truth to the theory that a growth mindset will lead to academic

success or if it is just student motivation from hearing the message of brain growth, the interventions appear to be working in student samples from junior high to college age students. Based on positive results from this research, Dweck and her team developed a computer-based intervention, Brainology, where students go through a series of six modules learning about the brain, visiting virtual brain labs, doing virtual brain experiments, seeing how the brain changes with learning, and how students can make their brain work better to grow smarter (Dweck, 2007). This program was used in 20 schools in New York City and the preliminary results are encouraging with reported changes in study habits and motivation. This program was developed in 2008 and is still undergoing scientific evaluation to assess its validity (Donohoe, Topping & Hannah, 2012). The aim of the program is to lead students through a series of activities and challenges. The program is designed to be completed in one session, which consists of a series of weeks, however all units can be revisited allowing it to serve as a one time or ongoing intervention. The program has proved to show short-term gains with academic achievement; however the long-term effects of the program are still being studied (Donohoe, Topping & Hannah, 2012).

### **Conclusion**

Almost a decade ago, the U.S. Congress passed the No Child Left Behind Act, which directed schools to eliminate gaps in standardized test scores by 2014 (Nesbitt, 2010). With this lofty goal in front of educators, teachers and administrators are looking for new interventions that may change the face of learning in students. It is the hope to find a research-based intervention that supports academic growth in all students, regardless of ethnicity, socio economic status, and race. This may be an unachievable goal; however developing a growth mindset in classrooms is the first step. There are encouraging studies around the world that show

short term interventions are having an impact on intellectual performance. Researchers around the globe have now shown that students who believe their intelligence can be developed (i.e. have a growth mindset) show superior academic performance across challenging school transitions, enhanced learning on challenging cognitive tasks, and superior performance on IQ tests (Dweck, 2010). The available research supports this academic growth in junior high school students through college students, with very limited research available on elementary age students. I will contribute to this research by answering the question; Does having a growth mindset impact a fourth grade student's perception of his or her intelligence and academic performance in the content area of math?

### **Chapter 3: Methodology**

This research study looked at the outcome of students' perception of intelligence by answering the question, Does a growth mindset impact a fourth grade student's perception of his or her intelligence and impact academic performance in the content area of mathematics? Students' perceptions were analyzed both pre and post a growth mindset intervention program, as well as looked at math data both pre and post mindset intervention. Chapter 3 addresses the research design, participants, setting, instruments used, procedures, and my overall data analysis in this chapter. My hypothesis is that students with growth mindset training who completed the Brainology intervention will demonstrate positive student gains and intellectual growth in the content area of mathematics over students who have not had the Brainology intervention.

#### **Design**

I conducted a quantitative research study using survey research and academic achievement data. Current research supports academic growth and a shift in perception after implementing the Brainology intervention program. Teaching students a growth mindset allows students to take risks. Instead of worrying how smart they are, they focus on getting smarter through learning. Programs such as Brainology help to teach a growth mindset (Dweck, 2010). Pre and Post survey results demonstrated students' perception of their intelligence in both the experimental group and the control group. Both groups participated in a pre- intervention survey, the experimental group received four weeks of intervention instruction through the Brainology program and the control group received no Brainology intervention. After the four-week intervention, both groups participated in the survey to demonstrate post-intervention survey data. Additionally, pre intervention academic data was compared to post intervention academic

data to determine if any academic growth was noted as a result of the Brainology intervention program.

### **Participants**

I conducted this study with four, fourth grade classrooms of 28 students in each class. I conducted this research on upper elementary, fourth grade students, because it has been hypothesized that adolescence appears to be the time when intelligence begins to crystalize (Dewar, 2010; Blackwell et al., 2007; Lehmann, 2002; Freedman-Doan et al., 2000) and not much age appropriate research on this group has been completed. This was quasi-experimental research due to the selection of participants in each classroom. The classes were designed to be randomly populated, however extenuating circumstances (teacher requests, student separations, and cluster groupings) tend to affect the classroom make up. As the outgoing principal of this school site, I was responsible for designing the classes, but the effects of this study were not considered when generating the classrooms. The school name, classroom teacher names, and student names will remain anonymous.

### **Setting**

This study took place in four, fourth grade classrooms at Richmond Elementary School, which is a Title One Elementary School with 42% of the student body socio-economically disadvantaged and receiving free or reduced lunch. Two of the classrooms served as a control group and two as an experimental group. The two experimental classes are one-to-one technology classrooms where each participant has his or her own personal Chrome Book. These two classrooms participated in the four-week Brainology intervention program. Having access to personal technology had an impact on the outcome of this research study, as it allowed the

experimental classrooms to use the Brainology intervention program to study brain growth and to identify with their own intelligence.

### **Instrument(s)**

I used both pre and post survey data and math achievement data from unit tests to demonstrate students' perception of his or her intelligence and academic performance. Survey data was collected both pre and post intervention using a modified *Theories of Intelligence* survey (Dweck, 2000). The survey was scored using a four point Likert scale not offering a neutral response option, with one being strongly agree and four being strongly disagree. Mathematic achievement data was taken using a unit one math assessment, pre mindset intervention, and a unit two math assessment post intervention. These research tools successfully document the data by looking at both perception and academic growth in the experimental group and the control group.

### **Procedures**

The following steps took place when conducting this research

1. An academic assessment was given to all participants in the content area of mathematics prior to select students receiving the intervention.
2. Once IRB approval was received, the pre intervention survey was given to all participants.
3. After the pre intervention survey was taken, the Brainology program started in the experimental classrooms (4 week succession).
4. At the completion of the Brainology program, the post intervention survey was given to all participants.

5. At the conclusion of the specified math units, an academic assessment, post mindset intervention, was given to students.
6. Pre intervention achievement data of both the experimental group and the control group was compared to post intervention achievement data to determine growth results.

### **Limitations**

This timeline was chosen for the study to allow time for all of the research to be completed. I am an insider to this study as I was the principal at this school site last school year and because of this I understood the time constraints and possible need for additional time to be added to the timeline. Additionally, the unit one and unit two math content were different which may have altered the results based on math unit content difficulty. After participating in mindset professional development, it is my belief that having a growth mindset will positively impact student performance.

### **Analysis**

To analyze the data, the Likert scale survey data was translated into percentages comparing the percentage of students from the experimental group and control group for a growth mindset versus a fixed mindset. The pre and post intervention achievement data was also analyzed using the percent of students who scored proficient on the final unit assessments, to determine if significant academic gains were made by the experimental group as compared to the control group. I used this data as evidence to help prove my hypothesis that with a growth mindset significant academic gains will be made.

### **Conclusion**

By conducting this research I hoped to establish a link between the Brainology intervention program and students perception of their intelligence, which will ultimately affect their academic achievement results. Through the intervention program students are taught their brains form new connections every time they learn. Three recent studies by Joshua Aronson, Catherine Good, and Carol Dweck support this claim by showing increased motivation, better grades, and higher achievement test scores after an intervention took place (Dweck, 2010). Most of the recent research has been conducted on junior high age students or older. I demonstrated similar research to answer the question Does having a growth mindset impact a fourth grade students' perception of his or her own intelligence and impact academic performance in the content area of math?

## Chapter 4: Data Analysis

The purpose of this study was to answer the question, Does a growth mindset impact a fourth grade student's perception of his or her intelligence, and overall academic performance in the content area of math? Reading current research the data suggests that having a growth mindset perception of intelligence will lead to overall academic growth. A current research study has found that those with a growth mindset outperform their classmates with fixed mindsets-even when the students entered with equal skills and knowledge. A growth mindset fosters the growth of ability over time (Blackwell, et al, 2007).

A survey, which was an adaption of Dweck's Implicit Theory of Intelligence, (Dweck, 2010) was given to all of the fourth grade students both in the experimental group and control group. Throughout this chapter I will look at the pre-intervention survey data of both the control group and the experimental group and compare it to the post intervention survey data of both groups. Additionally, I will look at academic data, from the control and experimental groups, for the unit one math assessment, which was given prior to the Brainology mindset intervention, and compare it to the unit two math assessment data, which was given after the Brainology mindset intervention. This will examine the academic mathematic achievement of both the control group and experimental group pre and post the Brainology intervention. The Brainology intervention provided the experimental classes with video tutorials explaining how the brain functions, learns, and remembers, and how it changes in a physical way when we exercise it. It teaches students how to make their brains work better and how to form new connections in their brain to get smarter (Dweck, 2009). The data will be analyzed to note any growth in overall perception of intelligence and academic growth. Finally, I will look at the survey data and achievement data and interpret it in relation to the results I have received. This chapter will end with a summary of

the entire chapter and all of the results analyzed. Previous research has been conducted using middle school, high school, and college age students. My research will be completed on upper elementary age students.

### **Data Presentation**

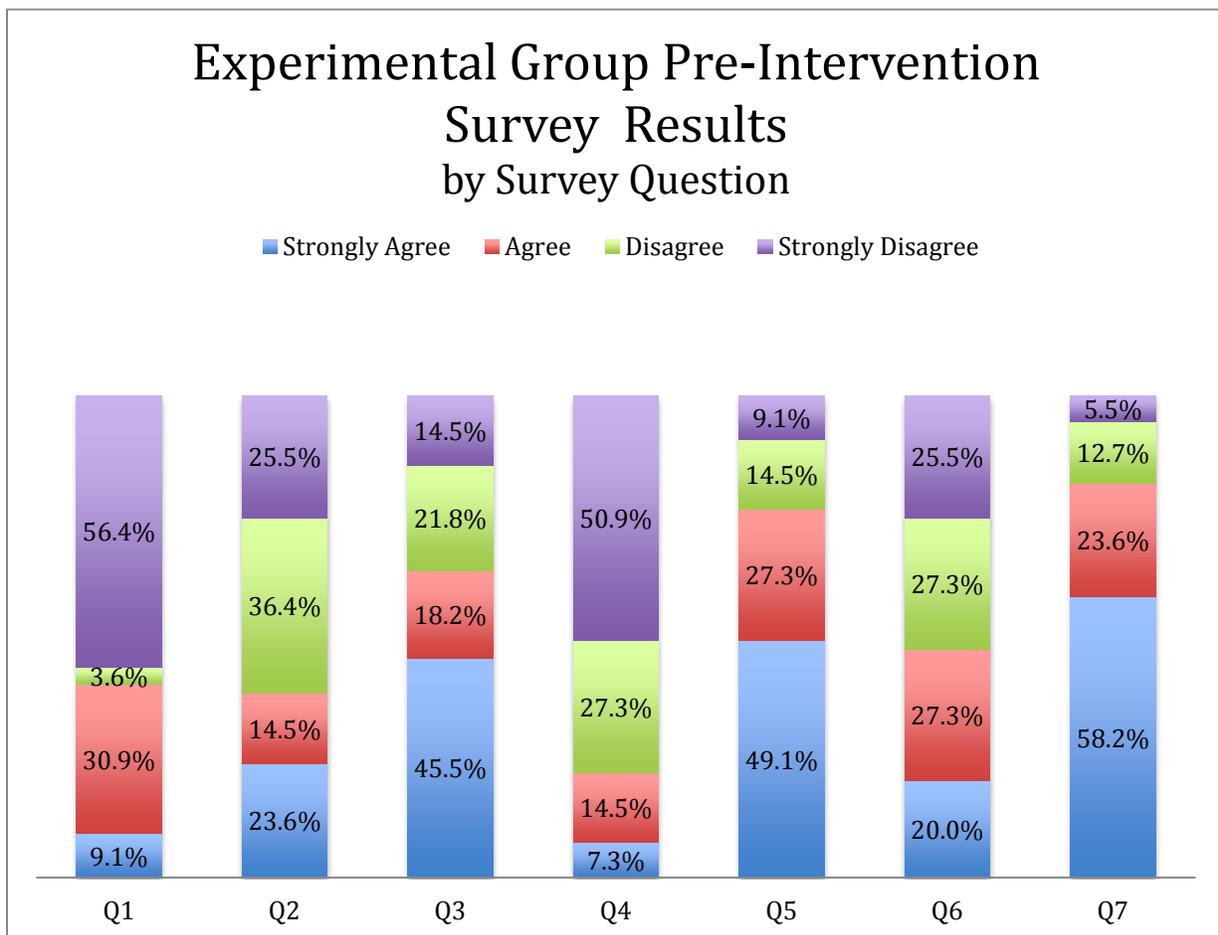
During this research period the following research was collected, a pre intervention survey of all four classrooms, a pre intervention achievement data collection of the unit one mathematics assessment, a post intervention (Brainology) survey, and a post intervention achievement data collection of the unit two mathematics assessment. Only the two experimental classrooms completed the Brainology intervention program, however all four classrooms completed both the surveys and achievement assessments. In order to answer the research question, Does a growth mindset impact a fourth grade student's perception of his or her intelligence, and overall academic performance in the content area of math pre and post intervention data was needed from both the experimental groups and control groups.

The Theories of Intelligence survey was given to all classrooms both pre and post intervention. (see Appendix A to view the survey). The survey consisted of seven questions, four of the questions identifying with a fixed mindset and three of the questions identify with a growth mindset. The data presentation creates a story of the data collection from conception to analysis. The presentation shows the data from individual survey question to combined survey questions all the way through a comparison of pre and post intervention survey data. The achievement data presents the same story from unit one achievement results to unit two achievement results, through a comparison of achievement data by classrooms.

**Pre-Intervention Data Presentation**

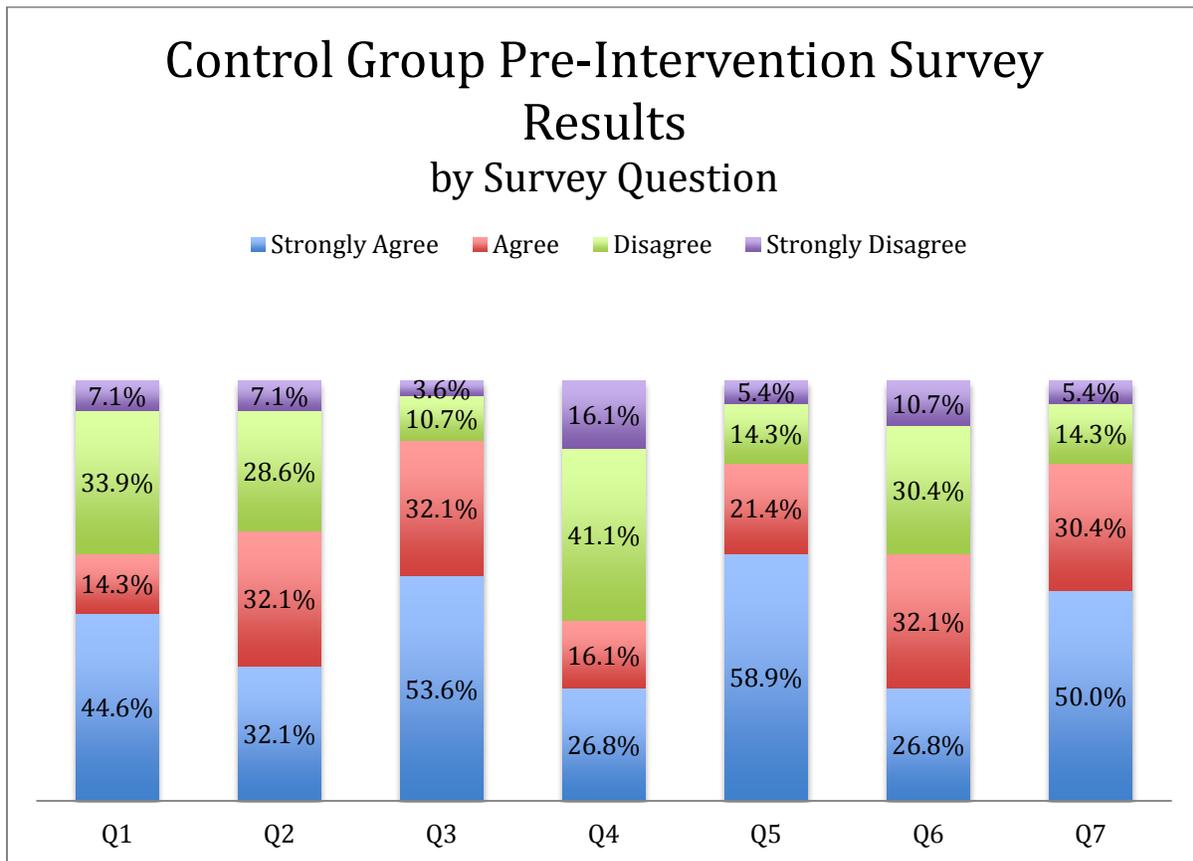
Table 1.1 identifies the pre intervention survey results of both experimental classrooms combined, broken down into percentages of strongly agree to strongly disagree. This chart identifies the percentage of student in the experimental group who rate themselves as strongly agreeing, agreeing, disagreeing, and strongly disagreeing with each individual survey question.

*Table 1.1:* Theories of Intelligence Survey: Experimental group survey results per survey question.



The same data presentation was used for the control group. In the chart below, Table 1.2, the control group classrooms are combined to present their data by individual survey question from strongly agree to strongly disagree.

*Table 1.2: Theories of Intelligence Survey: Control group survey results per survey question.*



Identifying the data in this manner displays the survey results for each individual question and the percentage of students and how they identified with each question. After continued analysis these charts make it difficult to determine a student’s pre intervention mindset, however it is important to create a picture of the results of each individual question and how they were

answered prior to combining them. In the following charts, table 2.1 and 2.2, fixed mindset questions numbers 1, 2, 4, and 6 were combined to give an overall picture of the percentage of students, in both the experimental group and control group, strongly agreeing to strongly disagreeing with a fixed mindset. By combining the strongly agree and agree percentages the data shows that 37% of the population in the experimental group identify with a fixed mindset and 57% of the control group identify with a fixed mindset. In tables 2.3 and 2.4 survey growth mindset questions 3, 5, and 7 were combined to give an overall picture of the percentage of students, in both the experimental group and control group, strongly agreeing to strongly disagreeing with a growth mindset. The experimental group shows 74% of students identifying with a growth mindset and the control group shows 82%. Highlighting the results in this manner provides a picture of student mindset prior to the intervention beginning. The data shows both groups identified with a growth mindset prior to any intervention occurring.

*Table 2.1:* Theories of Intelligence Survey: Experimental group pre-intervention fixed mindset survey results.

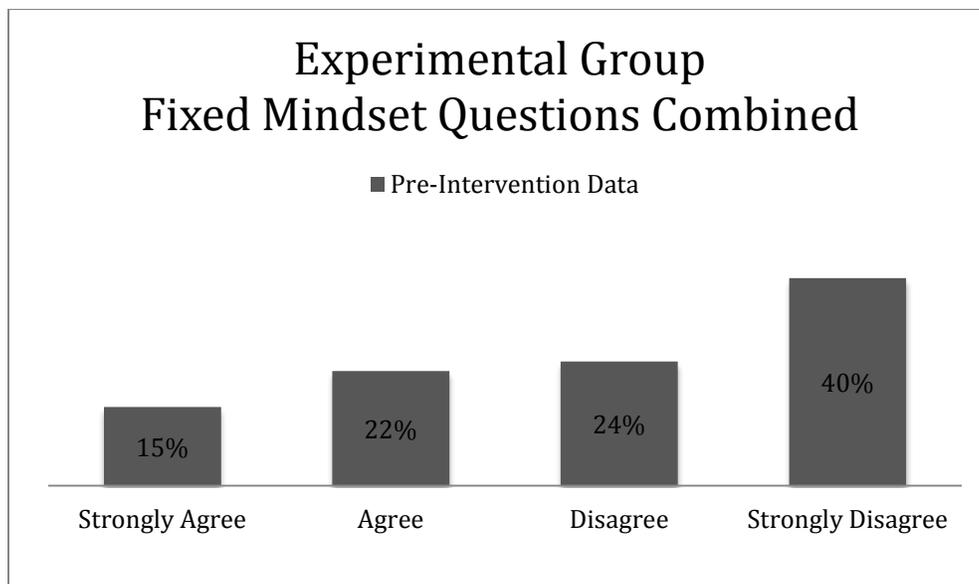


Table 2.2: Theories of Intelligence Survey: Control group pre-intervention fixed mindset survey results.

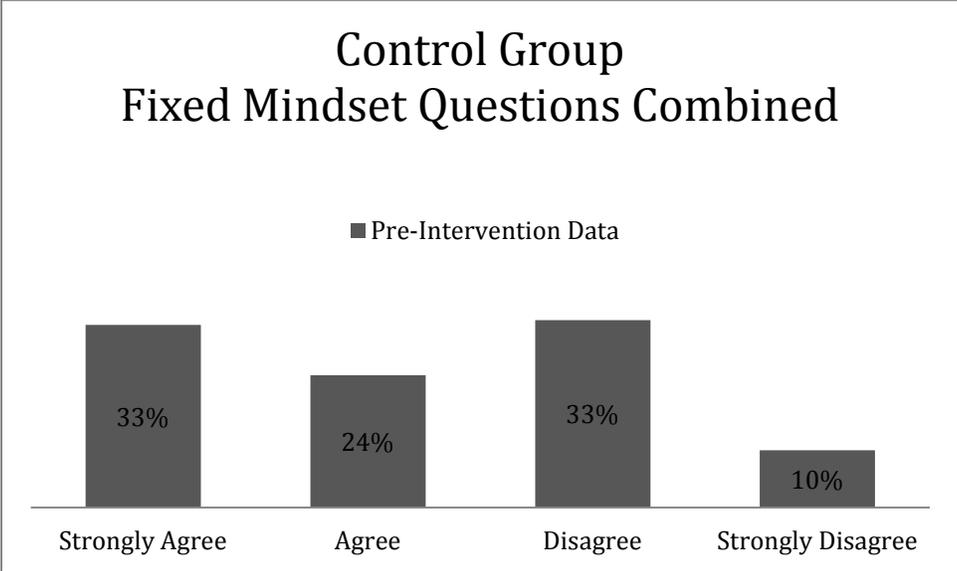


Table 2.3: Theories of Intelligence Survey: Experimental group pre-intervention growth mindset survey results.

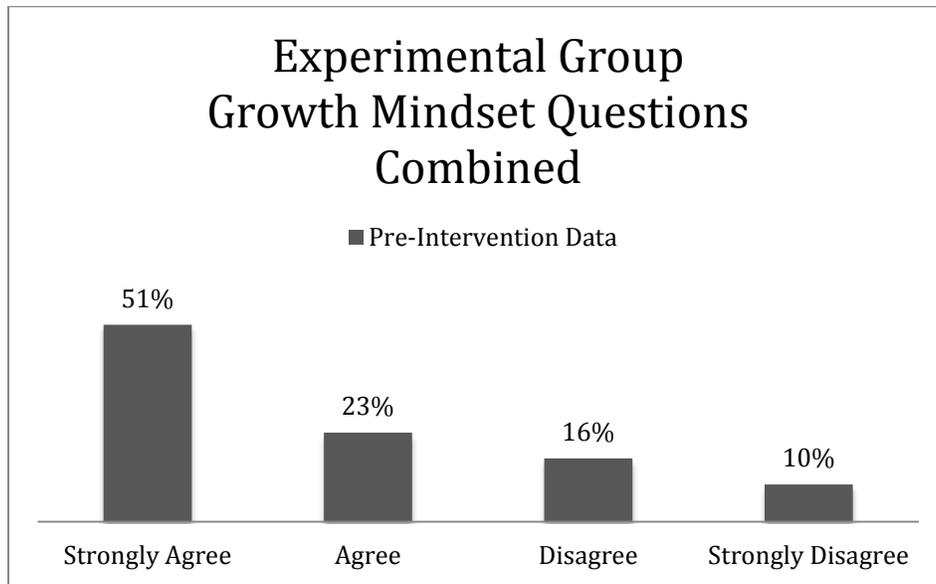
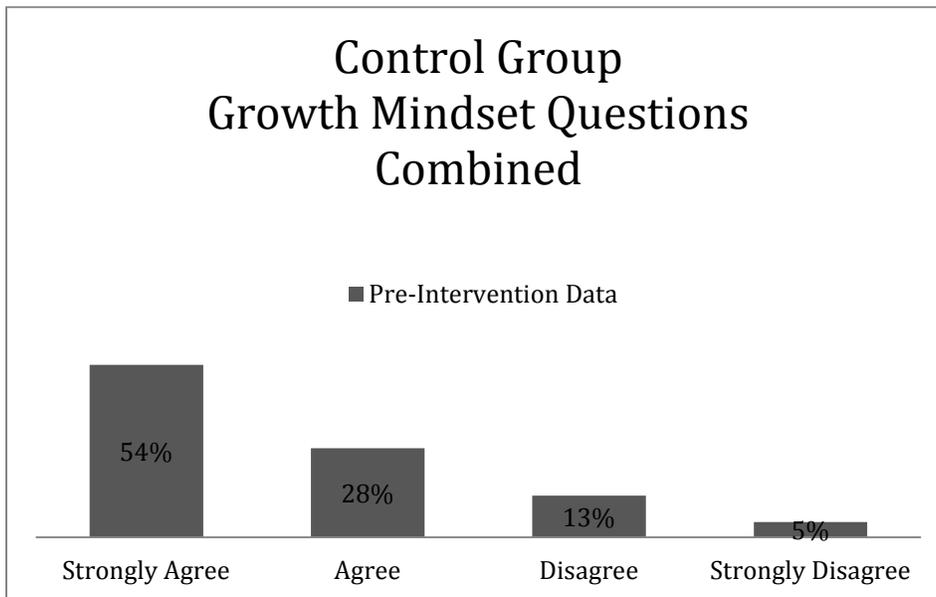
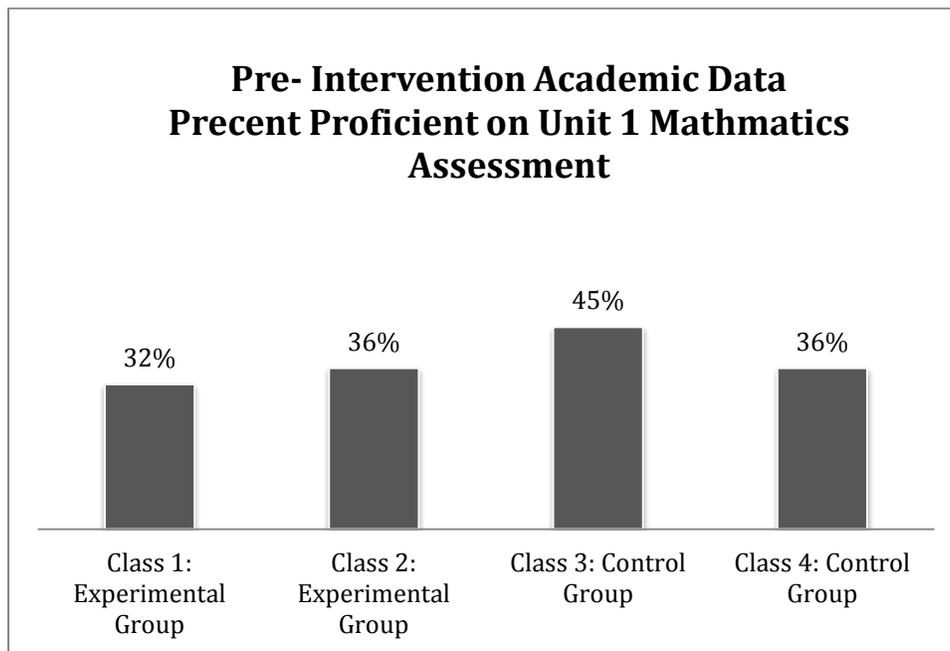


Table 2.4: Theories of Intelligence Survey: Control group pre-intervention growth mindset survey results.



To be able to answer the research question regarding mathematic academic achievement, pre intervention academic data was collected by classroom. Table 3.1 shows each of the four classrooms and their percent proficient of students on the unit one math assessment. Class three, a control group classroom, had the highest achievement results. This supports earlier research that the students entered the study with equal skills and knowledge (Blackwell, et al, 2007).

*Table 3.1:* Unit 1 achievement data.



**Post Intervention Data Presentation**

The same post intervention data collection and presentation, as in the pre-intervention data presentation, is used to show the post mindset intervention results. Table 4.1 and 4.2 identify the post intervention survey results of both the experimental classrooms and control group classrooms, broken down into percentages of strongly agree to strongly disagree per survey question. These charts identify the percentage of students in each group who rate themselves as strongly agreeing, agreeing, disagreeing, and strongly disagreeing with each individual question.

*Table 4.1:* Theories of Intelligence Survey: Experimental group post intervention survey results per survey question.

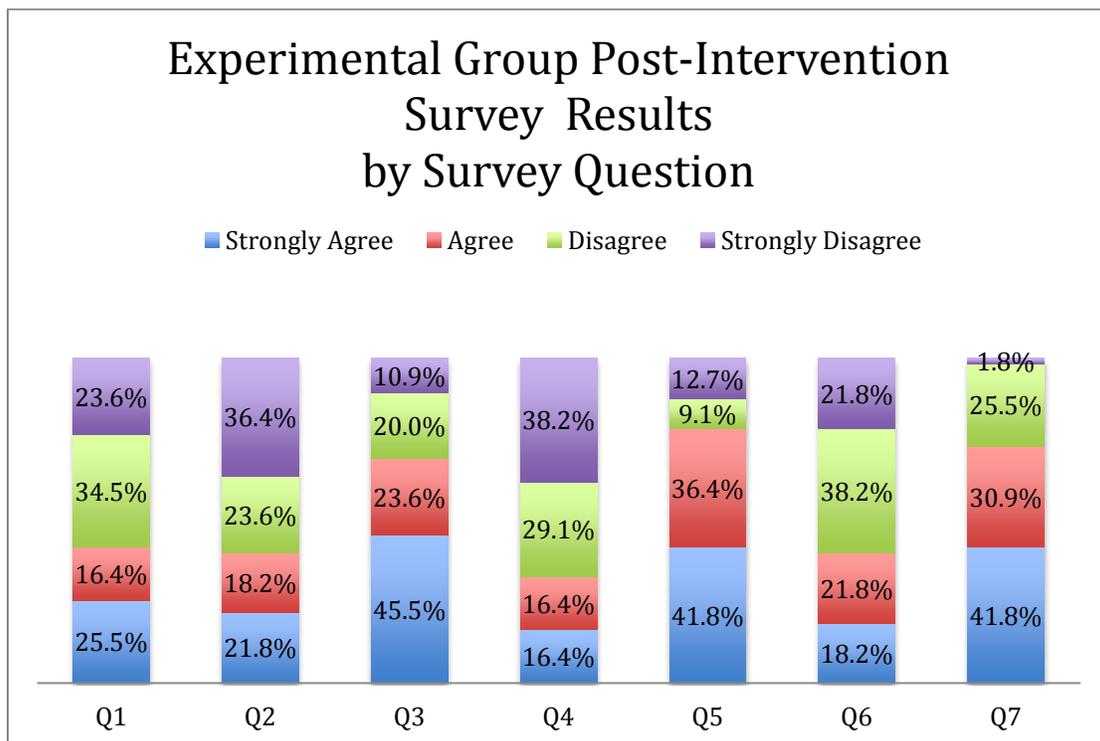
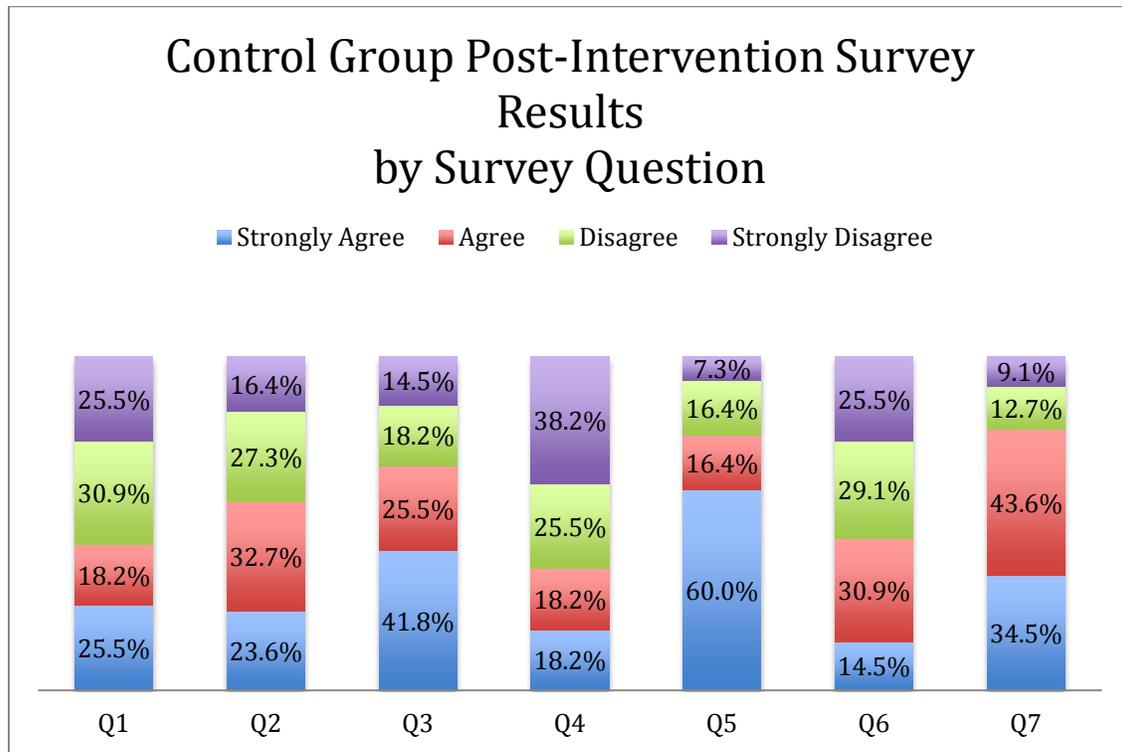
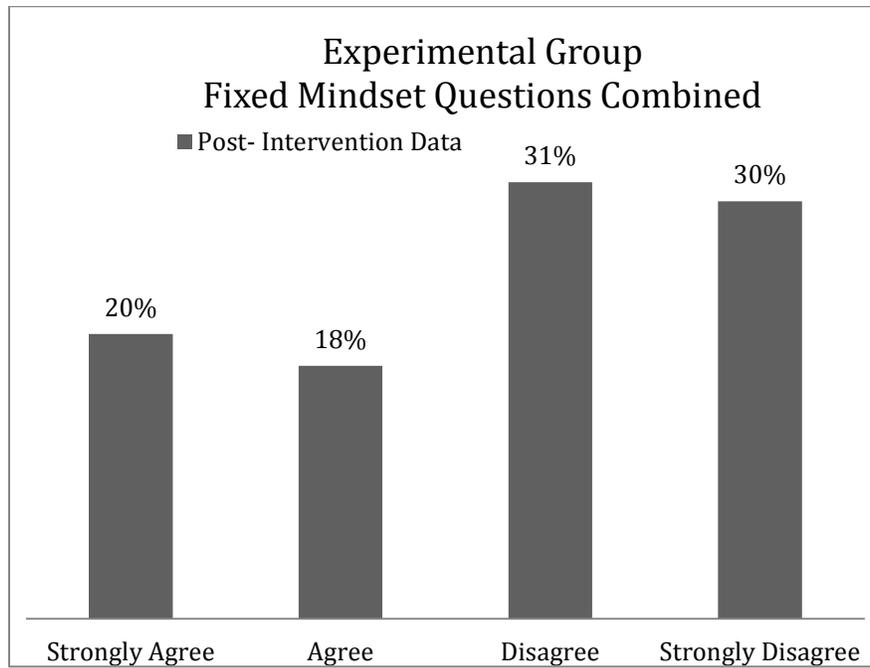


Table 4.2: Theories of Intelligence Survey: Control group post intervention survey results per survey question.



Tables 5.1, 5.2, 5.3, and 5.4 show the post intervention survey results for both the experimental and control groups. Table 5.1 shows the experimental groups post survey data results in relation to a fixed mindset and table 5.2 shows the control groups data results. The data doesn't differ much from the pre-intervention survey data, 38% of the experimental group identify with a fixed mindset and 55% of the control identify with a fixed mindset.

*Table 5.1: Theories of Intelligence Survey: Experimental group post intervention fixed mindset survey results.*



*Table 5.2: Theories of Intelligence Survey: Control group post intervention fixed mindset survey results.*

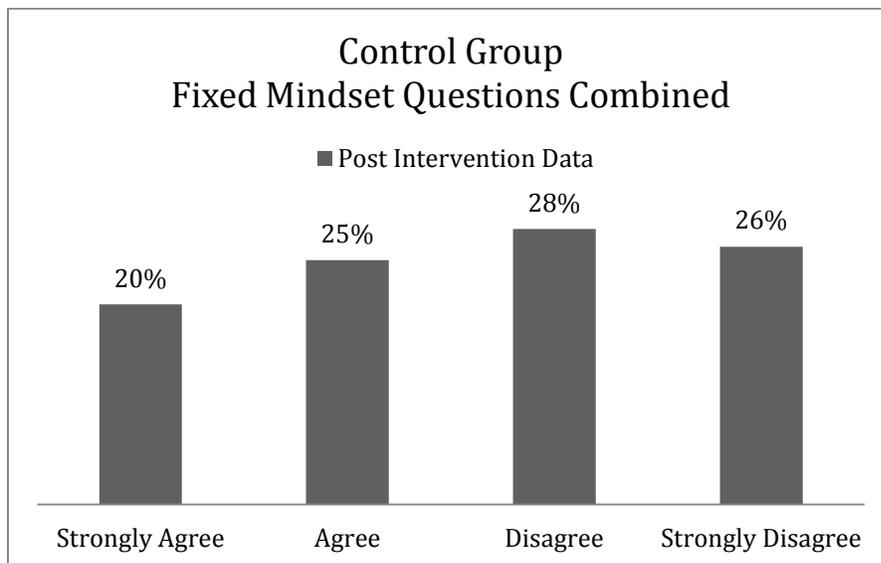


Table 5.3 shows the experimental group's growth mindset post survey data results and table 5.4 shows the control group's growth mindset survey data results. This data collection shows both the experimental group and control group having 73% of their population identifying with a growth mindset.

*Table 5.3: Theories of Intelligence Survey: Experimental group post intervention growth mindset survey results.*

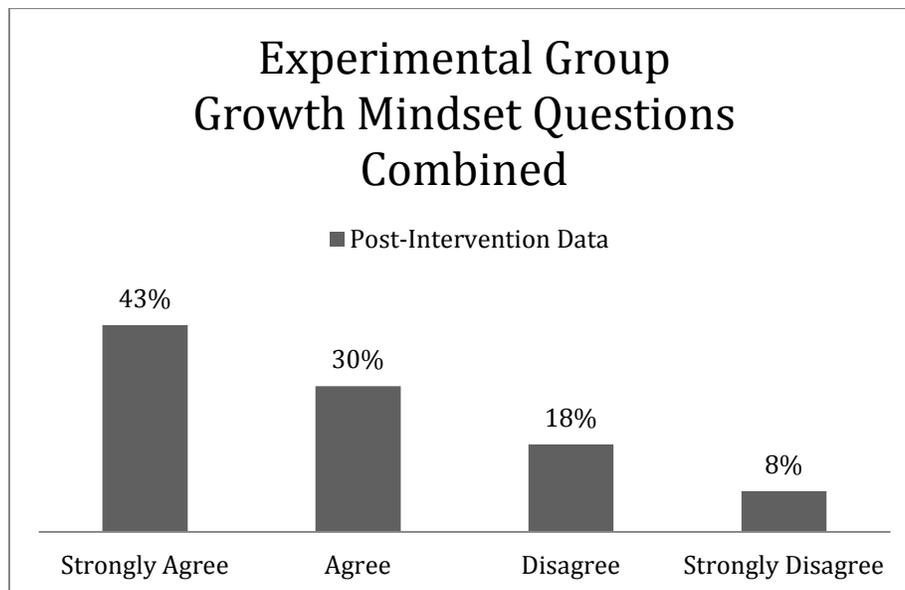
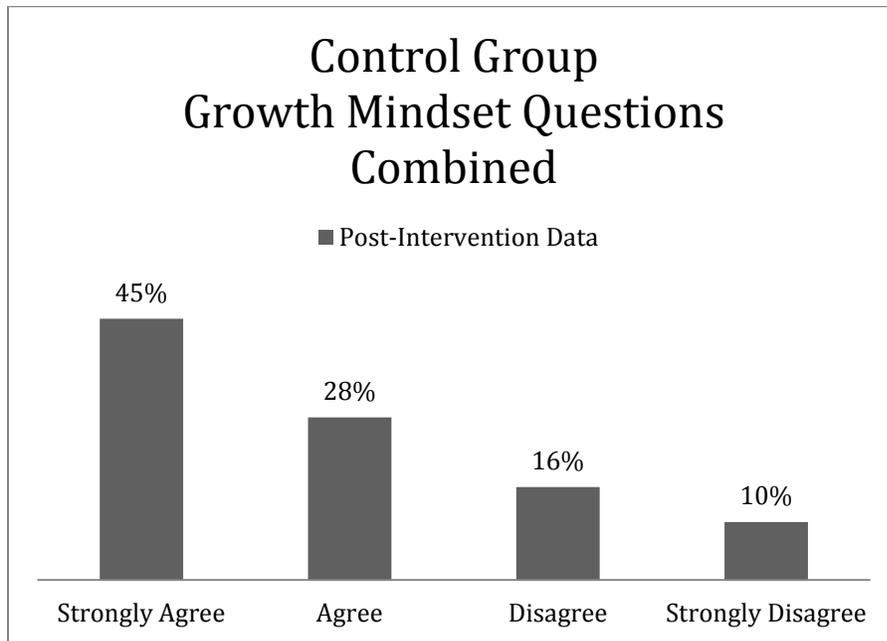
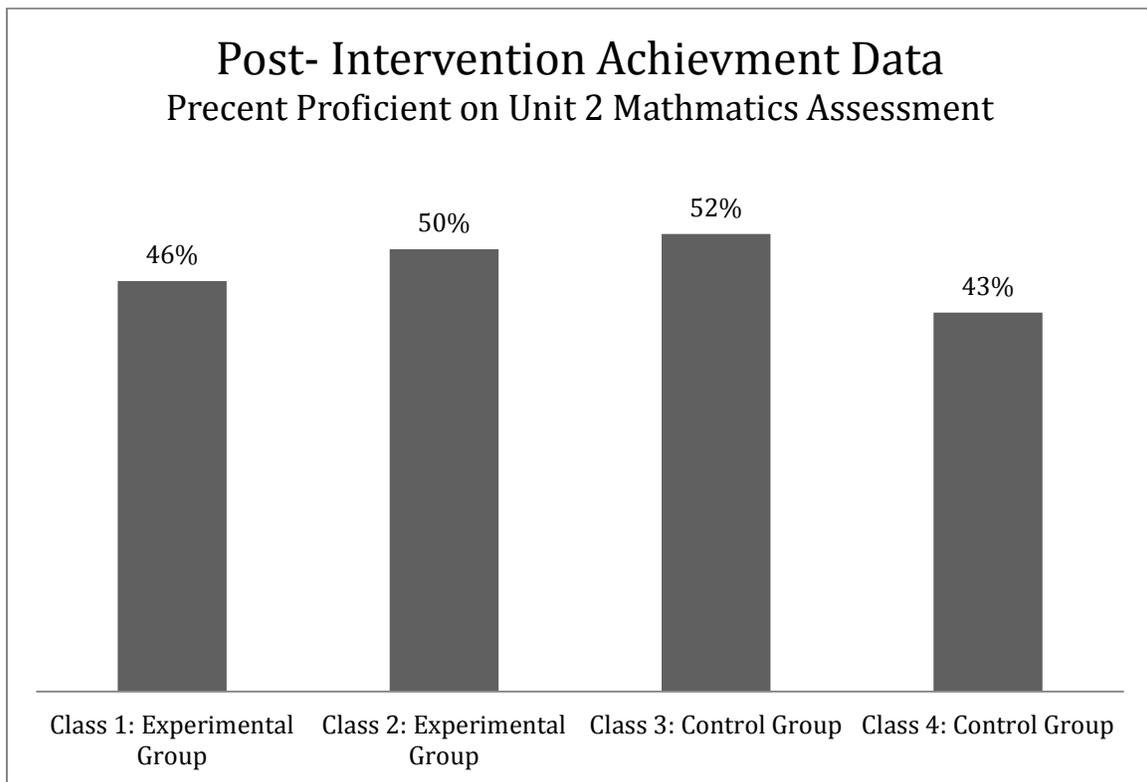


Table 5.4: Theories of Intelligence Survey: Control group post intervention fixed mindset survey results.



Post intervention achievement data was collected to document academic growth. Table 6.1 shows the post intervention academic achievement data. The achievement data shows the percent proficient in each classroom in relation to the unit two assessment. All four classrooms show academic growth, which will be addressed in the data analysis.

*Table 6.1: Unit 2 Achievement Data*

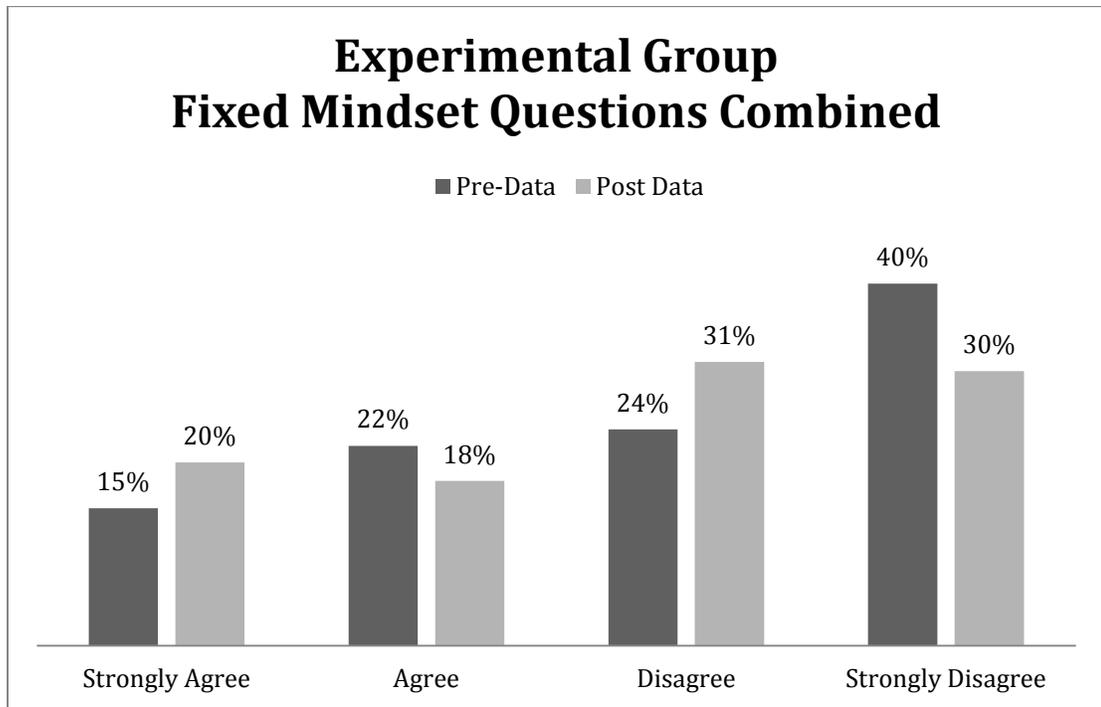


### ***Pre and Post Comparison Data Presentation***

To determine the outcome of my hypothesis, I needed to determine a student's mindset prior to the intervention and post intervention. The following charts show the comparison of survey data both pre and post intervention for both the experimental group and control group. Chart 7.1 and 7.2 compare the percentage of students in the experimental group, both pre and post intervention, strongly agreeing to disagreeing with either a fixed mindset or growth

mindset. Tables 7.3 and 7.4 show the same comparison data for control group. As displayed, both the experimental group and control group’s data results indicate a decline with the percentage of students identifying with a growth mindset. The experimental group declined their growth mindset results by 1% and the control group by 9%.

*Table 7.1: Theories of Intelligence Survey: Experimental group fixed mindset pre and post survey data combined.*



*Table 7.2: Theories of Intelligence Survey: Theories of Intelligence Survey:  
Experimental group growth mindset pre and post survey data combined.*

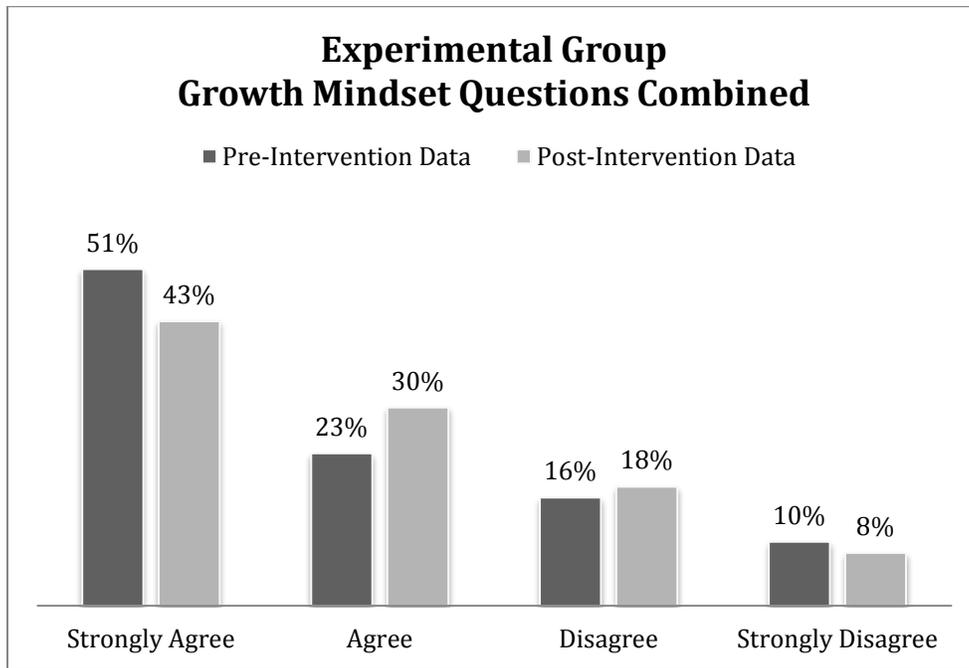


Table 7.3: Theories of Intelligence Survey: Theories of Intelligence Survey: Control group fixed mindset pre and post survey data combined.

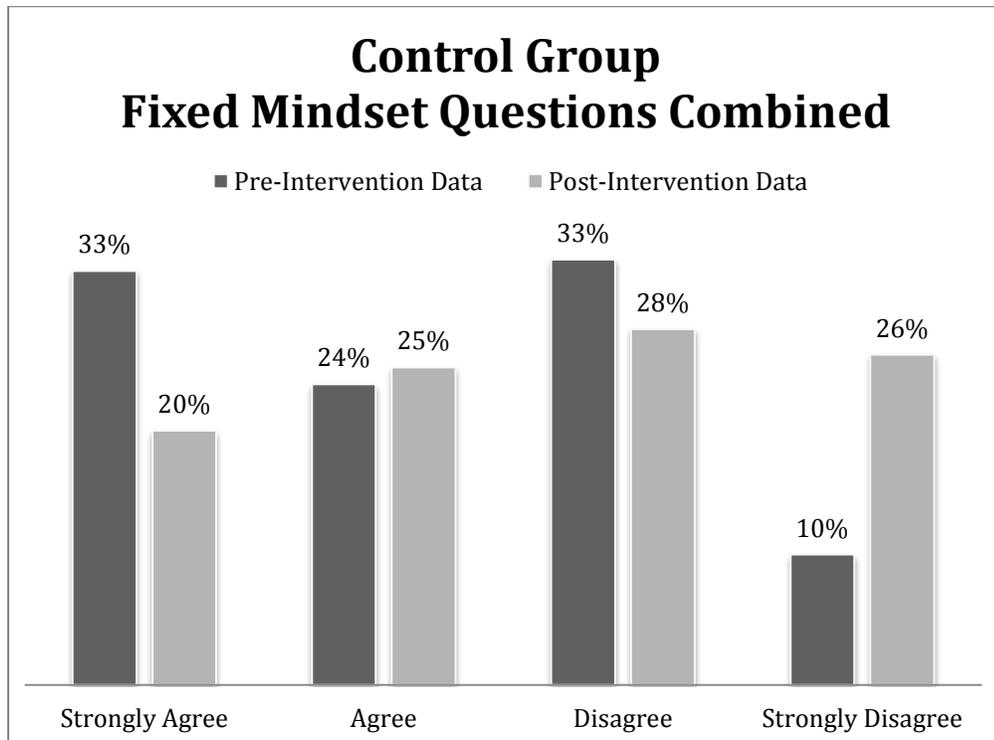
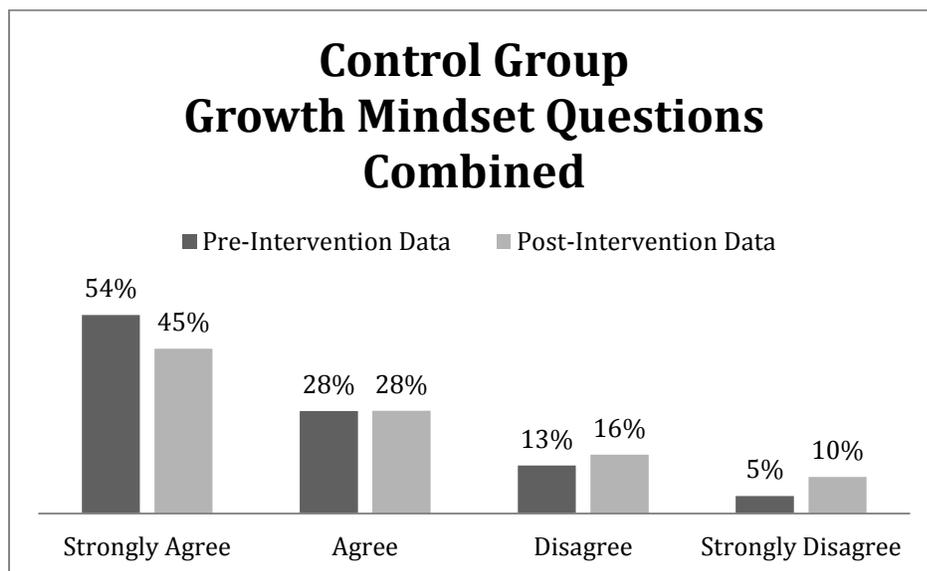
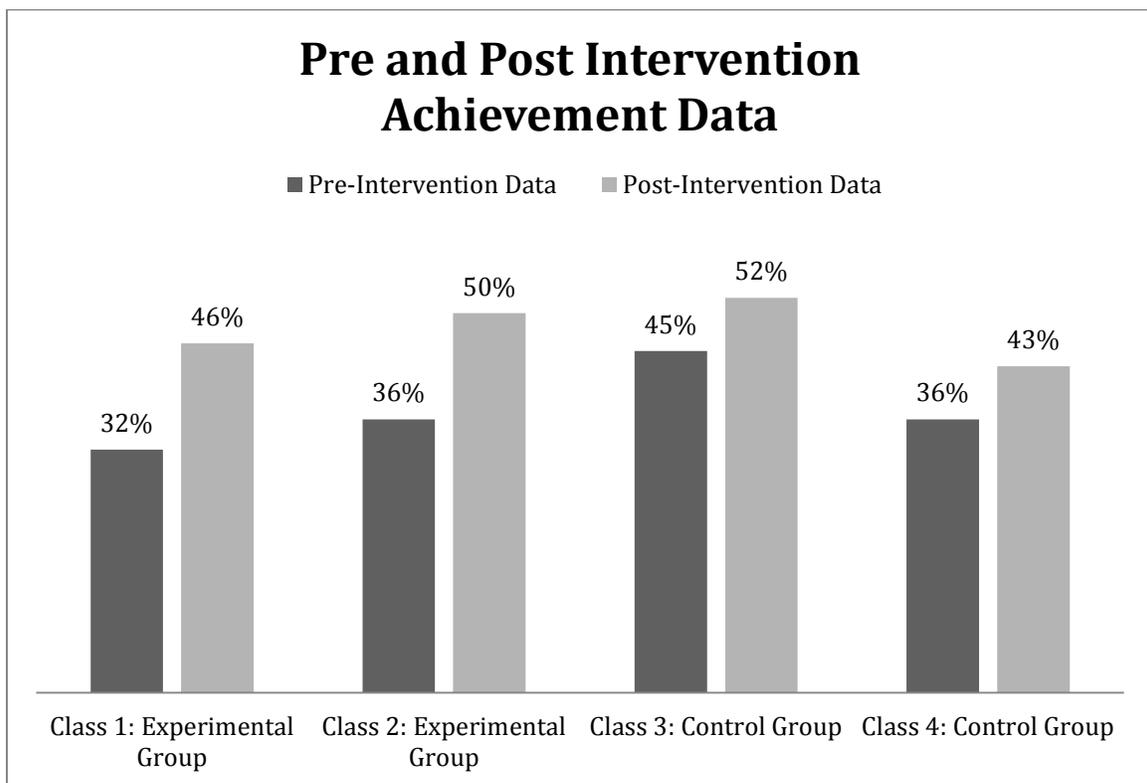


Table 7.4: Theories of Intelligence Survey: Theories of Intelligence Survey: Experimental group growth mindset pre and post survey data combined.



To conclude the presentation of data, table 8.1 documents the pre and post intervention achievement data, labeled as percent proficient by classroom. All classes showed significant academic gains post intervention. Both experimental classrooms gained 14 percentage points and both control groups gained seven percentage points.

*Table 8.1: Achievement Data: Student percent proficient comparison data of the unit 1 and unit 2 math assessments.*



### Data Analysis and Interpretation

When the fixed mindset and growth mindset survey questions were combined it provided a baseline of the percent of students identifying with a fixed mindset versus a growth mindset. The students in the experimental group overwhelmingly identified with a growth mindset. The

results show that 51% of students in the experimental group strongly agree with a growth mindset and 10% of student strongly disagree with a growth mindset. When the data is analyzed further by combining the strongly agree and agree as well as the strongly disagree and disagree, the results show 74% of students in the experimental group identify with a growth mindset and 37% identify with a fixed mindset. The control groups survey data shows 82% of students identifying with a growth mindset and 57% of students identifying with a fixed mindset. This baseline data was contrived by the fourth grade students taking a seven question survey with three questions relating to a growth mindset and four questions relating to a fixed mindset. The results of the survey may demonstrate confusion amongst the students when answering the questions. Several of the students answered different questions with the same survey rating, which negated the outcome. For example, question three states, No matter who you are, you can significantly change your intelligence and question four states the opposite, To be honest, you can't really change how intelligent you are. Many students gave both questions a number one rating, strongly agree, which indicates the same student strongly agrees with both a fixed and growth mindset.

The pre and post comparison data for both groups identify the post survey results for the experimental group show a more consistent trend of 38% of students identifying with a fixed mindset and 73% identifying with a growth mindset (see table 9.1 and 9.2 below). The results of this trend will be addressed in the following paragraph.

Table 9.1: Experimental group combined comparison fixed mindset data.

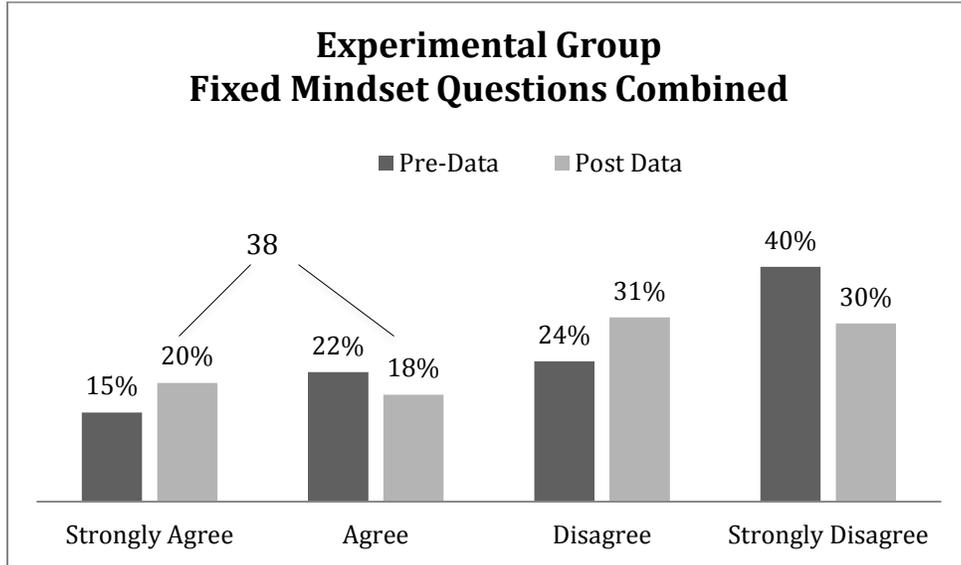
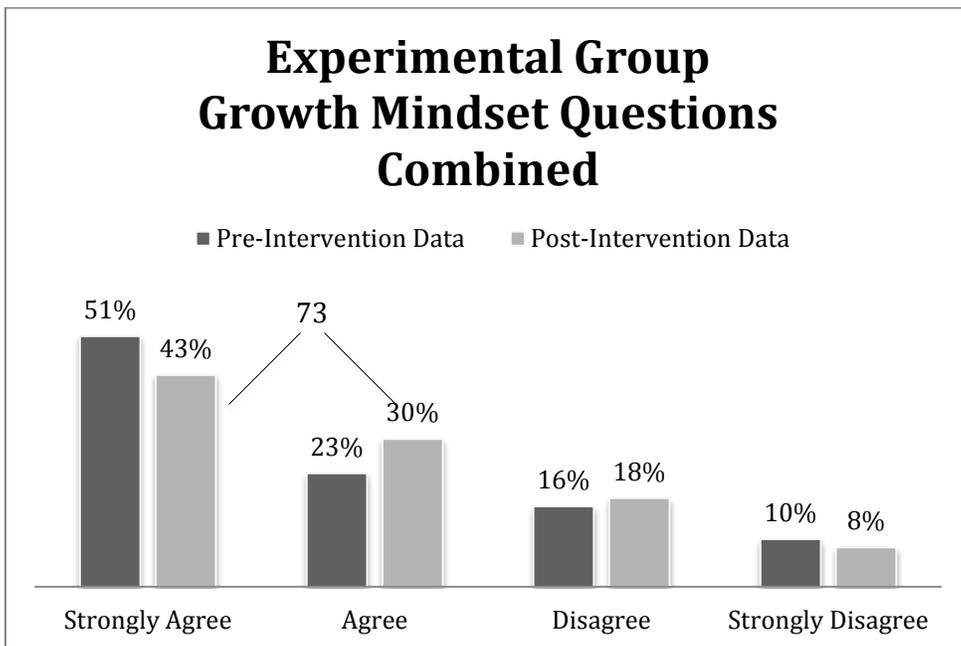


Table 9.2: Experimental group combined comparison growth mindset data



The control group survey results demonstrate more of an inconsistent trend with 55% of the students identifying with a fixed mindset and 73% of students identifying with a growth mindset (see tables 9.3 and 9.4 below).

Table 9.3: Control group combined comparison fixed mindset data.

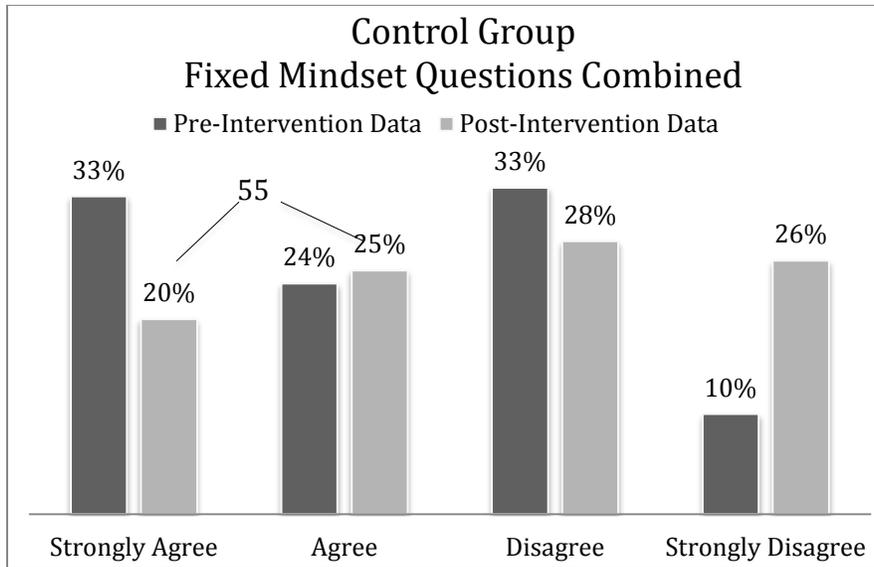
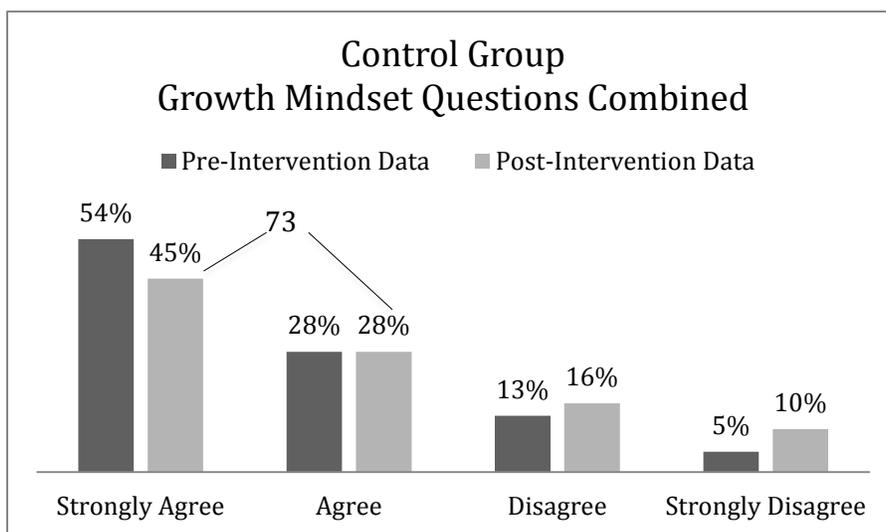


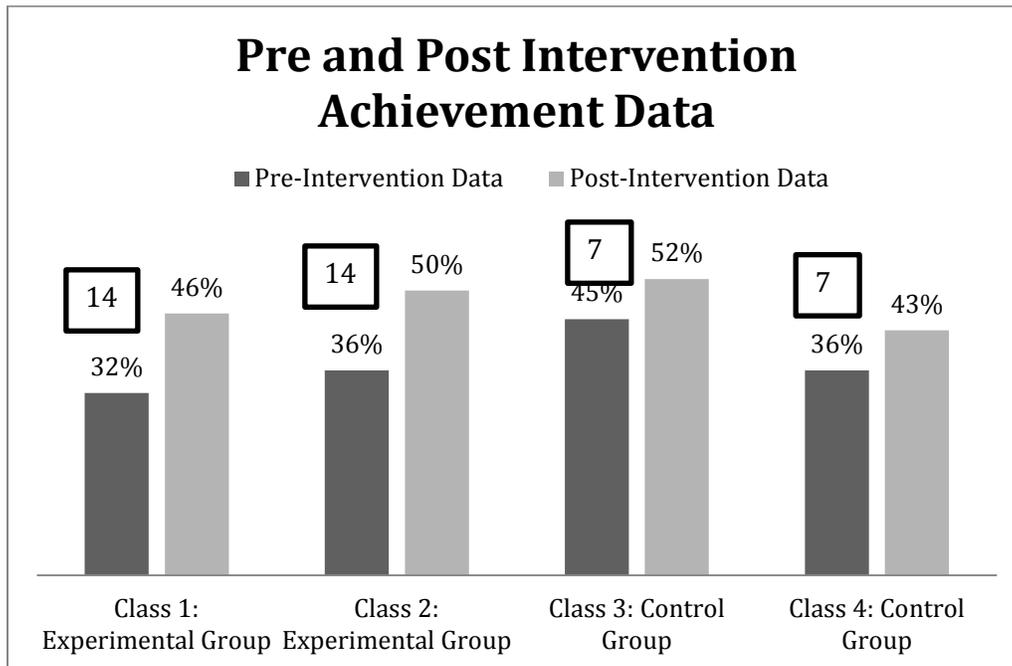
Table 9.4: Control group combined comparison growth mindset data.



The pre and post intervention survey data shows inconsistent trends and shows no conclusive outcome. Both the experimental group and the control group show 73% of the students identifying with a growth mindset. This is a decline from the pre-intervention data where 74% of the experimental group and 82% of the control group identified with a growth mindset, which indicates that the Brainology intervention had no impact on the experimental group versus the control group's mindset. The only trend identified between the two groups is the experimental classrooms answered the survey questions with more validity, less of a percent range between the fixed and growth mindset results. This may suggest they have a better understanding of a growth mindset versus a fixed mindset. Further studies would need to be completed to determine this.

The achievement data shows a trend in mathematical achievement between the two groups. Both the experimental classrooms increased their percent proficient by 14 percentage points and the control group classrooms both increased by seven percentage points. The data does not show the experimental classrooms as having higher achievement than the control group classrooms, however it does indicate a greater increase over time (see table 10.1 below). Blackwell et al. experienced similar research results and hypothesized a growth mindset fosters the growth of ability over time (2007).

Table 10.1: Percentage point increase per classroom.



Through interpretation this suggests the experimental group may have a better understanding of a growth mindset versus a fixed mindset, which impacted their achievement gains. Again, I recommend further longitudinal studies or another data collection method that might yield different results. Time was a limitation in this research study, taking an academic year to complete the research versus two months might prove to have a different outcome. Academic gains were noted at a higher rate amongst the experimental group and may show a continued increase with more time.

### Summary

Throughout this chapter a data story was presented and analyzed. I looked at the data from conception to final outcome to determine any significant trends. Most of what was identified in the analysis of the data proved to be inconclusive in answering the question, Does a

growth mindset impact a fourth grade student's perception of his or her intelligence, and overall academic performance in the content area of math? The findings presented in this chapter contradict my hypothesis and provide inconclusive results that having a growth mindset does impact academic achievement.

## **Chapter 5: Recommendations**

Mindset research is not often conducted on elementary age students because it is hypothesized that children are not born believing that intelligence is fixed or unchangeable and adolescence appears to be the time when beliefs about intelligence begin to crystalize (Dewar, 2010; Blackwell et al., 2007; Lehman, 2002; Freedman-Doan et al., 2000). My research was conducted on upper elementary age students in an effort to challenge this hypothesis, add to the current research and find an intervention program that would impact elementary age students. This chapter will summarize and interpret my research findings in relation to current research as well as consider implications and provide recommendations for the future study of mindset research in elementary age students. I provided several research findings and described my research methods in order from collection to presentation and will speak to my findings in this chapter.

### **Summary of Findings and Interpretations**

This experimental research study has shown results that are inconclusive when answering the question, Does a growth mindset impact a fourth grade student's perception of his or her intelligence, and overall academic performance in the content area of math? My hypothesis was that having a growth mindset would impact a student's perception of their intelligence and academic achievement. My research findings told a different story. This data was initially difficult to interpret when broken down by survey question. Each question was broken into the percent of students who strongly agree, agree, disagree, or strongly disagree with each survey statement. I combined all of the growth mindset questions (three) and fixed mindset questions (four) to get a baseline of student perception prior to receiving any intervention. The results showed inconsistency, which demonstrates the students may not have been able to identify with

their intelligence. After the Brainology intervention was complete both groups were surveyed again, this data analysis demonstrated interesting results. Both the experimental and control groups showed 73% of students identifying with a growth mindset, however 38% of the experimental group identified with a fixed mindset and 55% of the control group identified with a fixed mindset. These findings display that both groups identified more with a growth mindset regardless of the Brainology intervention. When you look at the achievement data one of the control group classrooms showed the highest percent proficient on both the pre and post achievement assessment. Overall, my hypothesis is not negated by my research findings. My hypothesis is that having a growth mindset will impact a student's perception of his or her own intelligence and overall academic achievement. Both groups showed 73% of their students identifying with a growth mindset and there was no significant increase in academic scores from the experimental group that received the intervention, Brainology. This confirms achievement gains among a group of students not receiving any formal mindset intervention, but still identifying with a growth mindset. The data did acknowledge the experimental group had a trend toward a higher point increase on their achievement scores than the control group as well as they appeared to have a more consistent view of their personal intelligence as indicated by the post intervention survey results. This proposes that the Brainology intervention program has an impact on student's understanding of mindset and given more time may prove to be an effective intervention for students.

### **Findings in Context**

Over the past decade extensive research has been on intervention models that help to promote a growth mindset. Several researchers have conducted studies that have shown that teaching students a growth mindset will result in increased motivation, better grades, and higher

achievement scores (Dweck, 2010). The hardest part has been finding an intervention model that teaches students about mindset and brain growth. Carol Dweck and her team developed a computer-based intervention, Brainology, to lead students through a series of brain growth modules (Dweck, 2007). Research has been done on junior high, high school, and college students who participated in this type of intervention program and the results show an academic increase (Dweck, 2010). My intent with this research study was to apply the Brainology intervention to two classrooms (experimental group) to see the impact brain growth modules had on creating a growth mindset in elementary age students. Very little research has been done on this age group and my hypothesis was it would impact academic growth. My research results contradicted many of the published studies, which show the experimental groups that received the intervention out performing the control group (Dweck, 2010). In my study that was not the case, my results showed no significant difference between the experimental group in either mindset identification or academic achievement.

### **Limitations and Future Direction**

The biggest limitation to my research study was the limitation of time. This study was conducted during a three-month period and to achieve valid results I recommend the study be conducted throughout an academic year at minimum. The data supports the theory that the experimental group was just starting to understand mindset and the positive impact it can have on their academic achievement. A similar research study was conducted on junior high students in 2008 and as of 2012 the results were still undergoing scientific evaluation to determine its validity (Donohoe, Topping & Hannah, 2012). My research results were inconclusive and with more time may demonstrate more validity. Another limitation was the age group of students being researched. It has been researched that students intelligence does not crystalize until

adolescents, which is why elementary age students aren't as likely to receive mindset intervention. In order to give this hypothesis validity this research study would need to continue with an expanded research time window. Finally, I was not in the classroom on a daily basis to observe teacher and student interaction and instruction. From the results of the study 73% of students in both groups identified with a growth mindset, which indicates student praise and a culture of risk taking is evident in all of the classrooms regardless of a mindset intervention program taking place. I believe in the concept of growing a growth mindset and creating a culture that values the process of learning in the classroom. In a school district that is already providing mindset training to its teachers it is hard to determine if the Brainology intervention program had an impact on student achievement.

### **Conclusion**

Does a growth mindset impact a fourth grade student's perception of his or her intelligence, and overall academic performance in the content area of math? The data results show no conclusive evidence to support my hypothesis. Given all the limitations of this study described above, the results of this research study show inconclusive results in proving academic performance will increase with a growth mindset. Since the conception of No Child Left Behind (NCLB) school districts are trying to eliminate the achievement gap by providing research based intervention programs during the school day. The effects of this study were to research an intervention program that would prove to be effective on all students regardless of ethnicity, socio-economic status, and race. The result of this study indicate 73% of all fourth grade students identify with a growth mindset and only time will tell if that will impact their academic achievement. Through this study and the comparison of the experimental group and control group, appropriate teacher praise along with creating a culture of risk taking and the value of

learning in the classroom has proven to be just as effective as the Brainology mindset intervention program with elementary age students. I recommend further studies, such as a longitudinal study to see the changes in student thinking and achievement over a longer period of time.

## Appendix

### Appendix A: Theories of Intelligence Survey

#### Theories of Intelligence

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This questionnaire has been designed to investigate ideas about intelligence. There are **NO** right or wrong answers. Using the scale below, please indicate the extent to which you agree or disagree with each of the following statements by writing the corresponding number in the space next to each statement.

Strongly Agree (1) Agree (2) Disagree (3) Strongly Disagree (4)
---

\_\_\_\_. You have a certain amount of intelligence (smarts), and you can't really do much to change it.

\_\_\_\_. Your intelligence is something about you that you can't change.

\_\_\_\_. No matter who you are, you can significantly change your intelligence.

\_\_\_\_. To be honest, you can't really change how intelligent (smart) you are.

\_\_\_\_. You can always change how intelligent (smart) you are.

\_\_\_\_. You can learn new things, but you can't really change your basic intelligence (smarts).

\_\_\_\_. No matter how intelligent (smart) you are. You can always change it quite a bit.

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