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Mindset and its Effect on Student Science Achievement

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I. Abstract: The focus of this study is to assess student attitudes and beliefs about their abilities in science and whether those can be changed. The ideas from Carol Dweck, Ph.D.'s *Mindset* will be discussed. In this study, surveys of students' mindset were administered, a mindset intervention was implemented, student choice was observed, and standardized test scores were collected to study mindset and its influence on academic performance and behaviors, and whether a mindset intervention can influence student attitudes and beliefs. While no statistically significant findings were observed, important implications for supporting the self-efficacy of students in the classroom are discussed.

II. Introduction:

Research tells us that students' mindset, defined as the established set of attitudes and beliefs a person adheres to, especially beliefs about their abilities, plays a major role in their academic performance (Dweck, 2008). Psychologist Dr. Carol Dweck, the leading researcher in the field of mindsets, outlines two fundamental mindsets that we can adopt: "fixed" or "growth" (Dweck, 2006). The mindset we adopt for ourselves determines our outlook on life, including: how we cope with challenges, how we define our success and failures, and how we measure our abilities (Dweck, 2006). People with fixed mindsets believe that abilities are fixed and can't be improved, whereas people with growth mindset believe that your abilities can be cultivated through continued efforts and practice (Dweck, 2006). Research has shown that in an academic setting, student mindset is indicative of their math and science achievement (Dweck, 2008).

Therefore, the purpose of my research will be to assess my students' understanding of mindset and whether they believe their intelligence and abilities, especially in the context of science, are fixed and unchangeable, or can be improved and developed. Through growth mindset instruction that supplements our regular science content, I hope to help my students with a fixed mindset *change* to a growth mindset. I believe this research is important because I've worked with many students and student-athletes who have struggled to cope with challenges, who believed that if they weren't good at a new skill immediately then they would never be able to master it, and they counted that as a failure. In fact, I've held this belief myself on numerous occasions throughout my life. I believe that Dr. Dweck's ideas and research can help us better prepare our students for the real world, and help them learn to fulfill their true potential.

III. Literature Review

Growth Mindset

The mindset of our students will be the central focus of this research; therefore, we should first understand the meaning of mindset and how it influences our students' thinking and academic performance. Mindset is described simply as the view we adopt for ourselves; but, this is no simple matter: mindset has profound influence on the way we lead our lives (Dweck, 2006). There are two primary ways in which most people view themselves and their abilities: the first is called a *fixed* mindset (also referred to as an entity theory of ability), when people consider their unique traits, such as intelligence, personality, or athleticism, to be permanent and unable to be changed, and the second is called a *growth* mindset (also referred to as an incremental theory of ability), when people understand that these unique traits can developed through focused effort (Dweck, 2006). Furthermore, people with a fixed mindset tend to be extrinsically motivated, performing for a grade or reward instead of mastery, whereas people with a growth mindset tend to be intrinsically motivated, performing to increase their knowledge and improve their abilities (Brougham & Kashubeck-West, 2018).

Research tells us that although each person has a unique genetic makeup, neither our genes nor our environment *by themselves* defines who we are – it is a constant give and take between the two, and genes require input from our environment to work properly (Dweck, 2006). This supplements additional research that tells us people have a capacity for lifelong learning and cerebral development far greater than most ever imagined; furthermore, while people differ in aptitude and character, skills can always be developed through experience, training, and effort (Dweck, 2006). The fundamental task

for us is to explore the consequences of adopting either a *fixed* or *growth* opinion of our abilities, and how psychological interventions can foster greater achievement.

In recent years, developments in educational psychology have found that psychological interventions can foster improvements in student achievement; furthermore, instead of providing new instructional materials or pedagogies, these interventions address how students view their abilities, school experiences, relationships, and learning tasks (Yeager *et al*, 2016). Research shows that students are more motivated to learn when they understand the potential to develop their abilities, feel safe and connected to others, and see that putting effort into something has meaning and value (Yeager *et al,* 2016). In addition, we know that when students doubt their abilities in school, such as viewing a failed science test as evidence that they're not a "science person," they tend to behave in ways that negatively affect their performance in that class, either by studying less or avoiding future science challenges they may learn from (Yeager *et al*, 2016). Therefore, what we say to students and how we reinforce the ideas of growth mindset in our classroom is critical to improving student confidence and overall academic performance.

Studies have shown that *how* students are praised for their academic achievement can influence their mindset and motivation – students praised for their effort, a growth mindset approach, tend to take on more difficult challenges and want to achieve mastery, whereas students praised for their intelligence, a fixed mindset approach, tend to be more concerned about grades and the appearance of being smart instead of truly learning (Brougham & Kashubeck-West, 2018). This is especially true for gifted students, who may be less likely to attempt more difficult activities due to fear of

failing and losing the "gifted" label (Brougham & Kashubeck-West, 2018). This understanding is critical for parents, educators, and counselors tasked with helping students improve their academic achievement. Now that we've discussed what mindset is, and why mindset interventions and the way we interact with and praise students can influence their mindset, we'll need to find classroom evidence that demonstrates the effects of mindset intervention on academic achievement, as well as methods for how we'll go about conducting our own research.

Classroom Evidence

Research indicates that teachers play a significant role in the classroom in terms of influencing the mindset, beliefs, learning goals, and achievement of their students (Schmidt *et al.* 2015). In one study, it was determined that the teachers who engaged in classroom practices that aligned with the growth mindset and belief framework were more effective in helping students succeed academically, focusing on mastery, achievement, and conceptual development, than teachers who didn't engage in those practices (Schmidt *et al.* 2015). The teachers' standard classroom practices in this case were supplemented by the Brainology mindset intervention course, which is an online interactive program that provides content to help nurture beliefs about the nature of intelligence, the value of effort, and achievement goals and attributions (Schmidt *et al.* 2015).

Furthermore, it's worth noting that in a study of classrooms with teachers who all had a strong growth mindset, improvements in student academic achievement were only accounted for in the classrooms with more experienced educators, who were better able to facilitate student growth (Schmidt *et al.* 2015). Specifically, this was

observed because the experienced educators created lessons that better promoted deeper understanding, and included an emphasis on mastery, learning, and growth, whereas the other teachers studied didn't regularly create lessons that promoted deep understanding (Schmidt *et al.* 2015). Remarkably, it was observed that the effective educators utilized the brainology program less than the other educators, emphasizing the importance of the teacher-student interactions and influence over the success of the classroom (Schmidt *et al.* 2015). Lastly, the most important difference between the educators studied lied in their usage of mindset messages in their daily interactions with students (Schmidt *et al.* 2015). The educators with improved student outcomes interacted with their students in a way that promoted growth mindset and reinforced the development of adaptive beliefs about learning, while the educators with no improved student outcomes didn't interact with their students in this manner (Schmidt *et al.* 2015). Now that we've seen how important teachers are to reinforcing the ideas of growth mindset and how that affects student performance, lets look at the trajectories of students learning about growth mindset, in terms of all skills necessary to be a successful student.

In another study, ninth graders undergoing mindset intervention were studied to determine if the concepts of growth mindset were influencing their academic performance and development of other skills (Schmidt *et al.* 2016). Like the previous study, the Brainology online interactive program was used to supplement growth mindset-oriented classroom practices (Schmidt *et al.* 2016). In this study, ninth graders showed significant increases in perceived control and interest in their academic content over the course of the year, and relative to the control group, experienced higher trajectories in skill development and overall learning (Schmidt *et al.* 2016). The research

findings in this study suggest that participating in mindset intervention changes beliefs about the nature of intelligence, the value of effort, achievement goals and attributions, and has measurable impacts on the way students approach everyday academic content, which is indicated by daily reports of their subjective experience doing academic work (Schmidt *et al.* 2016). Furthermore, additional research has found that growth mindset intervention can temper the effects of economic inequality among students (Claro *et al* 2016). Researchers have found that lower-income students are twice as likely to report a fixed mindset, and their mindset is a strong predictor for their success, which is an example of how economic disadvantage can lead to academic underachievement (Claro *et al* 2016). At every socioeconomic level in this study, students with a growth mindset outperformed their peers who did not have this mindset (Claro *et al* 2016). As a result, this evidence should compel us as educators to more effectively support students who face additional socioeconomic challenges through structural, social, and psychological means.

Science and Math Achievement

We know that mindset can influence student academic achievement, so now let's look at how it specifically influences science and math achievement. In one longitudinal study, student mindsets were assessed and then their math grades were tracked through seventh and eighth grade (Dweck, 2008). While the students all started with roughly equal prior math achievement, the impact of mindset is typically not observed until students face challenges and setbacks; therefore, throughout the next two years, the grades of the students with fixed and growth mindsets diverged, with growth mindset students achieving more while fixed mindset students remained about the same,

with a slight overall decrease in math achievement (Dweck, 2008). Analysis showed that students with growth mindset were more oriented toward learning goals, caring more about learning than grades, believed in the power of effort, and showed more mastery-oriented reactions to setbacks (Dweck, 2008). In science, researchers found similar results when examining students taking organic chemistry – using SAT scores as a control of entering ability, student mindsets were assessed and those with a growth mindset outperformed those without (Dweck, 2008). Interestingly, of those determined to have a fixed mindset, males outperformed females in the final organic chemistry grades, while of those determined to have a growth mindset, females slightly outperformed males (Dweck, 2008).

Methods

In another study, questions relating to active learning and student engagement, in association with growth mindset, were explored (Cavanagh *et al 2016*). Students' trust in their instructor, and growth mindset, were compared as predictors of engagement and course performance (Cavanagh *et al 2016*). While trust and mindset both significantly associated with engagement, growth mindset was not determined to be associated with students' final grades, leading researchers to conclude that the course experience itself was important to predicting success in this sample (Cavanagh *et al 2016*). Results were measured using a derivation of a self-report measure framework where students rated elements of their instructor's performance, expressed their beliefs about the nature of intelligence, commitment to active learning (Cavanagh *et al 2016*).

Furthermore, in one study focused primarily on the effects of growth mindset, researchers provided mindset instruction in the form of workshops that taught

the ideas behind growth mindset and the nature of intelligence to an experimental group, followed by comparison of their grades in the same subject to a control group that did not receive mindset instruction (Dweck, 2008). In another study, the mindset intervention came in the form of the Brainology online mindset instructional program and were randomly assigned within schools, with one day per week being dedicated to Brainology instruction, and supplemented by daily "End of Class" reports where students expressed their perceived control, skills, learning, interest, and importance (Schmidt *et al.* 2016). One study, students in the experimental group completed short mindset sessions over a number of days, with one session requiring students to read a short article about the brain and nature of intelligence and complete a worksheet, the next session requiring students to read a student testimonial from someone who struggled with a difficult topic, but improved with effort, and the last requiring them to write a letter of encouragement to other students based on what they had learned (Brougham & Kashubeck-West, 2018). Academic performance, mindset scale score, and attendance were used as dependent variables in this study; specifically, GPA of four core subjects from the semester prior to, and semester of, the intervention, and a mindset assessment before and after the intervention using the 3-item Theories of Intelligence scale (Brougham & Kashubeck-West, 2018).

Conclusion

We know from our research that people have the capacity for life-long learning and cerebral development, and while people differ in motivation and aptitude, skills can improve through focused effort and practice. How people interpret the nature of their abilities and intelligence can determine their motivation to develop them. People

who interpret their abilities and intelligence as being unchangeable have a *fixed* mindset, whereas people who interpret those characteristics as malleable and able to be improved have a *growth* mindset (Dweck, 2006). Our research demonstrates the positive outcomes for student success and motivation when they apply a growth mindset to the daily rigor of academic coursework. While mindset intervention is not always necessary to achieve these outcomes, as evidenced in a study reviewed here, our research shows that the educator engaging in growth mindset practices, from their interactions with students to the overall course experience they provide, is paramount to creating an effective learning environment that promotes student achievement (Cavanagh *et al 2016*). Growth mindset is an incredible tool for increasing a person's confidence in their abilities, not just in the classroom, but also in all areas of life – in sports, extracurriculars, relationships, and careers.

IV. Methodology

In this project, the essential questions we're trying to answer relate to what student mindsets about science class are, and how their mindset influences their motivation and performance in the science classroom. This research was performed in an eighth grade science classroom. Parents were notified of the nature of the research and be asked to grant permission for their student(s) to participate in the study. The essential questions were answered using a mixed-method approach, which requires the analysis of quantitative and qualitative data. In this project, quantitative data was collected in the form of mindset inventory scores and assessment data. Qualitative data was collected in the form of student responses collected during the growth mindset intervention.

At the beginning of the study, a mindset inventory in the form of a theories of intelligence scale adapted from University of Illinois at Chicago, and a content pre-assessment were administered. Next, I implemented a growth mindset intervention. This intervention required two class periods that utilized different modes of instruction to engage all students and teach the research behind growth mindset and impact of mindset in all areas of life, including academics. Students watched videos, received direct instruction, participated in discussions, and completed independent research presentations on growth mindset and famous figures who embodied the principles of growth mindset research. As an additional component to the study, student mastery of learning targets was measured using a choice board performance assessment; specifically, student mindset and attitude toward science was compared to choice in how they demonstrate mastery of learning target on a performance assessment to look for possible connections.

Lastly, the same mindset inventory administered at the beginning of the study was administered at the end to evaluate how student mindset and attitudes toward science changed as a result of the mindset intervention. At the completion of the study, data collected from the study was analyzed to determine student mindset and attitude toward science, and if those were changed by completing a mindset intervention, and if they are indicators for academic success in the science classroom. In order to compare mindset data to academic performance, I collected student IOWA science test scores from the previous year that were used to determine placement in science classes this year.

Using the theories of intelligence mindset inventory, student evaluations of 20 statements where they agreed or disagreed with the statement will be converted to numeric values according how the responses indicate student mindset. The values were

added to give each student a unique mindset score, with greater values indicating strong growth mindsets and lesser values indicating strong fixed mindsets. These scores were calculated for each student in an 8th grade class, totaling 83 students. When completing analysis, scores from the pre-inventory and post-inventory were compared, student responses from the growth mindset intervention activities were evaluated, and assessment data from the two units was compared. Using this data, I evaluated student mindset and attitude toward science, and discussed possible connections based on our mindset intervention, academic performance data, and choice board assessment data.

V. Data and Analysis

Survey Overview

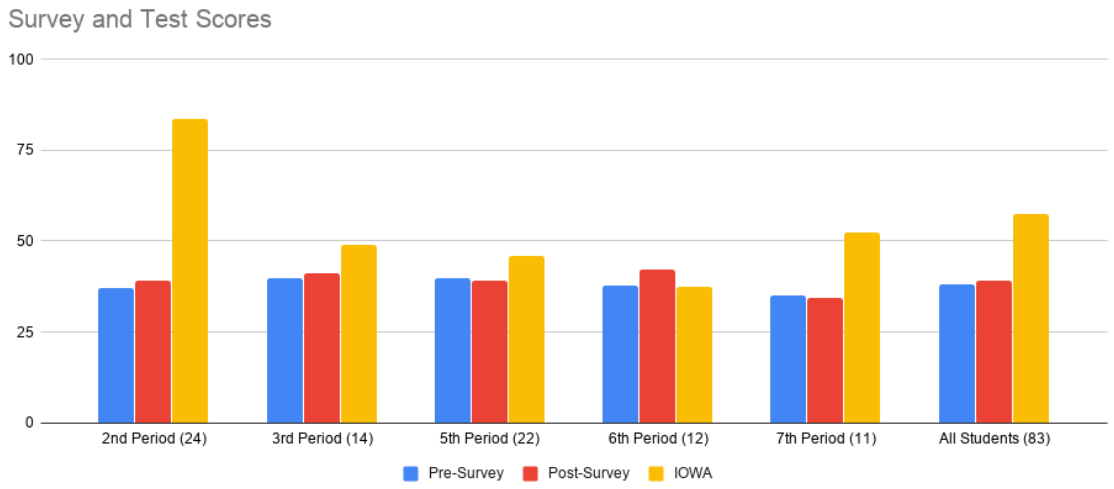
At the beginning of the study, a mindset inventory was administered to all students in each class. The inventory was adapted from a theories of intelligence scale published by University of Illinois at Chicago. The mindset inventory is included in Appendix A to this paper. The inventory asks students to evaluate twenty statements by either strongly agreeing, agreeing, disagreeing, or strongly disagreeing with them. There are fourteen ability mindset statements, eight that represent a fixed mindset and six that represent a growth mindset. There are six personality and character mindset statements, three that represent a fixed mindset and three that represent a growth mindset. Scores are assigned to each response depending on how students respond to each statement. Students who accumulate a greater amount of points for their score indicate having a stronger growth mindset. For example, a statement that represents a growth ability mindset would assign a student a higher score the more strongly they agree with the statement, and a statement that represents a fixed ability mindset would assign a student a

higher score the more strongly they disagree with the statement. Therefore, the greater the score, the stronger growth mindset the student has. The survey used in this study utilizes the following points scale for determining student mindset based on the survey results:

45 - 60 points	Strong Growth Mindset
34 - 44 points	Growth Mindset with some Fixed Ideas
21 - 33 points	Fixed Mindset with some Growth Ideas
0 - 20 points	Strong Fixed Mindset

Survey Results

2nd Period (24)	Pre-Survey	Post-Survey	IOWA
mean	37.08	39.04	83.52
3rd Period (14)	Pre-Survey	Post-Survey	IOWA
mean	39.86666667	41	49.13333333
5th Period (22)	Pre-Survey	Post-Survey	IOWA
mean	39.73913043	39.17391304	45.77777778
6th Period (12)	Pre-Survey	Post-Survey	IOWA
mean	37.69230769	42.15384615	37.53846154
7th Period (11)	Pre-Survey	Post-Survey	IOWA
mean	34.91666667	34.41666667	52.33333333
All Students (83)	Pre-Survey	Post-Survey	IOWA
mean	38.04545455	39.23863636	57.40963855
st. dev	5.267355748	5.887829485	
t-test	0.0300049254		
p-value	.447263.		



Student Choice Data

2nd Period (24)	Quiz/Test	Model	Story	Compare	Song
# of students	12	7	4	0	1
3rd Period (14)					
# of students	2	3	4	5	0
5th Period (22)					
# of students	11	3	3	4	1
6th Period (12)					
# of students	3	3	3	2	0
7th Period (11)					
# of students	4	2	1	1	3
All Students (83)	32	18	15	12	5

Analysis

To present the data, I analyzed scores by each class and as an entire grade with all 83 students. Students in all five of my instructional periods participated in the study. Students in my second period class comprise the advanced section our science course, while the other four periods comprise the regular sections of the science course. There are no students with IEPs or 504's in the advanced section; however, students who

are on IEPs and 504s are evenly distributed throughout the other four periods. Student placement in these courses is largely based on IOWA test scores from the previous year. Students in the advanced section were the highest scores on the test and therefore placed in the advanced section. The mindset intervention implemented in each class included the same content and processes, with IEP and 504 students receiving their necessary accommodations in the four regular sections.

The overall average score students received on the mindset inventory pre-survey was 38, which demonstrates a student having a growth mindset with some fixed ideas. This means that students on average had above-average growth ability mindsets and personality/character mindsets prior to participating in the mindset intervention, with these students still having some fixed ideas. After assessing individual results, no pattern was found in the specific ideas that students still had fixed ideas about. Second period had an average score of 37.08, third period had an average score of 39.9, fifth period had an average score of 39.74, sixth period had an average score of 37.69, and seventh period had the lowest average mindset score of 34.92, which is very close to being in the "Fixed Mindset with some growth mindset ideas" range. The overall average score students earned on the IOWA test before entering 8th grade was 57.4. Students in the second period class scored the highest overall on the IOWA test with an average score of 83.52, third period had an average score of 49.13, fifth period had an average score of 45.78, sixth period had an average score of 37.54, and seventh period had an average score of 52.33. All of these results are compared side-by-side in Data Table 1 and will be discussed for possible connections in the discussion section of this paper.

As an additional component to this study, student choice of assessment was recorded in order to be compared to mindset and academic achievement. The purpose was to see if mindset and past academic achievement are indicators of student preference in demonstrating mastery of content. Students were assigned this project at the end of the "Layers of the Earth" unit and had the choice of creating a test or quiz with an answer key, creating a 3-d model of the layers of the Earth, writing a story of what someone would encounter on a journey to or from the center of the Earth, comparing and contrasting the layers of the Earth, or writing a song or poem about the layers of the Earth.

In total, I had 83 students participate in this study. Out of these 83 students, 51 of them showed an increase in growth mindset ideas, 6 students did not demonstrate a change in mindset score, and 26 students demonstrated a decrease in mindset score. These account for changes in as few as 1 point between the pre and post-survey. The greatest increase in mindset inventory score was 21 points, and the greatest decrease in mindset inventory score was 23 points. The average change overall was an increase in 1.5 points from the pre to the post survey, with the average decrease in score being 5 points, and the average increase in score being 5 points. A T-test was performed to assess the statistical significance of the data, with a T-test value of 0.03 and p-value of 0.4 calculated, indicating no statistically significant difference between the pre-survey and post-survey results. With this mind, I'll continue moving forward in evaluating this data and its implications in the classroom in a qualitative manner.

VI. Discussion

Mindset and Assessment Data

When looking at survey data from the entire grade and completing statistical analysis, the t-test and p-value calculations indicate that the average score increase from the pre-survey to post-survey of 1.2 points is not statistically significant, meaning that the mindset intervention did not influence mindset and attitudes toward learning science. This will require a qualitative reflection on the mindset intervention itself; reflecting on the instructional strategies used and student engagement by looking at their responses to discussion prompts and research and presentation they prepared at the end of the two-day mindset intervention.

In regards to students' past academic achievement, the data tables in the analysis section include IOWA science test scores, which is a standardized test administered at the end of 7th grade in my field placement school where this study was conducted. As evidenced by comparing IOWA test scores to mindset score, there was no overall generalized connection observed in this situation between past academic achievement and mindset inventory score, both before and after the intervention. However, it should be noted that the class with the lowest IOWA test scores did end up having the strongest growth mindset score at the end of the study.

This pattern is observed in a couple other classes, with the three lowest academically performing classes (3rd period , 5th period, and 6th period, with 49, 45, and 47 IOWA scores, respectively) demonstrating the three strongest growth mindset scores at the end of the study (41, 39, and 42, respectively), and the two highest academically performing classes (2nd period and 7th period, with 83 and 52 IOWA scores, respectively),

having the two lowest mindset scores at the end of the study (39 and 34,respectively). Additionally, it should be noted that the class with the lowest scores on standardized test was influenced the most by the mindset intervention, with our sixth period class having the greatest increase in mindset score from the pre-survey to post-survey of around 5 points. This is contrast to the other classes with higher standardized test scores that was not as influenced by the mindset intervention and did not experience the same increase in mindset score from the pre-survey to post-survey. In order of highest IOWA score to lowest, second period had a mindset score increase in 2 points, seventh period did not change mindset score, third period increase by 1 point, fifth period did not change mindset score, and sixth period increased by 5 points. While we can't explicitly identify a connection quantitatively because of the lack of statistical significance in mindset survey data, we can include this in our qualitative discussion and reflection of the study.

Mindset and Student Choice Data

In the methodology, an additional component to this study was mentioned: an analysis of student choice in demonstrating content mastery in its relation to mindset and attitudes toward science. As mentioned, a choice board assignment was given at the end of the instructional unit following the growth mindset intervention. Students were given a variety of options that ranged from more traditional assessment options like tests and quizzes, and more creative options that reflect different disciplines and cross-curricular connections. While the data collected can certainly not lead to any generalizations regarding student choice and mindset – like our data collected on academic achievement and mindset, the analysis can help identify implications in this particular classroom and

be used in a qualitative manner when discussing student choice and mindset. However, in this event, no pattern is noticed when examining data from all classes in this study. While the two largest classes did have a higher percentage of students choose the more traditional options of creating a test or quiz, the classes are on the opposite ends of the academic achievement data, with one class being the highest performing and the other being the second lowest performing, and the mindset scores, like other classes, are too similar to draw any conclusions about possible connections between variables.

Qualitative Discussion

While much of the data collected points to a null hypothesis, meaning that the differences in mindset scores between the pre-survey and post-survey are not statistically significant, we can still use this information, as well as observations made throughout the study, in our discussion and reflection of the study. The most important observation in this case relates to the lower performing classes and their mindset scores, assessment data, and qualitative observations from the additional student choice component. It's clear that our lowest performing class academically had the greatest increase in mindset from before the mindset intervention to after. It's also clear that this class had a much more even distribution of choice in regards to their layers of the Earth assessment. Lastly, it's clear from observations made from these non-traditional assessment options, that some of my lowest performing students with the more fixed mindsets 1) had the greatest increases in growth mindset ideas, and 2) were better able to demonstrate understanding of content mastery when given the option to choose how to do it, and more often chose to complete the non-traditional assessment options. For example, one of my students in the lowest performing classes, who scored poorly on the IOWA test

(16th percentile), had one of the most significant increases in growth mindset ideas (from 40 to 51), and produced impressive work on the choice board assessment, writing a detailed narrative about a journey to the center of the Earth that met all rubric criteria. This situation was similar to three other students in this classroom who had similar mindset scores and academic achievement. While we can't make generalizations from this data, the implications in this classroom are worth studying further and in different classroom environments.

VII. Conclusions

The first purpose of this action research was to identify possible relationships between student mindset and attitudes toward science, and their science academic achievement. The second purpose was to see if conducting a mindset intervention could influence students to foster more growth mindset ideas. The last purpose was to identify possible relationships between student mindset and attitudes toward science, and assessment choice. Quantitatively, no conclusions can be made for these central questions. For the first central question, there was no pattern identified in the data to indicate that higher or lower academically performing classes had more growth or fixed mindsets. For the second central question, while there was an overall increase in student growth mindset from before to after the mindset intervention, statistical analysis pointed to a null hypothesis, meaning that the increase was due to chance and not because of the intervention. Lastly, there was no quantitative connection between student choice, mindset, and academic achievement. However, when looking at the information collected qualitatively, there are findings that support the need for further study. It was observed in this study that the lowest performing classes may have benefitted the most from the

mindset intervention. It was also observed that the lowest performing students tended to have the greatest increases in growth mindset ideas from before to after the mindset intervention, and that these students tended to demonstrate their understanding in non-traditional ways more effectively than on traditional assessments. As evidenced in the literature review, mindset interventions aren't always necessary to increase the growth mindset of students (Cavanagh *et al 2016*). One of the most important indicators of student mindset and academic performance is the quality of the teacher and their ability to reinforce the principles of growth mindset in daily instruction (Cavanagh *et al 2016*).

Limitations and Future Research

There are several limitations to consider when reflecting on this research project. The demographics of this project are limited to the community this school serves, which is largely agricultural and rural community with a majority Caucasian population and limited socioeconomic diversity. This means that student experiences, backgrounds, interests, attitudes and mindsets are going to be different than students in urban, suburban, private, and charter schools in different locations. This certainly impacts the information collected throughout this study. Another limitation in this study is the sample size, I was only able to survey and collect data on 83 students in one grade level. Additionally, as my time in this classroom was limited due to the student-teaching semester not starting until late January, I wasn't able to assess mindset, performance and growth throughout an entire academic year. This would have been useful in assessing effectiveness of daily growth mindset reinforcement throughout an academic year to determine effect of mindset on student academic achievement, whereas in this study we were largely limited to prior standardized assessment data and comparing to mindset

before and after a two-day mindset intervention. In a future study, I would work to expand my sample size and include students from different grade levels, collaborate with other schools to collect data from students from different backgrounds, and implement growth mindset interventions throughout an entire year and collect mindset and assessment data throughout the year.

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