THE IMPACTS OF TEACHING GROWTH MINDSET STRATEGIES TO STUDENTS IN INQUIRY SCIENCE 2 AT FERNDALE HIGH SCHOOL

by

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DEDICATION

This classroom research project is dedicated to my students past and present and to my children, Abigail and Cole Schuman. You can achieve anything with hard work. May you believe in yourself, go after your dreams, and find your way. I would like to thank Abigail and Cole for all their patience the last two years while my attention has been diverted. Among other things, you have gone too long without playdates and had to watch me work on too many holidays. I hope I can make it up to you. I love you!

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ABSTRACT

This classroom research project investigated the impact of teaching 20 minute growth mindset lessons once a week for six weeks to regular tenth grade science students during weeks six to twelve of an eighteen week semester. Growth minded students appreciate challenges and view mistakes as opportunities to learn. The project was driven by the desire to improve student behavior and engagement in learning. In addition to seeing if students would become more growth minded, I also wanted to see if student achievement in science would increase, if students could transfer their learning about mindsets to other courses and life experiences, and I wanted to know how this would impact me as the teacher.

Data sources included a Measure Your Mindset Survey, individual student interviews, student work, gradebook data, a Mindset Unit Evaluation, and a teacher reflective journal. Data from the six week treatment period was compared to data from the six week pre-treatment period and the six week post-treatment period.

Students that fully participated and engaged in the mindset lessons became more growth minded. Overall grades did not improve as a result of the treatment. However, mean test scores did go up. Students reported applying what they learned about the growth mindset to other courses. In addition, students felt that having a growth mindset helped them be more compassionate to aggressive peers.

The teacher saw observable improvements in student behavior and engagement as documented in the teacher journal. This made teaching more enjoyable. In addition, by learning about how to facilitate a growth mindset culture in the classroom, the teacher was able to improve her verbal and written feedback to students.

INTRODUCTION AND BACKGROUND

I teach science at Ferndale High School (FHS) in Ferndale Washington State. FHS is the only comprehensive high school in the city of Ferndale with a population of 13,010. The student body of 1,403 students is 52.3% male, 47.7% female, 17.7% Hispanic, 6.1% American Indian, 3.7% Asian, 65.9% White, and 6.6% other. This school population also consists of 12.8% special education students and 2.1% English language learners (ELL). The school-wide percent of students that qualify for free or reduced price meals is 33.7%. Within this population of learners are students that lack motivation and confidence. Students at my school are given the option to choose between general education and honors sections in their freshmen and sophomore years. Honors sections hold the majority of motivated college minded students whereas general sections house students with more of a history of academic and social struggles. The general classes have fewer students that feel they can step up as leaders and they often see fewer examples of growth minded individuals that value learning, the power of risk taking, and making mistakes.

With my classroom research project, I set out to learn how teaching growth mindset strategies to the general science students would affect their motivation and confidence. Students with a growth mindset believe they can improve their intelligence over time through hard work. In addition, growth mindset students appreciate challenges and constructive feedback while students with a fixed mindset believe they are born with a certain amount of intelligence. Fixed mindset individuals are more concerned with getting the correct answer than the process of learning. Fixed mindset students may also

feel uncomfortable with challenging assignments and getting feedback. For this project, I taught students about the mindsets with the goal of helping students become more growth minded active learners.

The research question and sub-questions I investigated are:

What are the impacts of teaching growth mindset research and practices to 10th grade general science students over the course of 6 weeks?

- In what ways do mindsets change after being taught growth mindset curriculum and is it retained?
- How do growth mindset lessons impact student learning in science?
- How do students apply their learning about growth mindset to other high school courses and life experiences?
- In what ways does learning about and teaching about growth mindset research impact me, as a teacher?

This research is important to other teachers that experience the same problems with tracking and want to increase student learning. The research is also of interest to students that care about their learning and want to do their best. It is especially important to the few motivated students in these regular classes that are frustrated by their peer's lack of contribution to learning. In addition, my teaching colleagues and administrators are interested in the outcome of this study as there is always a building wide concern and increasing accountability for student learning gains. The outcomes of this project provide the rationale and a plan for how to implement growth mindset instruction in the classroom.

CONCEPTUAL FRAMEWORK

Rationale for Teaching about Mindsets

What is it that makes one student more motivated than another? How can educators help students become more self-directed motivated learners? Psychologist and researcher Carol Dweck says,

> The most motivated and resilient students are *not* the ones who think they have a lot of fixed or innate intelligence. Instead, the most motivated and resilient students are the ones who believe that their abilities can be developed through their effort and learning (2007, p.7).

Carol Dweck goes on to outline rules governing students with growth and fixed mindsets. According to Dweck, students with a growth mindset are guided by three rules that help them reach their main goal of learning. The rules describing students with a growth mindset include: 1. They take on challenges, 2. They work hard, 3. They confront deficiencies and correct them. The growth mindset student "wants tasks that stretch their abilities" providing opportunities for mistakes that promote learning and they understand that "even geniuses…had to work hard for their successes" (Dweck, 2007, pp. 6-7). In contrast, the fixed mindset student's rules "stand in the way of learning". The rules describing fixed mindset students include: 1.They avoid making mistakes, 2.They avoid working hard, 3. They do not try to repair mistakes. Fixed mindset students believe that "mistakes or setbacks mean they lack ability" permanently and "hard work signals low intelligence." Because of this fixed mindset, these students "may quickly withdraw their effort, blame others, lie about their scores, or consider cheating" (Dweck, 2010, p.16).

Carol Dweck wrote, "Students who believe that intelligence or math and science ability is simply a fixed trait (a fixed mindset) are at a disadvantage compared to students

who believe that their abilities can be developed (a growth mindset)" (2008, p.2). She reviewed literature and explained how it shows that

a) mindsets can predict math/science achievement over time
b) mindsets can contribute to math/science achievement discrepancies for women and minorities
c) interventions that change mindsets can boost achievement and reduce achievement discrepancies; and
d) educators play a key role in shaping students mindsets.

Dweck discusses how in general about 40% of students have a fixed mindset, 40% have a growth mindset, and the other 20% are not consistently classified. Dweck discussed that "mindsets can play a key role in underachievement of women and minorities in math and science" (Dweck, 2008, p.5). She discussed how females with a growth mindset are "less susceptible to the negative effects of stereotypes" and are more likely to stay in math courses and "earn high grades" while fixed mindset females are more likely to lose their sense of belonging in their math class, have a "decreased intention to take math in the future and a decrease in their final grades in the course" (Dweck, 2008, p.5). Dweck discussed how negative stereotypes "embody the belief that an ability is fixed and that certain groups do not have it." She says, "The more that members of a negatively stereotyped group already hold a fixed mindset, the more susceptible they may be to such a message" (Dweck, 2008, pp.5-6). Carol Dweck also notes that cultures producing larger numbers of math and science graduates, especially females, tend to make "fewer assumptions…about inherent ability" (Dweck, 2008, p.9). Teaching growth mindset strategies may help lower achievement gaps that exist for female or minority students.

In Unleashing Brain Power, Matt Zalaznick discusses the importance of teaching science students neuroplasticity and the brains ability to become stronger. When "students develop their own hypothesis and make predictions, they will often make mistakes and have to persevere to figure out how to make improvements" (Zalaznick, 2015, p. 34). This high level learning will take a growth mindset for the brain to get past the difficulties and mistakes encountered along the way. In addition, these mistakes will only be appreciated by growth mindset students that like a good struggle and have a "thirst for challenge" (Zalaznick, 2015, p. 35).

The lack of effort and motivation my regular science students typically demonstrate when faced with challenges involving higher order thinking skills aligned with Dweck's definition of fixed mindset students. It is easy to see how having a fixed mindset would not promote learning while having a growth mindset would lead to achievement. The following studies provide evidence for the benefits of teaching students about mindsets.

Evidence That Mindset Instruction Works

In 2007, Blackwell, Trzesniewski, and Dweck reviewed research conducted on 373 students entering seventh grade. In one study, a questionnaire was used to assess "initial theories of intelligence, goals, beliefs about effort, and [fixed] versus [growth mindset] responses to failure" (Blackwell, Trzesniewski, & Dweck, 2007, p.249). After two years, students with a growth mindset "positively associated with positive effort beliefs, learning goals, low helpless attributions, and positive strategies" (Blackwell, Trzesniewski, & Dweck, 2007, p.250). In addition, math grades increased for the growth minded students and declined for the fixed minded students.

While the study above confirmed the positive outcomes of having a growth mindset, the second study looked at how mindsets can change. This closely addresses my first sub-question: In what ways do student attitudes about learning change after being taught growth mindset research and is it retained? Over the course of eight weeks, Blackwell, Trzesniewski, and Dweck taught growth mindset strategies in eight, 25 minute lessons to half of 91 seventh grade students from a "relatively low achieving" school (2007, p.254). This research found that "participants in the experimental group changed in theory of intelligence such that they endorsed [a growth mindset] theory more strongly after participating in the intervention" (Blackwell, Trzesniewski, & Dweck, 2007, p.256). More students from the mindset intervention were also reported by their teachers as "showing [positive] change in motivation in their math class" (Blackwell, Trzesniewski, & Dweck, 2007, p.256). In addition, students "declining grade trajectory was reversed following the intervention, while the grades of students in the control group who endorsed more of [a fixed mindset] theory continued to decline" (Blackwell, Trzesniewski, & Dweck, 2007, p.258). These studies provide evidence that growth mindset instruction could make a difference in learning, that mindsets can change and become more growth minded, and that it can still have an impact after two years.

Blackwell's team focused their research primarily on achievement in math. However, my second research sub-question asks, how does having a growth mindset impact student learning in science? Would Blackwell's outcomes be the same in science? Blackwell chose math because "mathematics is a subject that many students find difficult; thus, it meets the requirement of being a sufficiently challenging subject to trigger the distinctive

motivational patterns" associated with the growth mindset" (Blackwell, Trzesniewski, & Dweck, 2007, p.249). Science classes offer similar challenges as students are asked to analyze complex data, ask questions, design experiments, and propose solutions.

Another study, conducted in 2015 by Paunesku, Walton, Romero, Smith, Yeager, and Dweck "delivered brief growth-mindset and sense-of-purpose interventions through online modules to 1,594 students in 13 geographically diverse high schools" (Paunesku et al., 2015, p.784). The intention of the study was to see if "academic-mind-set interventions can have a meaningful impact on academic outcomes when delivered to a large sample in a scalable way" (Paunesku et al., 2015, p.786). In a 45 minute growth mindset tutorial, students read about mindsets and neuroscience and completed two writing tasks. The results of the study were increases in course completion for English, math, science, and social studies as well as increases in GPA. These studies show the importance of mindset in confronting challenges and making learning gains. They also indicate that whether the growth mindset instruction is brief or long, the message will have a positive result.

Yeager, Trzesniewski, and Dweck published a study in 2012 that addresses part of my third research sub-question: How do students apply their learning about growth mindset to other high school courses and life experiences? In their research, 230 ninth and tenth grade students from a medium to large California high school with 64% of students receiving free and reduced lunch participated in a study that positively measured the effects of teaching growth mindset on response to peer aggression, prosocial behavior, and classroom behavior. When exposed to aggressive peer behavior, the

students that had received six growth mindset lessons consisting of activities, readings, and lectures retaliated almost 40% less to aggression than the control groups. These same students received "more nominations from teachers for having reduced their conduct problems" (Yeager, Trzesniewski, & Dweck, 2012, p.981). It is also encouraging that the study "measured effects 2 weeks, 1 month, and 3 months post intervention" indicating retention of growth mindset thinking (Yeager, Trzesniewski, & Dweck, 2012, p.973).

Another study that supports the idea that teaching growth mindset will have positive impacts beyond my science classroom, was conducted by Yeager, Johnson, Spitzer, Trzesniewski, Powers, and Dweck in 2014. This research consisted of three studies looking at the relationship between mindset and stress, health, and academic achievement. In study one, students with a fixed mindset had "harsher immediate reactions to social exclusion" and they reported more stress and poorer health at the end of the school year (Yeager et al. 2014, p. 872-873). In addition, the fixed mindset students had a lower cumulative grade point average at the end of the year than their growth mindset peers. Studies two and three were identical studies conducted at two different schools. "Study 2 was conducted in a nonpoor, largely nonminority context" while study 3 was conducted in "one of the poorest performing and lowest-income" schools in California (Yeager et al, 2014, p. 877). In both these studies, students in the experimental group were taught a one-time growth mindset lesson followed by a computerized experience of social exclusion two days later. The experimental group in both studies reported "significantly less negatively" to the social exclusion (Yeager et al. 2014, p.878). Eight months after the study, experimental students reported less stress and

health problems. In addition, grades were improved especially by students that entered the year with a fixed mindset (Yeager et al. 2014, p.878).

These studies are encouraging and provide rationale for teaching students growth mindset strategies. Together they show that a little or a lot of growth mindset instruction whether offered one time or over the course of weeks to any group of students can have positive long term effects on learning, coping with social adversities, and overall health.

Carol Dweck (2008) made recommendations to educators including teaching brain plasticity and the view that talent is something that is developed over time, communicating to students "that we value…challenge-seeking, hard work, and learning from mistakes", and using specific process praise and "feedback about strategies, effort, perseverance, challenge-seeking, improvement, etc." (Dweck, 2008, p.12-13). With each recommendation, she included examples as to what a teacher might say to students in different situations. For example, '"That was too easy for you-sorry I wasted your time. Let's find something you can learn from.'" or '"I liked the effort you put in, but let's work together some more and figure out what it is you don't understand'" (Dweck, 2008, pp.12-13). These examples, along with the research discussed here and in the following section, were important reference tools for planning the methodology of my project.

Studies I Modeled My Methodology After

Donohoe, C., Hannah, E., and Topping, K. (2012) conducted classroom based research using Carol Dweck's online curriculum called Brainology. I utilized parts of Brainology that are open to public use to shape some of my lessons. The sample size of this study was small with only 33 participants between the ages of 13-14 years. This

study was unique because it used a mixed methods approach looking at both quantitative and qualitative data, whereas other studies only utilized quantitative data. These researchers used Dweck's theories of intelligence scale before and after four 40 minute treatment lessons followed by class discussions to measure changes in mindset. The researchers also conducted and recorded ten minute focus group interviews before and after the treatment lessons using a random sample of six students. To test for retention, a follow up test was conducted three months later (Donohoe, Hannah, and Topping, 2012, p.648). I used a similar mixed methods approach, but with random individual student interviews and my treatment lessons consisted of six weekly 20 minute lesson more like the study conducted by Blackwell, Trzesniewski, and Dweck (2007).

I used methods similar to what was used in studies conducted by Heidi Grant and Carol Dweck in 2003. In their study, Grant and Dweck asked college chemistry students to read a detailed scenario "about a failure experience in a college classroom…and to imagine it happening to them" (Grant & Dweck, 2003, p. 546). Students were "asked to indicate how they would feel, and how they would behave after the failure by rating their degree of agreement with a series of statements" (Grant & Dweck, 2003, p. 546). The results were tallied in a table and analyzed. Blackwell, Trzesniewski, and Dweck (2007) did a similar measure of response to failure with seventh graders. I used similar methods with different scenarios and questions more relevant to my classroom and students.

Additional methodology ideas came from Paunesku et al. (2015), Yeager, Trzesniewski, and Dweck (2012), and Yeager et.al. (2014). In these studies, students responded to questions that prompted them to reflect on what they learned and apply it to

their life. Paunesku et al. (2015) delivered one computerized 45 minute growth mindset workshop to high school students. In this workshop,

> [s]tudents read an article describing the brain's ability to grow and reorganize itself as a consequence of hard work and good strategies on challenging tasks. In keeping with our focus on underperforming students, the article stressed the fact that struggle and setbacks in school do not indicate limited potential; rather, they provide opportunities to learn (pp.786-787).

This message was reinforced through writing exercises where students summarized the article in their own words and then applied the content by writing advice to students facing challenges in school (Paunesku et al. 2015, p.786-787). For several of the lessons I gave my students, there was a reflective writing piece to help students internalize their learning and apply it to their life.

These research studies illustrate the importance of teaching students' growth mindset strategies and offer insights on how teachers might effectively go about it. Many of the methods used by these researchers are replicated here. The positive impacts that learning about mindset can have on not just academics, but reducing the achievement gap, resiliency in the face of social adversity, and overall health is impressive.

METHODOLOGY

Research Sample

This classroom research project was administered to two sophomore general science classes. These students typically struggle with motivation. Twenty nine of the 49 students in these classes returned their consent forms (*N=29)*. The 29 students that participated in this research project are representative of the 1,403 students that attend FHS. Table one shows demographics for my sample (*N= 29*).

Table 1
Student Demographics (N=29)

Gender			Local Races			English as 2nd Language			Special Education	
	%	*N*		%	*N*		%	*N*	%	*N*
Male	55	*16*	Hispanic	10	*3*	Spanish	14	*4*	10	*3*
Female	45	*13*	Asian	7	*2*	Russian	7	*2*		
			White	76	*22*	Punjabi	7	*2*		
			Black	7	*2*					

To measure the impacts of growth mindset instruction, I collected baseline data during the first six week grading period of the school year. This was followed by six weeks of treatment where students were taught growth mindset lessons. Post-treatment data was then collected during the last six weeks of the semester. Post-treatment data was compared to treatment and baseline data to look for impacts on both students and teacher.

Classroom Treatment Plan

For this project, I taught my students a 20 minute mindset lesson once a week for six weeks during the second six week grading period of first semester in fall 2016. The weekly lessons, were followed by instruction using the regular science curriculum. Two important aspects of the treatment period were providing opportunities for students to internalize their learning during the mindset lessons and maintaining a constant growth mindset culture throughout the whole class period. An example of how I helped students internalize their learning was during the first lesson, I had students write a response to a question about a time when they missed an opportunity to grow their brain. This internalization was a key part of the studies discussed in the literature review. To reinforce growth mindset thinking, I used a list of statements that encourage growth mindset thinking from the *Mindset Works* website. I reviewed the list and implemented

phrases from it each class period. For example, before students wrote lab procedures, I said, “This is challenging. The more we work on it and learn from our mistakes, the better we will get at writing procedures.” These weekly lessons followed by ongoing re-enforcement helped some students become more growth minded and focused on learning resulting in improved motivation, confidence, and engagement. Table two outlines my treatment. A detailed version with materials used is in Appendix A.

Table 2
Treatment Overview

Timeframe	Topic	Learning Target	Ongoing Treatment
Week 1: Friday, 11/11	The Brain & Neuroplasticity	I will learn what a healthy brain needs and that the brain is malleable and can change with effort and experience.	Use of growth mindset oral and written communication by teacher. Encourage students to use growth mindset language. Growth mindset posters were hung around classroom to reinforce concepts. Students have challenging content assignments followed by process praise.
Week 2: Tuesday, 11/8	Introduction to Mindsets	I will measure my mindset and interpret what this means for me as a student.	
Week 3: Monday, 11/15	How to Develop A Growth Mindset	I will learn the difference between a fixed and growth mindset and some things I can do to become more growth minded.	
Week 4: Tuesday, 11/21	Mindsets & Study Skills	I will learn some time management and study skill strategies I can use to learn and grow my brain.	
Week 5: Monday, 12/5	Failure & Challenge at School	I will learn that taking risks and making mistakes are opportunities to learn and should be valued.	
Week 6: Tuesday, 12/13	Review of Mindsets, Academic Supports, and One Story.	I will review key information from the last mindset lessons and I will learn about how one lady used a growth mindset to change her brain.	

Data Collection Methods

The data collection instruments used were selected to establish credibility, validity, and reliability. These instruments are similar to what was used in several studies (Blackwell, Trzesniewski, and Dweeck (2007), Donohoe, Topping, and Hannah (2012),

Grant & Dweck (2003), Paunesku et al. (2015), Yeager and Dweck (2012), and Yeager et al. (2014). In addition, the instruments provide a variety of data from a mix of perspectives across three points in time. These instruments are outlined in table three.

Table 3
Research Questions and Data Sources

Research Question	Data Sources		
	1	2	3
In what ways do mindsets change after being taught growth mindset curriculum and is it retained?	Measure Your Mindset Survey	Individual student interviews	Student responses and observations from growth mindset lesson questions
How do growth mindset lessons impact student learning in science?	Student scores for tests and test retakes	Classroom assignment completion records	6, 12, 18 week grading period grades
How do students apply their learning about growth mindset to other high school courses and life experiences?	Individual student interviews	Mindset Unit Evaluation completed by students	Teacher surveys from other content areas
How does learning about and teaching about growth mindset research impact me, as a teacher?	Teaching journal	Mindset Unit Evaluation completed by students	Individual student interviews

The research questions were addressed using data from surveys, interviews, my teacher journal, grade book entries, and student responses and observations as outlined in table 3. The Measure Your Mindset Survey (Appendix B) is a Likert Scale survey consisting of 24 statements that was administered and scored before and then four weeks after the treatment lessons. Originally I had planned to administer the survey immediately after the intervention and then after winter break six weeks later to measure for retention.

However, a week of snow days prior to winter break delayed the treatment unit test and post-treatment survey by four weeks. This made the post-treatment survey, more of a survey that measured retention. The individual student interviews (Appendix C) were conducted and recorded with a stratified random sample of 10 students using a set of pre-determined questions. The same 10 students were used for pre-treatment and post-treatment interviews. Teacher Surveys (Appendix D) were completed for each of these 10 students by their English, math, and social studies teachers before and after the treatment as well. Using writing prompts, I wrote in my teaching journal after lessons throughout the semester (Appendix E). Relevant student verbal responses were logged in the teacher's journal. Written student responses were also collected on handouts (Appendix A). Missing assignments, test scores, retake test data, and overall grades were logged and compared for the six, twelve, and eighteen week grading periods. Finally, a Mindset Unit Evaluation (Appendix F) was administered at the conclusion of the treatment period to gather data about the effectiveness of the instructional strategies used.

Pre-treatment data collected during the first six weeks of first semester included the Measure Your Mindset Survey, Teacher Survey, individual student interviews, and teacher journal entries. After the mindset treatment lessons, pre-treatment data collection methods were repeated for post-treatment data during the last six weeks of the semester. Data collected during the treatment and post-treatment time periods were compared to the pre-treatment data to determine the impacts of mindset instruction on both the students and teacher. These methods were chosen because they provided enough data to effectively address the questions. The research methodology for this project received an

exemption by Montana State University's Institutional Review Board and compliance for working with human subjects was maintained (Appendix G). Table four is a timeline for the data collection methods used.

Table 4
Data Collection Timeline for Fall 2016 – Winter 2017

Timeline	What Will Be Done
Pre-Treatment	
9/13 - 9/24	Pre-treatment teacher reflective journal written after each class.
10/13	Administer Measure Your Mindset survey to all IS2 students
10/13	Administer carbon unit test.
10/19	6 Week Grading Period Ends
10/19	Record 6 week assignment completion records.
10/17-10/21	Other Content Area Teacher Surveys
10-17-10/21	Individual Student Interviews
Treatment	
10/25-12/5	Teacher reflective journal written after each class continues.
11/4	Mindset Lesson 1: Brain & Neuroplasticity
11/8	Mindset Lesson 2: Measure Your Mindset
11/15	Mindset Lesson 3: How to Develop a Growth Mindset
11/21	Mindset Lesson 4: Time Management Strategies & Study Skills
11/29	Mindset Lesson 5: Failure & Challenge at School
12/5	Mindset Lesson 6: Review & One Specific Story
12/5	12 Week Grading Period Ends
12/5	Record 6-12 week assignment completion records.
12/5	Record test retake data from the carbon unit test
12/7	Mindset Unit Evaluation
~~12/13~~	~~Evolution Unit Test~~ Postponed due to snow week.
~~12/13~~	~~Measure Your Mindset Survey~~ Postponed due to snow week
12/17-1/2	Winter Break
1/5	Evolution Unit Test
1/5	Measure Your Mindset Survey Postponed due to snow week
1/9-1/27	Individual Student Interviews
Post-Treatment (Postponed from 12/7)	
1/9-1/27	Teacher reflective journal written after each class continues.
~~1/13~~	~~Measure Your Mindset Survey~~ Cancelled
~~1/13-1/20~~	~~Individual Student Interviews.~~ Cancelled
1/17-1/27	Other Content Area Teacher Surveys
1/27	Record 12-18 week assignment completion records.
1/27	Record test retake data from the evolution unit test.
2/1	Final Day of Semester

The data collection methods outlined above, provided a variety of quantitative and qualitative data across three different points in time. This wealth of data allowed me to effectively address each research question in order to find out how mindset instruction impacted both my students and myself.

DATA AND ANALYSIS

How Did Mindsets Change?

Ninety percent of the students interviewed as part of this study had never heard about Carol Dweck's research on fixed and growth mindsets and said they knew nothing about it (*N=10*). Only one student said she "may have heard about it last year from one of her teachers." The pre-treatment Measure Your Mindset Survey data showed that all students could become more growth minded (*N=29)* as no students were in the highest growth category (G5). Mindset profile numbers were used to determine which mindset group a student was in. Table five below from appendix B describes the mindset groups.

Table 5
Definitions of Mindset Profile Numbers and Mindset Groups

Mindset Profile Number	Mindset Group	People in your mindset group usually believe the following things:
24-35	F5	You strongly believe that your intelligence is fixed or that it doesn't change much. If you can't perform perfectly you would rather not do something. You think smart people don't have to work hard.
36-47	F4	
48-59	F3	You lean toward thinking that your intelligence doesn't change much. You prefer not to make mistakes if you can help it and you also don't like to put in a lot of work. You may think that learning should be easy.
60-71	F2	
72-83	F1	You are unsure about whether you can change your intelligence. You care about your performance and you also want to learn, but you don't really want to have to work too hard.
84-95	G1	
96-107	G2	You believe that intelligence is something you can increase. You care about learning and you're willing to work hard. You want to do well, but you think it's more important to learn than to always perform well.
108-119	G3	
120-131	G4	You really feel sure that you can increase your intelligence by learning and you like a challenge. You believe that the best way to learn is to work hard, and you don't mind making mistakes while you do it.
132-144	G5	

Student mindset scores were graphed (figure one) to show the distribution of students in the mindset groups before and after the treatment period to address the question of how mindsets changed after being taught growth mindset lessons.

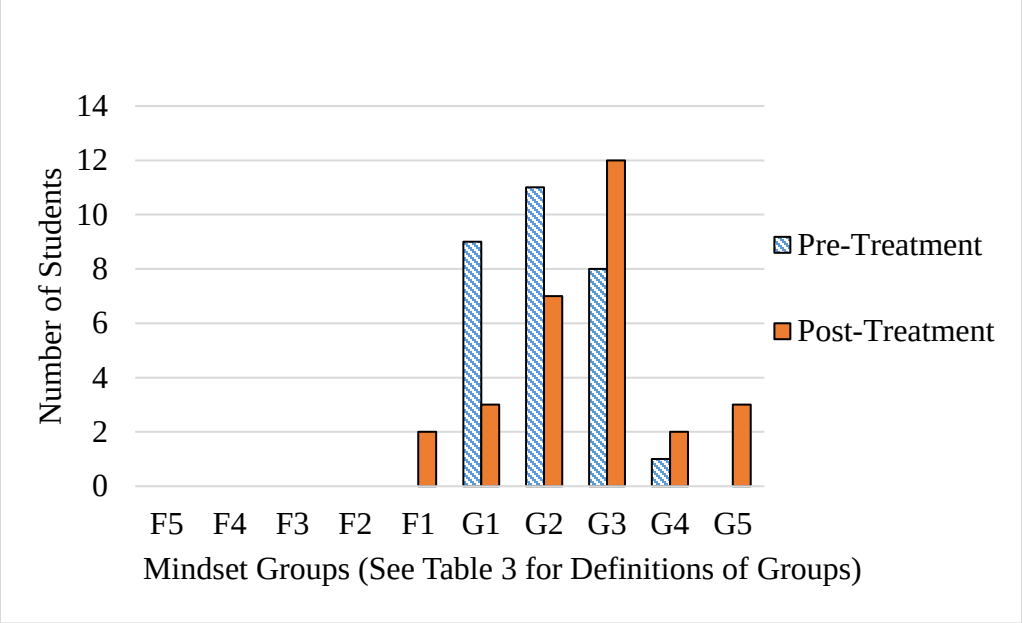


Figure 1. Overall distribution of students in mindset groups, (*N*=29).

Figure one shows that the distribution of students was skewed to the right for the pre-treatment data, indicating that the majority of students had a growth mindset with some fixed mindset tendencies. This suggests that these students all had the capability of becoming more growth minded learners. This is consistent with this population of learners in the general science courses that unintentionally get the message that they are not as smart or capable as other students. They want to do well, but they do not want to put forth much effort if they feel it may not pay off. After scoring the pre-treatment mindset survey, one student in the G1 category wrote, “I am very unsure about whether I can change my intelligence. I care about my performance and I also want to learn, but I

don't really want to have to work too hard." Another student in the G2 category wrote, "I agree with the description of my mindset. I don't like to work too hard, but I care about my performance." A student in the G3 category wrote, "I strongly believe we can increase our intelligence. While I do work hard, I'm not completely willing to put in an incredible amount of work." These statements indicate some fixed tendencies that students needed to let go of.

Many of these students lacked the skills used by students that are in honors tracked courses. On the Developing a Growth Mindset Survey, 16% of students said they never study, 60% of students said they rarely study, 8% said they study weekly, and 16% said they study daily (*N=25*). On this same survey, 64% of students requested more resources on time management, 8% of students requested resources on classroom behavior, 28% of students requested more information on studying at home, and 36% of students requested resources on organization. In response, I showed students a presentation about time management by the College Board and several students took resources I made available to start recording their assignments. Other students shared how they used their phones to keep track of assignments. I also showed students how they could use the website *Quizlet* as a study tool. Again, some students shared how they used the *Quizlet* on their phone to study. Table six below shows the amount of students that agreed they knew time management and study skill strategies on the Mindset Unit Evaluation.

Table 6
Amount of Agreement to Statements about Time Management and Study Skills (N=27)

Question		Strongly Agree	Agree	Agree A Little	Disagree A Little	Disagree	Strongly Disagree
I know time management strategies that promote success.	N	3	8	14	0	2	0
		25			2		
	%	11	30	52	0	7	0
		96			7		
I know study skill strategies that promote success.	N	3	11	9	1	3	0
		23			4		
	%	11	41	33	4	11	0
		85			15		

Ninety six percent of students agreed to some extent that they knew time management strategies on the post-treatment Mindset Unit Evaluation (*N=27).* One student wrote that they "set an amount of time to study" and another student said, "I am working on a plan." Students appreciated learning about these tools and hearing how some of their peers were using them. Eighty five percent of students agreed to some extent that they knew study strategies (*N=27).* Strategies students listed in their explanations included reviewing old assignments and notes, studying review packets, using flashcards, using *Quizlet*, having a quiet place to study, and devoting an amount of time for each class.

Prior to the treatment, the Measure Your Mindset Survey had the most students in the G2 category and the G5 category had no students in it (*N=29*). The post-treatment survey showed that the G3 category had the most students in it and the G5 category had three students in it indicating that some students did become more growth minded (figure one). The effect is that the post-treatment bars on figure one are skewed more to the right or more growth minded as compared to the pre-treatment bars on the graph. Fifty two percent of students increased their mindset with eight students moving up one mindset level and seven students moving up two mindset levels. However, 38% of students did

not move up or down and 10% of students actually went down one mindset level. Due to the week of snow days prior to winter break, I had to administer my post-treatment survey four weeks after the treatment period making these retention scores. It is possible that these students would have scored more growth minded right after the treatment period. Other factors that may have determined how much a mindset changes include attendance, attitude, and engagement in the mindset lessons. One student that went down a mindset level, missed two of the mindset lessons and another student missed one lesson. Despite these challenges, the students that went down one mindset level, agreed that they learned something new from the mindset lessons on the Mindset Unit Evaluation (*N=27*). In a post-treatment individual interview, one of these students said, "I didn't know what happens in your brain when you learn. Some of the videos were confusing, but the one about the lady that changed her brain was interesting." During another post-treatment interview, a student whose mindset stayed at the same level said, "I am more positive now. I know I can figure it out and improve." Another student that went up a mindset level said, "It was good to learn about it because some people just think they can't, but they can." These statements indicate a general positive response to the mindset lessons and that they had value to students.

During the treatment unit the focus shifted from being purely science content driven to learning about the mindsets and how students could apply it as they learned science. The more deeply students reflected on their approach to learning and life, the more likely it was that they would become more growth minded. During the first lesson, students were asked to describe a time when they missed out on a chance to grow a

stronger brain and to describe a time when they worked extremely hard on something that was difficult at first, but after practice were able to succeed (*N=29*). Of the 10% of students that went down a mindset, only one student was present and engaged. She wrote about how she missed out during her freshmen year because she did not do her work or try her best. This student also discussed how her first job "was very hard at first, but after [she] got used to going to work [she] started to get the hang of it." Of the 38% of students that did not change their mindset category, 64% of these students did not complete the reflection questions due to absences or lack of engagement in the lesson. In response to the first question, one of these eleven students wrote, "I missed out by eat[ing] Mcdonalds instead of a salad." For the second question about working hard the student wrote about having to "memorize football plays." These responses showed that the student was not connecting deeply with the lesson. This student and several of the students above, had a bad attitude about the mindset lessons stemming from the requirement for consent forms to participate in the project and the disclaimer on all paperwork that said, "Participation in this research is voluntary. Participation or non-participation will not affect your grades or eligibility to participate in any other class activities." For these students that generally want to get good grades, but do not want to work hard or face challenges, reading this statement was like giving them permission to check out. I had to work really hard to try to change the class culture and explain the benefits of the lessons. In addition, I had to explain that the disclaimer statement really meant that I would not use their data in my study unless I had their permission, but that they were still required to participate in all activities for the class. Other students did

make good connections including three students that changed their mindset level. In response to the first question, one of these students said, “I could have started reading earlier.” For the second question, this student wrote about how he was able to “learn to sing and play the guitar at the same time.” It is possible, that there would have been more of a positive change in these student’s mindsets with more buy in and depth of reflection. The 28% of students that went up two mindset levels and the 24% of students that went up one mindset level, all wrote more in depth responses about specific opportunities they missed to grow and specific times when they did overcome obstacles. One student that moved up a mindset wrote about how she “stopped doing Math Olympiad” because she “thought it got too hard, so [she] gave up and quit without progressing.” This same student went on to discuss in the second question how “volleyball was super hard at first, but now it is easy and fun.” Another student that moved up two mindsets said, “I missed out in middle school because I had a fixed mindset. I always told myself I couldn’t do something and missed out on learning.” She went on to discuss how this year in math she was working harder and doing a lot better. Making these personal connections at the beginning, may have helped students see the value of learning about mindsets, which would have increased their engagement in the lessons leading them to more of a change in thinking.

In addition to looking at whole group data, I also wanted to know how the mindset lessons would impact certain subset populations such as different genders.

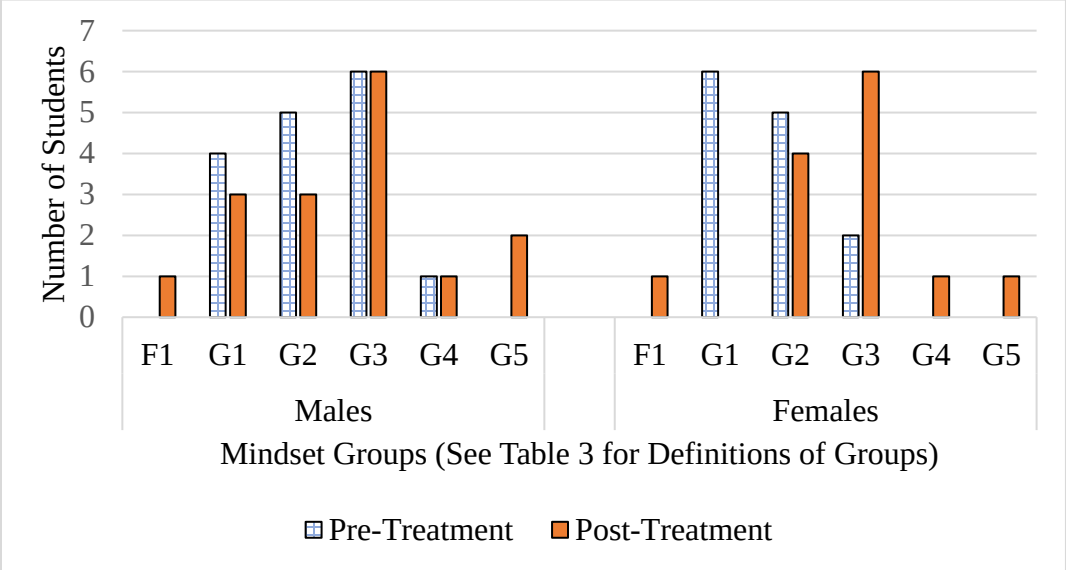


Figure 2. Distribution of males and females in mindset groups, (*N*=29).

There has been some research done indicating that mindsets may differ between males and females in the science classroom. Figure two shows the distribution of males and females in the mindset groups. Post-treatment mindset groups became more skewed to the right for both males and females indicating that both males and females increased their mindset. However, prior to the treatment, males had a more symmetrical distribution. Females, on the other hand, were skewed more to the left showing more fixed mindset tendencies going into the treatment period. This could be the result of traditional cultural stereotypes that females are not as good at science as their male counterparts. For males, 31% increased their mindset while 62.5% of females increased their mindset. For the males, 12.5% went down one mindset level along with 8% of the females. Fifty six percent of males stayed in the same growth category along with 15% of females. For the males, 12.5% went up one level along with 46% of females. Nineteen percent of males and 31% of females moved up two levels (*N=29)*. Females went from

being skewed to the left to having a more symmetrical distribution similar to the males indicating that the mindset lessons may have helped level the playing field and lower the achievement gap between males and females.

Two other groups of interest are the eight ELL students and three special education students in my sample.

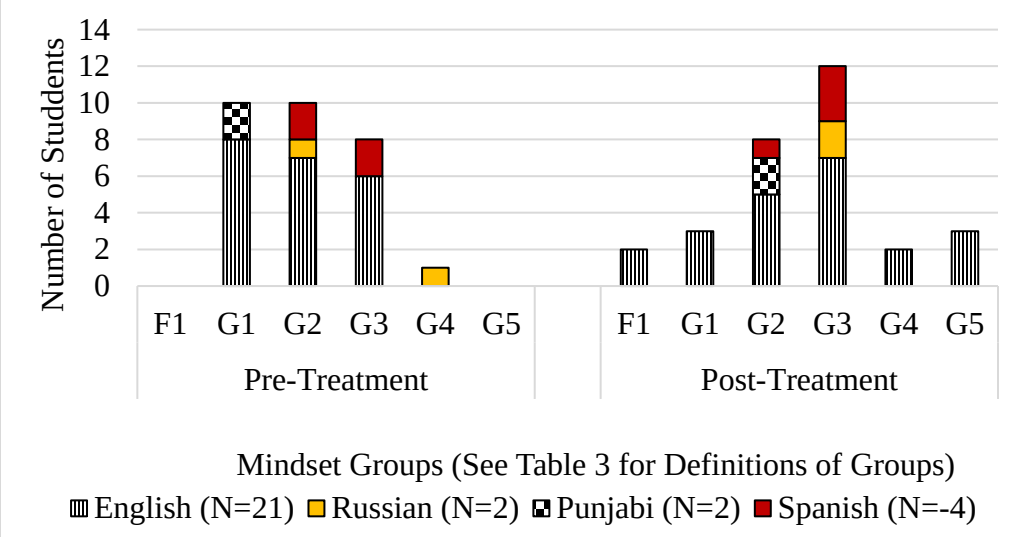


Figure 3. Distribution of ELL in mindset groups, (*N*=29).

Figure three above shows that ELL students are generally growth minded and 67% of ELL students became more growth minded. For example, both Punjabi speaking students moved from G1 to G2. One Spanish speaking student moved from G2 to G3, while the others stayed the same. One Russian speaking students started off at G2 and moved up to G3 while the other moved from G4 to G3. The four students that became more growth minded all had excellent attendance and were engaged in the mindset lessons. One ELL student that showed no change in mindset missed three of the mindset lessons and the other student showing no change missed one lesson and parts of others. The Russian speaking ELL student that went down a mindset missed the end of lesson

one where students reflected on when they missed opportunities to grow and when they worked hard at something and improved. In addition, this student also missed the lesson where students scored their own mindset and learned what the mindsets were. Missing such important introductory lessons and opportunities to reflect and make connections may have confused the student and prevented him from increasing his mindset.

Figure four below shows that the special education students were also generally growth minded at the start and were able to benefit from the mindset lessons.

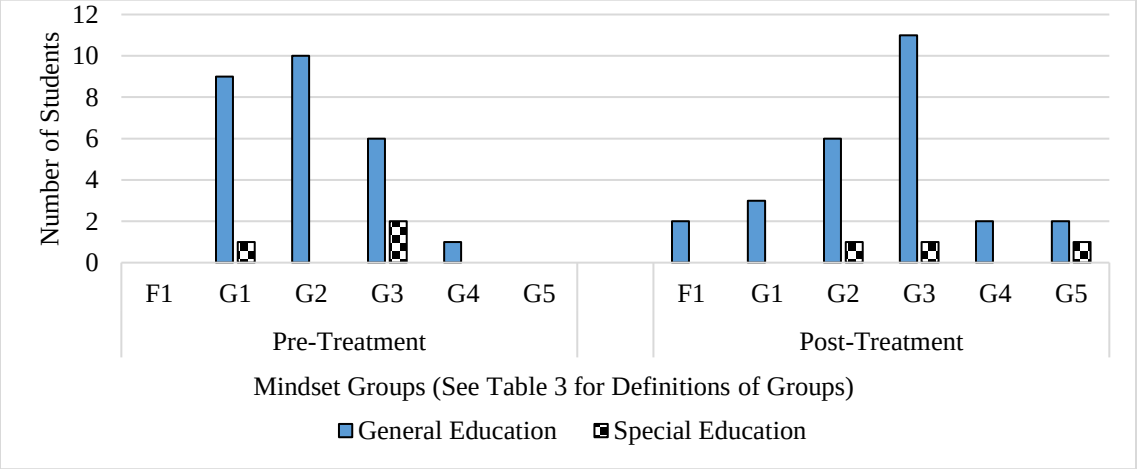


Figure 4. Distribution of special education students in mindset groups, (*N*=29).

One special education student moved from G1 to G2 and another student moved from G3 to G5. Both of these students had excellent attendance and were fully engaged in the mindset lessons. The student that did not change his mindset score and stayed at G3, missed two of the mindset lessons and parts of others.

Students that fully participated in the mindset lessons demonstrated more positive change in their mindset. On the Mindset Unit Evaluation, 81.5% students agreed to some extent that they were able to learn from the growth mindset lesson (Table 7, *N=27*). Of the 18.5% of students that disagreed to some extent that they learned something, one of

these students missed two of the lessons and three of the students were not engaged in the lessons. Some students had probably heard similar messages before, but just needed to be aware of fixed mindset thinking and needed reminders of how to be growth minded. Constant reinforcement is needed to change mindsets, so students do not slip back into old fixed mindset ways of thinking. On the Mindset Unit Evaluation, 81.5% of students said the growth mindset lessons were helpful. Other students said the mindset lessons were encouraging, informing, interesting, cool, fun, good, challenging, and great a reminder.

Table 7
Amount of Agreement to the Statement of Whether Students Learned Something New from the Mindset Lessons (N=27)

Question		Strongly Agree	Agree	Agree A Little	Disagree A Little	Disagree	Strongly Disagree
I was able to learn something new from the growth mindset lessons.	N	6	10	6	3	2	0
		22			5		
	%	22	37	22	11	7	0
		81.5			18.5		

The Impact on Student Learning in Science

The results of the Measure Your Mindset Survey, individual student interviews, and student observations and responses to mindset lesson assignments did show a positive impact on student mindsets. However, the results for my second research question of how the mindset lessons would impact student learning in science did not show as many gains as anticipated. The data demonstrates that the mindset lessons did not work to increase student on time assignment completion rates. Figure five shows on

time assignment completion went down 14% from the pre-treatment chapter 11 to the treatment chapter 6 (*N=29*). However, students did turn in eight percent more late assignments during the treatment chapter as compared to the pre-treatment chapter indicating an increased understanding of the importance of doing assignments. Homework was a variable that may have influenced on time completion. Students were asked to finish up class work at home during the treatment period to offset time spent on the mindset lessons. While this was only about twenty minutes of homework, these students were not used to having homework and it was difficult getting them to complete it even with the extra encouragement and resources provided during the mindset lessons.

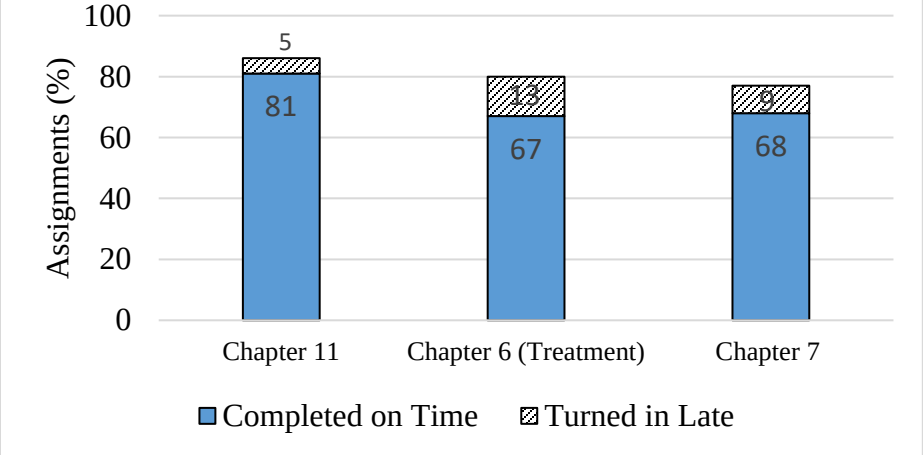


Figure 5. Assignments completed on time versus late, (*N*=29).

Figure six and table eight show that while on time assignment completion did not improve during the treatment period, overall test grades did improve.

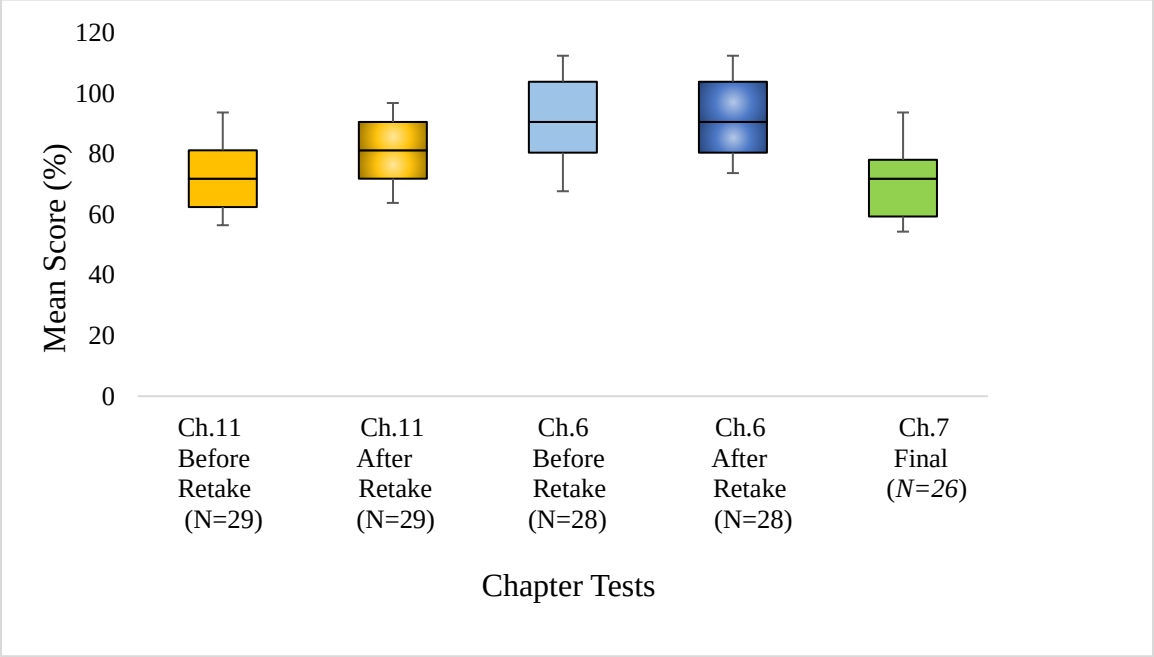


Figure 6. Mean chapter test scores, (*N*=26-29).

Table 8
Mean and Medians for Chapter Test Scores (N=27)

	Pre-Treatment		Treatment		Post-Treatment
Chapter Test	Ch.11 Before Retake (*N=29*)	Ch.11 After Retake (*N=29*)	Ch.6 Before Retake (*N=28*)	Ch.6 After Retake (*N=28*)	Ch.7 Final (*N=26*)
Mean (%)	75	79	89	91	69
Median (%)	75	81	91	91	72

At the conclusion of the treatment period, mean and median test grades (including retake scores) were the highest at 91% (*N=29*). This was 12% higher than the pre-treatment test mean average. This could be indicative of students putting forth more effort and paying attention as a result of the mindset lessons. Despite these gains in testing, the treatment did not positively impact mean overall grades. Overall grades went down one percent from 83% to 82% between the six and twelve week grading period and there was no

change between the twelve week and final grade. These units were relatively equal in difficulty. However, students had four weeks off of school before they were tested for the second unit due to snow days before winter break. With this long gap in time, it was tough to come back to a review and test that should have happened a month earlier. In addition, this left less time for students to work through the third unit, so they did not get as much practice demonstrating their learning as some activities were skipped due to the time constraints. These difficulties may have contributed to the lack of gains observed in grades.

One important aspect of having a growth mindset is learning from your mistakes. One major way that is encouraged is by having students come in after school to look over what they missed on their test, make a plan to study, and then schedule a retake test. Students can only earn back points lost on these tests. Because it takes an out of class time commitment on the part of students, it has been historically very difficult to get this population of learners to take advantage of this learning opportunity. During the individual student interviews, I learned that many students will only retake a test if they earn a certain grade. Two students said they would retake a test if they scored less than a B and another student said if they scored less than C. To encourage more students to take advantage of test retakes, I hung up a huge poster with the word “Dedication” and I discussed with students different ways we could show our dedication including retaking tests. Over the course of the next few weeks, 31% of students came in to retake their chapter 11 test. To honor those students, I hung their names on the poster. Two of those students commented when they came that they wanted to get their name on the dedication

poster. The chapter 11 retake brought the test average from 75% to 79% and the chapter six retake brought the test average from 90.5% to 92%. While 31% of students did a test retake during the mindset lesson intervention period, only 3% of students did a test retake during the post-treatment period. Seven percent of the students failed the chapter six test and should have retaken it, but did not. This indicates the need for constant continued reinforcement of growth mindset thinking to get more students in to retake their tests in the future. An increase in test retakes would further increase mean test averages and might even have an impact on overall grades.

Applications to Other Courses and Life Experiences

For my third research question, I wanted to know how students might apply their learnings about the mindsets to other high school courses and life experiences. In the Mindset Unit Evaluation, 92% of students agreed to some extent that they could apply growth mindset thinking to other classes such as math, English, or social studies (*N=27*, Table 9*)*. One student said, "You can always grow in your learning in every subject." Another student said, "I can never give up on my schoolwork when it gets tough." One student wrote specifically about math and said, "I'm really bad at math, but if I work on it, I could get better." Only two students disagreed to some extent that they could apply growth mindset thinking to other classes and only one of these students backed up their answer selection with an explanation that stated, "I don't enjoy those classes." These students have low cumulative grade point averages of 2.2 and 2.7 and in the past have earned C or D grades in science. I have struggled with getting these students to engage in learning throughout the year and they did not respond positively to the mindset lessons

and their lack of participation prevented them from benefiting. However, it is encouraging that the majority of the students could transfer learning from the mindset lessons beyond the science classroom.

Table 9
Amount of Agreement to the Statement of Whether Students Could Apply the Mindset Thinking to Other Classes (N=27)

Question		Strongly Agree	Agree	Agree A Little	Disagree A Little	Disagree	Strongly Disagree
I can apply growth mindset thinking to other classes such as math, English, or social studies.	N	6	13	6	1	1	0
		25			2		
	%	22	48	22	4	4	0
		92			8		

For each of the ten students I interviewed, I had their math, English, and social studies teachers fill out a Teacher Survey (Appendix D) to see if these core teachers noticed any areas of growth. For 90% of these students, their teachers noted improvements throughout the semester in one or more areas of assignment completion, motivation, confidence, engagement, and mindset. Teachers' comments showed that 20% of students made gains in math, 60% of students improved in English, and 30% of students improved in social studies. Fifty percent of these improvements also correlated with what the students said when I individually interviewed them. One student's math teacher noted on the survey that the student had "started coming in once a week to ask clarifying questions and get extra help." During the interview when I asked the student if she had made changes in her way of thinking or approach to learning as a result of the mindset lessons, she said, "Yes, in Geometry and my grade went up a fair amount. It was

really helpful. Geometry is so hard for me, so I would just not turn in assignments, but now I have a tutor that helps me work through assignments and I'm trying to get help instead of giving up." On the Mindset Evaluation this student also wrote, "While I'm not that good at math, I can work on it and train my brain to become better." Another student in the interview discussed how the mindset lessons helped him in English saying, "With the really hard essay I had to write. I didn't want to do it, but I did it because I knew it would be good for me." This student's English teacher noted on the survey that he had increased his confidence and mindset.

In addition to these core academic classes, students also discussed how the mindset lessons helped them in other subjects and aspects of life. One Student said, "With guitar it was hard at first, but I kept trying and it got easier to play things and understand notes." Another student said,

> Usually I will try something and if it's not working I will want to quit. Now I want to keep trying. Even if I fail, it is worth trying and maybe it will work. I have a hard time in P.E. I tell myself I can do it and push myself. Last year I could not do the 20 minute run and this has really motivated me to keep trying.

All students interviewed felt they could apply the mindset lessons to their relationships and in social settings. One student that was really resistant to the mindset lessons, said that he could apply what he learned to "working stuff out with people because [he has] had trouble with that in the past." When asked this same question, another student immediately thought of a young man in the class that is really rough to be around and has a history of bullying. She said, "If you have more patience with students like [Billy], and help him, and dedicate time to him, then he will get better." Another student in the same

class said, “I try to talk to difficult people and get to know them better, then maybe I will get along with them better.” An additional student said, “If you get into an argument, instead of having a fixed mindset like I’m right, you can use a growth mindset and…try to fix things and make compromises instead of being angry.” These examples demonstrate how students could transfer learning about mindsets to other courses and life experiences.

Impacts on Teacher

The primary reason I chose this classroom research project was to decrease classroom management issues and help this population of students become more motivated and engaged in learning. I was first introduced to the mindsets two years ago and last year I experimented with it and thought it had made a difference, so I wanted to learn more. I hoped that by learning more about mindsets and increasing my efforts of maintaining a more growth minded culture, I would help students become more engaged learners. With an increase in student engagement, I thought I would see a decrease in behavior problems. This was the driving factor behind my fourth research question of how learning about and teaching about mindsets would impact me as a teacher.

An analysis of my journal entries shows that student behavior problems declined and overall student engagement increased during the treatment period. For six of the eight pre-treatment class periods, I wrote about major struggles with classroom behaviors with several students. Common problems I faced were lack of student focus, students not staying in their assigned groups, students leaving the classroom without permission, inappropriate use of technology, students not listening, talking during instruction, poor

partner talk, and a general lack of effort. I noticed that several of these behaviors seemed to come out during challenging lab activities and I wondered if students were just trying to avoid challenge and risk taking. Once the mindset lessons started, classroom behavior improved. I only wrote about struggles with classroom behaviors on two of the nine treatment class period. One of these days was the day of the first mindset lesson. On that day, I really struggled because several students refused to do the Measure Your Mindset Survey because of the disclaimer saying participation was voluntary. Some students just seemed to be filling it out without reading it and one student even appeared to copy another students answers. I pulled the students aside, talked to them, and had them restart. The rest of the period, I struggled with keeping students on task and effectively using their work time. Several class periods later during another challenging lab, I had trouble with students wandering off, using technology inappropriately, and the group that finished their work first refused to move on to the next assignment. I had a long talk with that group about how they were capable of challenging themselves further and how they would benefit from the learning. I explained that if they pushed themselves, then others would notice and follow their lead. During the next lab, these students continued to work the whole class period and did push themselves beyond what other groups were doing. During the post-treatment period, behavior in general continued to be good. Every now and again a student or two would show low effort or inappropriately use their phone, but for the most part the classes could stay on task and engage in the lessons throughout the period. Teaching became much more enjoyable without having to constantly deal with behavior management.

Another area I really wanted to learn more about with this project was what language I should use with students to facilitate a growth mindset. During the pre-treatment, there were three different days when a student said something and I was not sure how to respond. During a lab a girl who felt unsure of herself said, “I’m stupid.” This was followed by her lab partner saying, “She’s dumb, her words not mine.” At the time I responded with, “Let’s be encouraging toward one another.” Later in my journal I wrote about how I could have discussed how she was not feeling confident because we were using new lab techniques and that with practice, she would be able to successfully complete the lab. I could have encouraged her by saying that she was not there yet, but she would be and that we are all learning and making mistakes is how we learn. On another day a different student said, “Except this assignment, I have all A’s.” I said, “I would not expect less.” In my journal I wrote about how I could have said it was because he worked hard and learned from mistakes along the way. Another time a student said, “We’re geniuses!” I did not know exactly how to respond in the moment. However, later in my journal I wrote that “I could have said you know that because last year you paid attention and worked hard.” Another thing I could have said was, “This is too easy for you. You need something more challenging. I’m sorry I wasted your time.” As I reflected during this pre-treatment period, I realized that I needed to emphasize the importance of challenges and making mistakes in learning. While I helped a student one day, I tried to minimalize a mistake that he made and provide comfort by saying, “that part is confusing.” I journaled about how I should have emphasized how challenging problems that make us really think are important for learning. During the treatment period, when I

introduced radioactive dating which is typically a topic students struggle with, I said, "This is a challenging topic to learn, but with hard work and practice, you will get it." In the past I would have apologetically introduced the activity as something we needed to do to cover the standards instead of an opportunity to challenge ourselves and learn. By introducing the lesson using a growth mindset, I was able to increase student engagement in the lab activity. After passing back the pre-treatment unit test, I wrote about how I was so focused on having students retake their tests in order to bring up their grades instead of emphasizing the importance of learning from mistakes. By journaling about these incidences and looking up what I could say in the future, I was preparing myself for the treatment period and doing a better job facilitating a growth mindset. This helped me realize how much I needed to review what growth minded language I should use for introducing lessons and providing feedback. As a result, I printed out the Growth Mindset Feedback Tool and Growth Mindset Framing Tool from the *Mindset Works* website. I tried to review these tools prior to every lesson during the treatment period, so I would promote a learning environment where challenges and mistakes were opportunities for learning and so I would know how to provide feedback that would enforce the idea that students would increase their abilities with effort.

Another area I wanted to gather more information on during this project was the effectiveness of my feedback. During the individual student interviews, 70% of students said that more written feedback in their notebooks would be helpful (*N=10*). During the pre-treatment period, I checked off if assignments were completed, but I was wondering if students needed more. As a result of the student responses from the interviews during

the treatment period, I purposefully chose a few key things to write specific feedback on whenever I graded notebooks. During the post-treatment interviews, 50% of students said my feedback had improved, 10% of students said they still needed more feedback, and 40% of students thought my feedback was the same. I also learned how much students valued the time I spend going over the warm-ups and when I circulate around from group to group and answer questions during class. Table ten below shows the extent to which students agreed to whether I promoted a growth mindset in my written and verbal feedback on the Mindset Unit Evaluation (*N=27).*

Table 10
Amount of Agreement to Statements of Whether Mrs. Schuman Promotes a Growth Mindset in Feedback (N=27)

Question		Strongly Agree	Agree	Agree A Little	Disagree A Little	Disagree	Strongly Disagree
Mrs. Schuman promotes a growth mindset with written feedback.	N	3	17	6	0	1	0
		26			1		
	%	11	63	22	0	4	0
		96			4		
Mrs. Schuman promotes a growth mindset in her verbal feedback.	N	7	14	4	0	1	1
		25			2		
	%	26	52	15	0	4	4
		93			7		

Ninety six percent of students agreed to some extent that I promoted a growth mindset with written feedback. In their explanation one student wrote, “She tells us what we need to improve on.” Another student wrote, “You encourage us to redo and learn material that we didn’t understand the first time.” Ninety three percent of students agreed to some extent that I promoted a growth mindset with my verbal feedback. One student explained how I said, “Your brain can change and be flexible, it just requires exercise.” Another

student wrote, “You always encourage us to work hard to understand if we don’t get something.” The two students that disagreed to some extent that my feedback promoted a growth mindset had negative attitudes about learning about the mindsets. This data helped me see that my efforts to speak and write feedback in a growth minded manner made a positive difference to most students. I will continue to develop these skills.

INTERPRETATION AND CONCLUSION

The pre-treatment Measure Your Mindset Survey indicated that all students had the capability of becoming more growth minded. In response to my question on how mindsets would change after being taught mindset lessons, it was found that students that attended and fully engaged in the mindset lessons with a positive attitude had the most gains in mindset. Four weeks after the treatment, the post-treatment survey showed that 52% of students increased their mindset, 38% stayed the same, and 10% moved down a mindset level. Individual student interviews and the Mindset Unit Evaluation revealed that all students learned something new from the treatment lessons indicating that the lessons had value to students. Students that exhibited the most growth were more reflective and made personal connections as they worked through lessons. This is consistent with the reflective writing students did in the studies conducted by Paunesku et al. (2015), Yeager, Trzesniewski, and Dweck (2012), and Yeager et al. (2014).

An analysis of subset populations also showed that mindsets were able to increase regardless of gender or whether or not a student is ELL or special education. Both males and females increased their mindset with 31% of males increasing their mindset and 62.5% of females increasing their mindset. Sixty seven percent of ELL students and sixty

seven percent of special education students also became more growth minded after the treatment lessons. The gains experienced by these populations may help lower any achievement gaps that could exist. According to Dweck (2008), females and minorities with a growth mindset are more likely to stay in courses and "earn high grades" (p.5).

For my second research question I wanted to know how the mindset lessons would impact student learning in science. Even though student mindsets did change and students became more growth minded, I did not see a measureable difference in overall student achievement. On time assignment completion actually went down by 14% and overall grades went down 1%. On the other hand, 8% more late assignments were turned in during the treatment period and the biggest gains were seen in test grades. The mean treatment test scores were 12% higher than the mean pre-treatment test scores. During the treatment period, nine students came in to retake their test compared to four during the pre-treatment period. Test retakes brought the mean chapter eleven test grade up 4% and the mean chapter six test grade up 1.5%. While there was little measurable increase in student achievement, in the future this could be maximized by starting the mindset lessons at the start of the year followed by continuous reinforcement.

In response to my question about how students would apply their learnings to other high school courses and life experiences, it was found that students were able to transfer what they learned about having a growth mindset in science to other content areas and social interactions. Like Blackwell, Trzesniewski, and Dweck (2007), I saw student's other content area teachers report "[positive] change in motivation" despite the fact that I did not see the extent of academic gains realized by that study (p.256). Ninety

percent of student's English, math, or social studies teachers saw improvements made in one or more areas of assignment completion, motivation, confidence, engagement, and mindset. When interviewed, 50% of these students discussed the same gains noticed by their teachers. Other students talked about how they applied the lessons to elective courses such as music and P.E. In addition, all students said they could apply having a growth mindset to their relationships and social settings. My students expressed the need for compassion and patience toward aggressive peers similar to the students in the study conducted by Yeager, Trzesniewski, and Dweck (2012). The positive impact that these six short mindset lessons had across academic disciplines and varying social situations is amazing and suggests that the time investment is well worth it. These are powerful examples of how teaching growth mindset strategies can transcend to lifelong skills that are transferable to any situation.

For my final research question, I wanted to know how learning about and teaching about mindsets would impact me as a teacher. This was perhaps the most significant impact of this classroom research project. The primary reason I selected this project was to minimize behavior problems and increase student engagement. During the treatment period, student behavior and engagement greatly improved making teaching more enjoyable. I saw students shift from following fixed mindset rules to growth mindset rules as outlined by Dweck (2007, pp. 6-7). Instead of students avoiding hard work and risks, students began to work hard and take on challenges. This was driven by improving my ability to foster a learning environment where the importance of challenges and making mistakes were emphasized. Using resources from literature, I learned how to send

growth mindset messages when responding to challenging student comments, introducing lessons, and when giving verbal and written feedback. The more I studied and practiced using the growth mindset language, the easier it became over time. Most students saw a difference in my feedback and appreciated my efforts to improve the quality of my feedback.

Teaching students about the mindsets takes time away from science instruction. However it is worth the time and effort because once students know what it is and a growth minded culture is maintained, behavior problems diminish and student engagement increases. To have long lasting impacts, the growth mindset needs to be continually reinforced throughout the year. As a result of these efforts, I have learned how to teach students about the mindsets. I have also learned strategies that I can use to maintain a growth mindset classroom culture. These skills will be of benefit in the future regardless of the classes I teach as fixed mindset thinking can show up and hinder any group of learners at any time.

VALUE

As a result of this classroom research project, I now have a tool kit to use to teach students a growth mindset. The more I learned about the mindsets, the more I was able to identify evidences of fixed mindsets in my classes and come up with creative ways to foster a growth mindset. To get realistic baseline data, I delayed reviewing the mindset research at the beginning of the school year and began the year employing my traditional teaching style. However, I could not stop thinking about mindsets during this time and how I could help students become more growth minded. This drive encouraged me to

brainstorm strategies for what I could do differently once the treatment period began. Throughout the semester, I improved my ability to offer both written and verbal growth minded encouragement. I came up with creative ways to encourage students. I hung up inspirational growth mindset posters and strategies for students to use in helping each other during group work. I made a dedication wall to encourage test retakes and I made a growth mindset themed bulletin board to encourage growth mindset thinking. I provided free resources on the bulletin board, such as assignment sheets to help students with their organizational skills. I enjoyed developing these new strategies and now they are ready for me to use next year and beyond.

While not all students increased their mindset, all students felt they benefited in some way from the lessons. The most notable benefit was the positive increase in student behavior and engagement. I look forward to teaching these lessons without the battle of getting consent forms and the confusion over the disclaimer about voluntary participation. It will be wonderful to teach these lessons from the start of the year and continuously build a growth mindset culture in my classroom. In the future, I will begin the year by having students take a short online survey to measure their mindset. Students found the survey I used to be long and tedious to score. Using an online version that gives instantaneous feedback will accomplish the same thing, save time, and provide a powerful launch into the mindset lessons. I will use the same lessons sprinkled throughout the semester. I hope that starting the year off this way will help students quickly develop a growth mindset leading to more immediate student engagement and more gains in achievement. In *Mindset* (2006), Carol Dweck discusses the need for

continual reinforcement, because it is easy to slip back into old fixed mindset habits. Dweck says, “Keep a growth mindset in your thoughts. Then, when you bump up against obstacles, you can turn to it” (Mindset, p.246). It will be important for me to provide ongoing support for students to keep their fixed mindset in check.

What I have learned from this classroom research project is applicable to any teacher of any subject. In fact, I plan to teach about mindsets to my chemistry students as well next year. The more I delved into this project, the more I saw evidences of a fixed mindset amongst some of my chemistry students. There are always students that think they are just not good at a particular subject or they are good at some things only because they have certain gifts. According to the growth mindset, anyone can be good at anything with effort. I plan to share what I have learned with my colleagues and make resources available. The results of my work demonstrate the impact that a growth mindset had on the academic and social lives of my students. Imagine the power of a unified school-wide growth mindset culture.

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APPENDICES

APPENDIX A

TREATMENT TIMELINE, TOPICS, AND MATERIALS DESCRIPTION

Timeline	Topic and Learning Target	Description of Materials Used	Ongoing Treatment
Week 1: Friday, 11/11	Brain & Neuroplasticity I will learn that the brain is malleable and can change with effort and experience.	-PowerPoint with guided notes of brain structure, what you need for a healthy brain, and how your brain is like a muscle. -Reading: "You Can Grow Your Intelligence" by Brainology - Reflection Q's: Describe a time you missed out on a chance to grow a stronger brain. What was your reason? What is something you do well and how did you develop that?	Use of growth mindset oral and written communication by teacher. Encouraging students to use growth mindset language. Growth mindset posters will be hung around classroom to reinforce concepts. Students have challenging content assignments followed by process praise.
Week 2: Tuesday, 11/8	Introduction to Mindsets I will measure my mindset and interpret what this means for me as a student.	-Students score the Measure Your Mindset pre-treatment survey and determine their own mindset. -Students write a reflection about whether they think their score is accurate and how it applies to their thinking.	
Week 3: Monday, 11/15	How to Develop A Growth Mindset I will learn the difference between a fixed and growth mindset and some things I can do to become more growth minded.	-Students listen to PowerPoint about the mindsets and strategies that help develop a growth mindset. -Students fill out a survey about their study habits and what resources they need to become a better student.	
Week 4: Tuesday, 11/21	Mindsets & Study Skills I will learn some strategies I can use in school to learn (grow your brain).	-Students brainstorm and share strategies for success and study skills. -Students learn about time management skills from the College Board website and how to use the Quizlet website for studying.	
Week 5: Monday, 12/5	Failure & Challenge at School I will learn that taking risks and making mistakes are opportunities to learn and should be valued.	-Students solve metal brain teaser puzzles. -Derek Sivers "Why You Need to Fail" video (15 minutes) -Discuss academic support available at school.	
Week 6: Tuesday, 12/13	Review of the mindsets, academic supports, and one specific story. I will review key information from the last mindset lessons and I will learn about how one lady used a growth mindset to change her brain.	-Students watch "The Woman Who Changed Her Brain" video. (14 min) -Review of the mindsets, how it applies to the video, and academic supports.	

APPENDIX B

MEASURE YOUR MINDSET SURVEY

Directions: Place a check in the column that identifies the extent to which you agree with the statement.

How much do you agree or disagree?	Strongly Agree	Agree	Agree A Little	Disagree A Little	Disagree	Strongly Disagree
1. Your intelligence is something very basic about you that you can't change very much.						
2. No matter who you are, you can change your intelligence a lot.						
3. You are a certain kind of person, and there is not much that can be done to really change that.						
4. You can greatly change how intelligent you are.						
5. You can always change basic things about the kind of person you are.						
6. Music talent can be learned by anyone.						
7. Only a few people will be truly good at sports-you have to be "born with it."						
8. Science is much easier to learn if you are male or maybe come from a culture who values science.						
9. The harder you work at something, the better you will be at it.						
10. No matter what kind of person you are, you can always change substantially.						
11. Trying new things is stressful for me and I avoid it.						
12. Some people are good and kind, and some are not-it's not often that people change.						
13. I appreciate when parents, coaches, and teachers give me feedback about my performance.						
14. I often get angry when I get feedback I don't like about my performance.						
15. All human beings without brain injury or birth defect are capable of the same amount of learning.						
16. You can learn new things, but you can't really change how intelligent you are.						
17. You can do things differently, but the important parts of who you are can't really be changed.						
18. Human beings are basically good, but sometimes make terrible decisions.						
19. I like my work best when it makes me think hard.						
20. I like my work best when I can do it really well without too much trouble.						
21. I like work that I'll learn from even if I make a lot of mistakes.						
22. I like my work best when I can do it perfectly without any mistakes.						

23. When something is hard, it just makes me want to work on it more, not less.						
24. When I work hard, it makes me feel as though I'm not very smart.						

First, circle the number in the box that matches each answer.

Mindset Description of Each Statement	Strongly Agree	Agree	Agree A Little	Disagree A Little	Disagree	Strongly Disagree
1. ability mindset-fixed	1	2	*3*	4	5	6
2. ability mindset-growth	6	5	4	3	2	1
3. personality/character mindset-fixed	1	2	3	4	5	6
4. ability mindset-growth	6	5	4	3	2	1
5. personality/character mindset-growth	6	5	4	3	2	1
6. ability mindset-growth	6	5	4	3	2	1
7. ability mindset-fixed	1	2	3	4	5	6
8. ability mindset-fixed	1	2	3	4	5	6
9. ability mindset-growth	6	5	4	3	2	1
10. personality/character mindset-growth	6	5	4	3	2	1
11. ability mindset-fixed	1	2	3	4	5	6
12. personality/character mindset-fixed	1	2	3	4	5	6
13. ability mindset-growth	6	5	4	3	2	1
14. ability mindset-fixed	1	2	3	4	5	6
15. ability mindset-growth	6	5	4	3	2	1
16. ability mindset-fixed	1	2	3	4	5	6
17. personality/character mindset-fixed	1	2	3	4	5	6
18. personality/character mindset-growth	6	5	4	3	2	1
19. ability mindset-growth	6	5	4	3	2	1
20. ability mindset-fixed	1	2	3	4	5	6
21. ability mindset-growth	6	5	4	3	2	1

22. ability mindset-fixed	1	2	3	4	5	6
23. ability mindset-growth	6	5	4	3	2	1
24. ability mindset-fixed	1	2	3	4	5	6

Second, add up all the numbers you circled and write the total here: _____. This is your mindset profile number.

Third, use the table below and your profile number to determine your mindset.

Mindset Profile Number	Mindset Group	People in your mindset group usually believe the following things:
24-35	F5	You strongly believe that your intelligence is fixed or that it doesn't change much. If you can't perform perfectly you would rather not do something. You think smart people don't have to work hard.
36-47	F4	
48-59	F3	You lean toward thinking that your intelligence doesn't change much. You prefer not to make mistakes if you can help it and you also don't really like to put in a lot of work. You may think that learning should be easy.
60-71	F2	
72-83	F1	You are unsure about whether you can change your intelligence. You care about your performance and you also want to learn, but you don't really want to have to work too hard.
84-95	G1	
96-107	G2	You believe that your intelligence is something you can increase. You care about learning and you're willing to work hard. You do want to do well, but you think it's more important to learn than to always perform well.
108-119	G3	
120-131	G4	You really feel sure that you can increase your intelligence by learning and you like a challenge. You believe that the best way to learn is to work hard, and you don't mind making mistakes while you do it.
132-144	G5	

Do you think the description of your mindset matches the way you think and feel? Which parts are true for your and which are not? Explain your thinking.

Participation in this research is voluntary. Participation or non-participation will not affect your grades or eligibility to participate in any other class activities.

Modified based on the work of Carol S. Dweck and the following resources

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APPENDIX C

INDIVIDUAL STUDENT INTERVIEW QUESTIONS

Pre-treatment Questions

This statement will be read to students: **Participation in this research is voluntary. Participation or non-participation will not affect your grades or eligibility to participate in any other class activities.**

1. In general, do you enjoy school? Why?

2. What is your favorite subject in school? Explain.

3. What have you enjoyed about IS2? Why?

4. If you could change one thing about IS2, what would it be and why?

5. Do you feel you have the ability to complete assignments and activities in this class? Explain.
    - If not, what can you do to get the extra support you need?
    - Have you sought out extra help? What was that like?
    - If yes, if you did need help, what would you do?

6. What does doing well or being successful in science class mean to you? What does it look like?
   How do you know if you are doing well in class?

7. Do you feel like you are learning in science class? Provide a specific example.
    - How do you know when you are learning?
    - Which activities help you learn best?
    - Which activities are the hardest for you?

8. Is the material in class challenging enough for you? Explain. Provide a specific example.
    - How do you typically respond to academic challenges or setbacks?

9. If you fail a quiz or test, how does it make you feel? Why?
    - Is this true in all your classes?

10. Do you take advantage of test retakes?
    - Does that help you understand your mistakes?

11. When you make a mistake on an assignment, how do you respond?
    Is this true in all your classes?

12. Does my written feedback help you? How?
    - How could I improve my written feedback?

13. Does my verbal feedback help you? How?
    - How could I improve my verbal feedback?

14. What do you know about Carol Dweck's research on fixed and growth mindsets?

15. What else do you think I should know?

Post Treatment Questions

This statement will be read to students: **Participation in this research is voluntary. Participation or non-participation will not affect your grades or eligibility to participate in any other class activities.**

1. In general, do you enjoy school? Why?

2. What is your favorite subject in school? Explain.

3. What have you enjoyed about this class? Why?

4. If you could change one thing about this class, what would it be and why?

5. Do you feel you have the ability to complete assignments and activities in this class? Explain.
    - If not, what can you do to get the extra support you need?
    - Have you sought out extra help? What was that like?
    - If yes, if you did need help, what would you do?

6. What does doing well or being successful in science class mean to you? What does it look like?
   How do you know if you are doing well in class?

7. Do you feel like you are learning in science class? Provide a specific example.
    - How do you know when you are learning?
    - Which activities help you learn best?
    - Which activities are the hardest for you?

8. Is the material in class challenging enough for you? Explain. Provide a specific example.
    - How do you typically respond to academic challenges or setbacks?

9. If you fail a quiz or test, how does it make you feel? Why?
    - Is this true in all your classes?

10. Do you take advantage of test retakes?
    - Does that help you understand your mistakes?

11. When you make a mistake on an assignment, how do you respond?
    Is this true in all your classes?

12. Does my written feedback help you? How?
    a. How could I improve my written feedback?

13. Does my verbal feedback help you? How?
    a. How could I improve my verbal feedback?

14. Did you enjoy learning about the mindsets? Explain.

15. Have you made changes in your way of thinking or approach to learning as a result of the mindset curriculum? Provide an example.

16. Have you applied the mindset curriculum to your other classes? Provide an example.

17. Can you apply this way of thinking to other situations such as relationships? Explain.

18. What else do you think I should know?

APPENDIX D

ENGLISH MATH AND SOCIAL STUDIES TEACHER SURVEY

Note: Participation in is voluntary. Participation or non-participation will not affect students' grades or eligibility to participate in any other class activities.

Directions: Please complete the following survey for the student to the best of your knowledge. The results will be used to try to measure whether not the skills taught in a mindset curriculum in science class are transferable to other high school courses. Pre and post treatment survey results will be compared. Thank you for taking the time to fill this out.

Student ID#_____ Teacher: _____ Class/Subject: _____

1. What is the student's current grade in class? _____

   If you have category grades, would you please list them along with the percent/grade the student has in each category.

Category Name	% of total grade the category makes up	% and Grade Student has earned in the category

   If you have grading period grades, please list them:

   _____ 6 week _____ 12 week _____ Final

2. How many missing assignments does this student have in your class? _____
   Describe the student's assignment completion habits.

3. Please rate the student's motivation in your class by placing a check in the corresponding box:

Highly Motivated	Motivated	Average	Unmotivated	Extremely Unmotivated

If possible, please describe with a specific example:

4. Please rate the student's confidence level in your class:

Very Confident	Confident	Average	Less than Average	Extreme Lack of Confidence

If possible, please describe with a specific example:

5. How engaged on average is the student in the learning activities in your class?

Highly Engaged	Engaged	Average	Less Engaged than Average	Extremely Unengaged

If possible, please describe below and include a specific example:

6. Please rate how often the student seeks out additional support outside of class. If unknown, check here: _____.

Several Times A Week	Once a Week	1-3 times a Month	4 or fewer times a semester	Not at all

If possible, please describe below and include a specific example:

7. How does this student respond when he/she makes a mistake in class? Please explain and provide a specific example if possible.

8. How does this student respond when he/she receives a poor grade?

9. Read the following descriptions of growth and fixed mindsets.

> Students with a growth mindset believe they can improve their intelligence over time through hard work. Growth mindset individuals appreciate challenges and constructive feedback. They believe mistakes are an important part of learning. Students with a fixed mindset believe they are born with a certain amount of intelligence and they are more concerned with getting the correct answer than the process of learning. Fixed mindset students may feel uncomfortable with challenging assignments and may feel uncomfortable getting feedback.

What mindset you think the student has based on behaviors you have observed? Explain.

APPENDIX E

TEACHER REFLECTIVE JOURNAL WRITING PROMPTS

Each journal entry will include the following for period one and for period two:

Date

Outline of the lesson.

Names of absent students.

Responses to each of the following questions:

1. What are three positive things that happened today?

2. What are three negative things that happened today?

3. What student observations did you make today that illustrated fixed mindset thinking?

   What might you do to steer students toward a growth mindset?

4. What student observations did you make today that illustrated a growth mindset?

5. What teacher actions did you take today that fostered a fixed mindset? What might you do differently in the future?

6. What teacher actions did you take today that fostered a growth mindset?

During the treatment period I may also want to address the following questions:

1. How did students respond to the mindset lesson?
2. How did the mindset lesson impact the rest of your instructional time?
3. What would you change about the mindset lesson?

APPENDIX F

MINDSET UNIT EVALUATION

Name:_____Period:_____Date:_____

Mindset Unit Evaluation

Directions: Answer the following questions as completely as you can.
Participation in this research is voluntary. Participation or non-participation will not affect your grades or eligibility to participate in any other class activities.

How does Barbara's (The Woman Who Changed Her Brain) story relate to you?

Rate the extent to which you agree with the following statements by placing a check in one box:

1. Mrs. Schuman promotes a growth mindset in her written feedback.

Strongly Agree	Agree	Agree A Little	Disagree A Little	Disagree	Strongly Disagree

Provide a specific example:

2. Mrs. Schuman promotes a growth mindset in her verbal feedback.

Strongly Agree	Agree	Agree A Little	Disagree A Little	Disagree	Strongly Disagree

Provide a specific example:

3. I was able to learn something new from the growth mindset lessons.

Strongly Agree	Agree	Agree A Little	Disagree A Little	Disagree	Strongly Disagree

Explain:

4. I can apply growth mindset thinking to other classes such as math, English, or social studies.

Strongly Agree	Agree	Agree A Little	Disagree A Little	Disagree	Strongly Disagree

Explain:

5. If I am in a group with a student that has not contributed much in the past, I know ways to try to encourage that student to participate.

Strongly Agree	Agree	Agree A Little	Disagree A Little	Disagree	Strongly Disagree

Explain:

6. If I am in a class with a student I have not gotten along with in the past, I will avoid working with that person because I believe that person cannot change.

Strongly Agree	Agree	Agree A Little	Disagree A Little	Disagree	Strongly Disagree

Explain:

7. I know time management strategies that promote success.

Strongly Agree	Agree	Agree A Little	Disagree A Little	Disagree	Strongly Disagree

Explain:

8. I know study skill strategies that promote success.

Strongly Agree	Agree	Agree A Little	Disagree A Little	Disagree	Strongly Disagree

Explain:

Complete the following statements.

9. The growth mindset lessons were

10. If I fail a test, I should

11. I would like more information about

APPENDIX G

INSTITUTIONAL REVIEW BOARD EXEMPTION

MONTANA STATE UNIVERSITY

INSTITUTIONAL REVIEW BOARD

For the Protection of Human Subjects
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MEMORANDUM

TO: Catherine Schuman and Walt Woolbaugh
FROM: Mark Quinn Mark Quinn CMQ
DATE: October 12, 2016
SUBJECT: "*The Impacts of Teaching Growth Mindset Strategies to Students in Inquiry Science 2*" [CS101216-EX]

The above research, described in your submission of October 12, 2016, is exempt from the requirement of review by the Institutional Review Board in accordance with the Code of Federal regulations, Part 46, section 101. The specific paragraph which applies to your research is:

__X__ (b) (1) Research conducted in established or commonly accepted educational settings, involving normal educational practices such as (i) research on regular and special education instructional strategies, or (ii) research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.

__X__ (b) (2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless: (i) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability, or be damaging to the subjects' financial standing, employability, or reputation.

____ (b) (3) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement}, survey procedures, interview procedures, or observation of public behavior that is not exempt under paragraph (b)(2) of this section, if: (i) the human subjects are elected or appointed public officials or candidates for public office; or (ii) federal statute(s) without exception that the confidentiality of the personally identifiable information will be maintained throughout the research and thereafter.

____ (b) (4) Research involving the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens, if these sources are publicly available, or if the information is recorded by the investigator in such a manner that the subjects cannot be identified, directly or through identifiers linked to the subjects.

____ (b) (5) Research and demonstration projects, which are conducted by or subject to the approval of department or agency heads, and which are designed to study, evaluate, or otherwise examine: (i) public benefit or service programs; (ii) procedures for obtaining benefits or services under those programs; (iii) possible changes in or alternatives to those programs or procedures; or (iv) possible changes in methods or levels of payment for benefits or services under those programs.

____ (b) (6) Taste and food quality evaluation and consumer acceptance studies, (i) if wholesome foods without additives are consumed, or (ii) if a food is consumed that contains a food ingredient at or below the level and for a use found to be safe, or agricultural chemical or environmental contaminant at or below the level found to be safe, by the FDA, or approved by the EPA, or the Food Safety and Inspection Service of the USDA.

Although review by the Institutional Review Board is not required for the above research, the Committee will be glad to review it. If you wish a review and committee approval, please submit 3 copies of the usual application form and it will be processed by expedited review.