THE IMPACT OF TEACHING GROWTH MINDSET TO BIOLOGY STUDENTS AT SENTINEL HIGH SCHOOL

by

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DEDICATION

To my mom and dad. There are no words to express how grateful I am to have you two as my parents. I cannot thank you enough for everything you have done for me.

TABLE OF CONTENTS

LIST OF TABLES

Table Page

LIST OF FIGURES

Figure Page

ABSTRACT

This classroom research project investigated the impact of teaching growth vs fixed mindset lessons twice a month for four months to nine and tenth grade biology students and eleventh and twelfth grade AP biology students. Mindset has been shown in many studies to have a large impact on student learning and future success. This project was conducted to try and shift a student mindset towards the growth and away from the fixed side on the mindset spectrum. In addition, to try and improve student mindsets, I also wanted to see if there was a correlation to student learning and growth, as well as overall student wellness. I collected data from student mindset survey and a student wellness survey before and then after administering the treatment. The treatment was a series of mini lessons that were taught to the students twice a month for four months. Student interviews were conducted after the treatment as well. The students' overall grades from quarter 1 and quarter 2 were used as a metric to measure academic growth. Results showed growth in student mindsets and various aspects of wellness from pre to post assessments. Out of all students that completed the pre and post mindset assessment nearly 90% of them increased their mindset score. Every class period showed an increase of average mindset score. There was no correlation between student mindsets and academic achievement or academic growth. There were some categories of student wellness that were unchanged, but there were many aspects of student wellness that showed improvement from pre to post assessment. The students verbal and written responses to prompts about mindset and wellness support these findings. In conclusion, students who were exposed to a treatment of mindset lessons showed increases in both their mindset score and overall wellness.

CHAPTER ONE

INTRODUCTION AND BACKGROUND

Context of the Study

The purpose of this study was to investigate how the mindset of students affects their growth, overall wellness, academic performance, and various other aspects of their educational and life experiences. Humans possess a mindset in regard to learning and growing. On one end of a spectrum mindset, is called a "fixed mindset", where a person thinks that intelligence, skills, and talent are born into them, and they cannot change these personal elements or characteristics. The other end of the spectrum is called a "growth mindset", where a person thinks that intelligence, skills, and talent can be grown, and they can change as a person. Therefore, this approach recognizes a spectrum with a totally fixed mindset at one end and then a complete growth mindset at the other. It has been shown (Blackwell et al. 2007; Yeager et al. 2014. Dweck, 2007) that a student's mindset affects their academic achievement as well as their ability to deal with adversity, and cope with stress.

Background

Most things we do as humans are learned after birth, like walking, talking, interacting with others, creating a piece of art, designing an experiment, performing a physical task or sport, etc., and the list could go on. All of those behaviors are examples of potential skills, and we have the ability to improve upon, and fine-tune them. It was my hope with this action research project to shift my students toward a complete growth mindset. This shift will hopefully, in turn,

increase their learning, academic achievement, and more importantly their success (however they decided to define that) for their entire life. I have said from day one as an educator that my number one job is to help kids. I believe that affecting my student's mindset is one of the most powerful things I can do for my kids, because it can have benefits that reach far beyond the classroom. I intend to share these results with my fellow teachers and building administrators but most importantly, I plan to share this with my future students. I hope to show them how the mindset they take with them throughout their life will have an impact on many different aspects of their life. I hope to show them that adopting a growth mindset is not about increasing academic achievement and performing better in school, although that is a welcome outcome, but more importantly I hope to show them that a growth mindset can have major impact on all aspects of wellness throughout their entire life.

Focus Question

My focus question was, What are the impacts of teaching growth mindset to my biology students?

My sub-questions included the following:

1. How does student mindset change after being exposed to growth mindset?
2. How does student mindset affect student growth throughout a school year?
3. How does student mindset affect their overall wellness?

CHAPTER TWO

CONCEPTUAL FRAMEWORK

Mindsets

Your mindset matters. Growth mindset can be summarized as "the belief that your basic qualities are things you can cultivate through your efforts, your strategies, and help from others," (Dweck, 2016, p.7) but how can a mindset lead to a growth? The simple answer is because your mindset determines your beliefs, your beliefs determine your actions, and action is the vessel of improvement. Phycologist Carol Dweck, often considered to be the mother of growth mindset research, summarizes this well. She states that students that possesses a growth mindset tend to operate by three rules:

1. They take on challenges.
2. They work hard.
3. They confront their deficiencies and correct them.

On the contrary students that possess a fixed mindset tend to operate using three very different rules:

1. They avoid making mistakes.
2. They don't work hard.
3. If they make mistakes, they don't try and correct them (Dweck, 2007, p. 7).

These rules represent critical aspects of growth and improvement. Individuals who possess a growth mindset take on challenges, put in more effort, and use their mistakes to learn. Individuals that possess a fixed mindset shy away from challenges, don't put as much effort in,

and don't correct mistakes when they make them. They deny themselves the basic but vital ingredients of improvement. Dweck states "For thirty years, my research has shown that the view you adopt for yourself profoundly affects the way you lead your life" (Dweck, 2016, p.6).

How Mindsets can Change

In 2014, researchers measured the personality of 9th grade students in the first month of school. They had students rate statements, such as the following, to deduce the students' opinion on personalities and their ability to change: "Bullies and victims are types of people who really can't be changed" (Yeager et al., 2014, p. 6). The research instrument used a Likert style with 1 = Strongly disagree to 6 = Strongly agree. The various responses were then analyzed to see if the student identified more with entity theory (fixed mindset) or with incremental theory of personality (growth mindset). The researchers then tested the students' short-term reactions to social adversity, global stress, health, and grades over the course of the year. They provided this summary:

> In summary, an entity theory of personality—which was measured during a student's first weeks in high school–predicted not only more negative short-term reactions to social adversity (a domain-specific effect) but also greater stress, worse health, and lower grades over the course of the year, controlling for initial levels of these variables. This suggests that implicit theories may have longer term, cross-domain implications during a socially difficult adolescent transition (Yeager et al, 2014, p. 6).

My number one hope as an educator is to help kids, and so I think best practices way to accomplish this is to introduce them to a growth mindset and help them exercise it. Yeager et al. observed that the growth mindset that students' possessed helped reduce negative short-term reactions to social adversity, reduced stress, increased health, and increased academic achievement. The second part of this study went on to introduce "incremental theory

interventions" during the first month of high school. The researchers stated the purpose of this section of the study as: "The intervention was designed to redirect adolescents' implicit theories away from an entity theory, so as to cut off cascading cycles of stress, illness and underperformance before they could gain momentum" (Yeager et al., 2014, p. 7). As can be seen in the intervention (shown below) the researchers did a single treatment over one day. In contrast, I spent at least fifty minutes with my kids, four days a week, for almost ten months of the year. I discouraged any fixed mindset language that I heard and positively reinforced growth mindset whenever I could. Although my treatment was technically only 8 weeks for my AR project, I continued to teach and reinforce growth mindset for the entire year. Hopefully this helped it stick with students. The 2nd part of the study (Yeager et al, 2014) is described below:

> The experimental intervention (incremental theory of personality) presented information in support of the idea that people have the potential to change and that therefore (a) if you are excluded or victimized, it is not due to a fixed, personal deficiency on your part, and (b) people who exclude or victimize you are not fixed, bad people but instead have complicated motivations that are subject to change. Students read a brief article summarizing actual neuroscience studies showing that people's behaviors are controlled by "thoughts and feelings in their brains" and that such pathways in the brain can be changed. Next, participants read three quotes purportedly written by upperclassmen who had previously read the same article. The upperclassmen provided testimonials of how they used the information discussed in the article when they encountered a peer conflict. Finally, participants were asked to write their own version of such a narrative to share with future ninth graders, drawing on the examples they had just read from the upperclassmen or on their own experiences in high school or middle school (Yeager. 2014 p.13).

Yeager et al (2014) found that students with a growth mindset or "incremental theory" reported significantly lower global stress scores as well as improved reports of heath 8 months after the intervention. Yeager et al (2014) also reported that students who possessed a growth mindset led to higher grades over the course of the year. With one short treatment about incremental theory

(growth mindset) at the start of the year they were able to get some positive results in both academic achievement and reduced stress.

An additional study assessed 7th grade students' beliefs on intelligence and their math performance. The researchers also used the terms entity theory (fixed mindset) vs incremental theory (growth mindset). In the study researchers found that "...students' with the entity and incremental theories did not differ significantly in their math achievement test scores as they entered junior high school, as these results show, they began to pull apart over the 2 years of junior high school" (Blackwell et al., 2007 p. 251). The students' mindsets were indicators of their future growth and success. These results again show that student mindset matters, and over the course of an academic career it can have a huge effect. I wanted to show these ideas to my students, and have them understand that their beliefs about growth will affect how much they grow mentally. Now imagine how much growth a student (i.e., Human) is missing out on if they move through their life with a fixed mindset. The Blackwell et al. (2007) study states "...it was students' motivational framework, rather than their initial achievement, that determined whether their math grades would climb or not as they made their way through junior high school" (Blackwell et al., 2007 p.258). The mindset of the student determines their growth, thus if the students' motivational framework is so important, how can we modify that? What can we do to change their motivational framework? This was the intervention in their study:

> ..students in the experimental group were taught that intelligence is malleable and can be developed; students in the control group had a lesson on memory and engaged in discussions of academic issues of personal interest to them… The key message was that learning changes the brain by forming new connections, and that students are in charge of this process. This message of malleable intelligence was presented in the context of an interesting reading, which contained vivid analogies (e.g., to muscles becoming stronger) and examples (e.g., of relatively ignorant

> babies becoming smarter as they learned), supported by activities and discussions (Blackwell, 2007, p. 254).

Again, their treatment consisted of a single lesson on malleable intelligence and neuroplasticity, not multiple months of exposure every day of class. The aspects of malleable intelligence and neuroplasticity were also included in my treatment. These two papers do a fantastic job highlighting the importance of mindset on human growth and development. They help to show that student mindset matters more than initial achievement.

Teacher Mindsets

The mindset of the student matters, but how important is the mindset of the teacher? Dweck (2007) states "As educators, we want all of the students we teach to profit from our efforts. A growth mindset – **ours and theirs** – helps students to seek learning, to love learning, and to learn effectively" (Dweck, 2007, p. 10). I believe this is a critical part of a classroom education, and this belief is supported by the recent research and David S. Yeager and his team. They looked at the performance and growth of 9,167 students and 223 different math teachers. They asked the question, "Can students independently implement their growth mindsets in virtually any classroom culture, or must students' growth mindsets be supported by their teacher's own growth mindsets" (Yeager et al., 2022, p.18). Their research supported the latter hypothesis. The study showed that teachers who often portrayed a fixed mindset projected that belief onto their students and in turn their students possessed more of a fixed mindset. Inversely, teachers who regularly exercised a growth mindset saw an increase in students' growth mindsets as well.

This was also shown in a separate study that looked at 57 different teachers and nearly 2000 students. This study revealed that "teachers with growth mindsets have a mild positive and statistically significant association with the development of their students' growth mindsets" (Mesler. R, 2021, p. 1). This paper further supports the stance that a teachers' mindset can greatly influence the mindset of their students. We as teachers are models for our students, and we need to remember that our mindsets, and therefor behaviors and then actions, are being seen by every student every day. Our mindsets as teachers affects the mindsets of our students, and the mindsets of our students is a strong predictor of academic success. But what about overall wellbeing?

How Mindsets Affect Wellness

A study conducted in Mexico looked at the relationship between growth mindset, wellbeing, and performance in 1,240 college students and found "that individuals who scored high in growth (vs. fixed) mindsets showed increased levels of wellbeing and also performed better in school" (Alvarado, 2019, p. 853). Although this study was conducted on college age students there are many things that can be gleaned from it. Mindset is shown yet again to affect student wellbeing as well as academic performance. This quote from the article perfectly sums up the intentions of my project "... a growth mindset will allow a person to live a less stressful and more successful life" (p. 846). I think that this can sometimes be overlooked or forgotten in schools. Standardized test scores, graduation rates, curriculum, and student behaviors often dominate meetings and discussions. Teachers are here to help kids. Teaching them about specific content should only be part of the job description.

Another study investigated how one exposure to a growth mindset lesson could impact anxiety and depression. Researchers introduced 96 adolescents between the age of 12 and 15 to a single 30 minute computer-guided online lesson on growth mindset. After this single treatment the subjects saw a reduction in "known risk factors for anxiety and depression in adolescents experiencing or at risk for internalizing problems" (Schleider, 2016, p. 170). Thus, this is yet another article that provided strong evidence that a growth mindset supported the long-term health and happiness of students. With the recent post-pandemic increase in focus on student wellness in our schools, the significance of this should not be understated. One single exposure to a 30 minute lesson on a computer was their entire treatment and they were able to show statistically significant improvement of student wellness. In response to these findings, I want to leverage the influence of mindset for the most possible benefit, and student wellness is at the top of the list.

But how does a growth mindset physically manifest? We are biological creatures that operate within the realms of chemistry and physics. Is there any physical difference between a human that possesses a growth mindset and one who possesses a fixed mindset? It turns out there is, for example, in a study conducted on 231 healthy adolescent students, scientists performed structural magnetic resonance imaging to look at neuroanatomical correlates of growth mindset and grit. The scientists were trying to see if there was a physical manifestation of growth mindset and the brain. Their study "presents novel evidence for the neuroanatomical basic of grit and highlights that growth mindset might play an essential role in cultivating a student's grit level" (Wang, 2018, p. 1688). Thus researchers saw a greater increase in volume in specific portions of the brain with students that possessed a growth mindset vs students that possessed a fixed

mindset. This ties in perfectly and corelates to exactly what we would expect to see in regard to neuron myelination and neuroplasticity.

As shown in the studies summarized above, there is extensive research showing the benefits of teaching kids about growth mindset. This provided me with ample justification to conduct my action research project.

CHAPTER THREE

METHODOLOGY

Demographics

My action research included four sections of sophomore level biology and one section of advanced placement biology this past year. I used all of my classes in this study for a total of 112 students with a distribution of 14 seniors, 13 juniors, 84 sophomores, and 2 freshmen. With the exception of a handful of absences, every student took the pre and post-treatment measure of your mindset surveys, as well as the pre and post-treatment Princeton U-matter surveys. Every class was exposed to the treatment plan. I did have to modify the treatment schedule for AP biology to accommodate for lab and test scheduling. I conducted stratified random sampling for my student interviews. After administering the initial mindset survey, I looked at the distribution of mindset scores and split the students into various groups (i.e., the sample strata) including high growth mindset, low growth mindset, and fixed mindset. Once I had students placed in these groups, I randomly sampled students within each strata for interviews. For my biology classes I had a large variety of students, and I think this provided me a good representative sample of the entire student population at Sentinel High School. It is the final mandatory science class so for some students it may be their last, but for others it may be the last non-AP Science course they take. This leads to some classes being quite difficult when it comes to scaffolding and trying to make lessons and activities appropriately challenging for all students. Such is the life of a public school teacher. The total student population of Sentinel High School is 1397 with 399 of them eligible for free and reduced lunches. This is 28.5% of the student population.

Within this student population there are 50 Hispanic/Latino students, 67 American Indian students, 22 Asian students, 21 African American students, 2 native Hawaiian or other Pacific Islander students, and the rest of the student population is white.

Treatment

I implemented a series of growth mindset lessons, examples, exercises, and videos to try to slide kids over to the growth mindset side of the spectrum. Although you can see the detailed "treatment implementation plan" (Table 1, below), I think a huge part of kids acknowledging and then adopting a growth mindset is modeling it as a teacher. How did I respond to their questions? What did I say when a kid says, "I am just not good at science". How did I model a growth mindset for them as a lifelong learner? I think this was extremely important and something that was hopefully shown every time they were in my class. Hopefully students witnessed endless examples of growth mindset from me and their peers throughout the entire year. Having a growth mindset is a skill. We can grow and practice this skill.

In addition to an ongoing treatment of modeling a growth mindset throughout the entire year I also taught a series of mini lessons that covered the topics shown in Table 1.

Table 1. Treatment Plan used in the Action Research Project at Sentinel High School.

Timeframe	Topic	Treatment
November 2nd 2022	Princeton U-Matter survey.	Students took the Princeton U-Matter survey.
November 4th 2022	Measure your mindset survey	Students took the survey over mindsets.
November 7th 2022	Kaizen it.	Mini Lesson on Kaizen. Everything is a Skill. Kaizen it. Student chose a skill to kaizen.
November 14th2022	What is a Mindset?	Showed this video: Growth Mindset Introduction: What it is, How it Works, and Why it Matters By Trevor Ragan. https://www.youtube.com/watch?v=75GFzikmRY0&ab_channel=TrevorRagan
December 5th 2022	The Brain, neuroplasticity, and myelin.	Mini Lesson over the human brain, neuroplasticity, and myelin. What is the science behind learning? What physically is happening when you learn? Tied this into cells and cellular structures lesson and then watched these videos: https://www.youtube.com/watch?v=1EQ3kAPzVVI&ab_channel=TheBrainCentre https://www.youtube.com/watch?v=kWIagHUqD8A&t=96s&ab_channel=PlasticityCenters

January 13th 2023	Wabi-Sabi	Mini lecture over Wabi-Sabi. The recognition and appreciation of imperfection and impermanence.
January 24th 2023. End of the semester.	Kaizen cards	Student completed "Kaizen cards" for me. On one side of a note card I asked them "What is something I do as a teacher that you like?" On the other side I asked them "What is something I could improve upon as a teacher?"
February 10th 2023	Ikigai.	Lesson about Ikigai. Japanese word for "sense of purpose" or "reason for being." Your Ikigai is: Something that society / the world needs. Something that you love. Something that you are good at. Something that you can get paid for.
February 17th 2023	Read and discussed abstract of scientific paper. Took final growth mindset survey.	Students were reminded of neurons, myelin, and neuroplasticity. We then read through and discussed the abstract and implications of: Neuroanatomical correlates of grit: Growth mindset mediates the association between gray matter structure and trait grit in late adolescence (Wang, 2018, p. 1688).
March 7th 2023	Princeton U-Matter Survey	Students completed final wellness survey.

March 10th 2023	Student Interviews	Students were selected via stratified random sampling in regard to their second quarter grades. Two students were randomly selected for every grade category per class. Refer to appendix D for interview questions.

The first mini lesson was introducing students to a Japanese concept called Kaizen. “Kai” means change and “zen” means good. It is a quick and catchy word that represents the idea of a growth mindset or continual growth. After introducing mindsets and the concept of Kaizen (good change or continual improvement) I started “Kaizening” with my kids during the passing periods as they trickled into the classroom. I have done this in years past and it has been pretty cool. They choose something they wanted to get better at and have a couple of minutes during the passing period where they can practice. Kids chose everything from juggling, to origami, and drawing, Sudoku’s, handstands, these balance boards I have in class, and so on. I participated as well with the kids as well and tried to be a good model of a growth mindset. We started with doing 1 push up the first week, then 2 then next, and 3 the third and so on. We did this for nearly the entire semester and it was pretty cool for some kids. For future years I have thought about doing a variation of this by doing a different exercise on each day. For example, doing push-ups on Monday, pull ups on Tuesday, Sit ups on Wednesday, body squats on Thursday and then going on a run Friday. This was all completely voluntary and no student was forced to participate in this. Some students sat at their desks and did nothing, still others looked at their phone, but the majority of students in the majority of classes started to Kaizen something. This “Kaizen time” was only during the passing period and the first minute or two of class so it did not take away

from any instructional time. We started with 1 pushup on the week on November 7th and at the time of writing this we were up to twenty. The mini-lessons on growth mindset and kaizen time along with my modeling was the treatment for my project.

Instrumentation

The measure your mindset survey was taken from a previously completed action research project done by Schuman (2017). It was a modified version that was used in two previously completed studies (Blackwell, 2007; Yeager, 2014). The U-matter survey was developed by Princeton university as a tool for individuals to self-assess the various aspects of their wellness. The Princeton U-matter survey was recommended to me by a colleague at Sentinel and is also used in the health and wellness class they teach. These two data collection methods were selected to ensure credibility and validity. Triangulation was also used in addition to getting peer colleague and professor review. The research methods and data collection instruments for this project received an exemption by Montana State University's Institutional Review Board (refer to appendix C).

Table 2. Data Collection Matrix

Focus Questions	Measure your mindset survey. Pre and Post	1st and 2nd quarter grade.	Student Interviews	Princeton U-Matter survey. Pre and Post
How does student mindset change after being exposed to growth mindset?	x		x	
How does student mindset affect academic growth throughout a quarter?	x	x	x	
How does student mindset affect their overall wellness?	x		x	x

CHAPTER FOUR

DATA AND ANALYSIS

Results

The first question I investigated was how does student mindset change after exposure to the treatment of mindset lessons. Before exposing students to any mindset lessons, they completed the measure your mindset self-survey (Appendix A). Then after exposure they completed the same mindset survey. The results can be seen and are discussed below (Figure 1) (Figure 2).

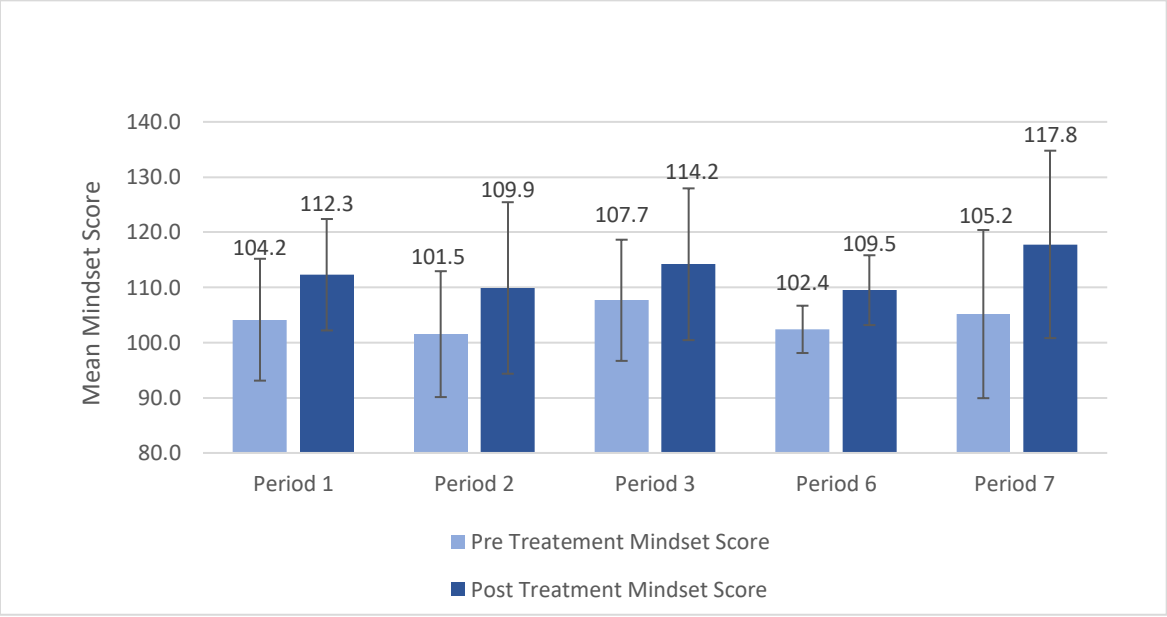

Figure 1. Pre vs Post Treatment Student Mindset Scores (*N*=94). Bars above histograms show SD

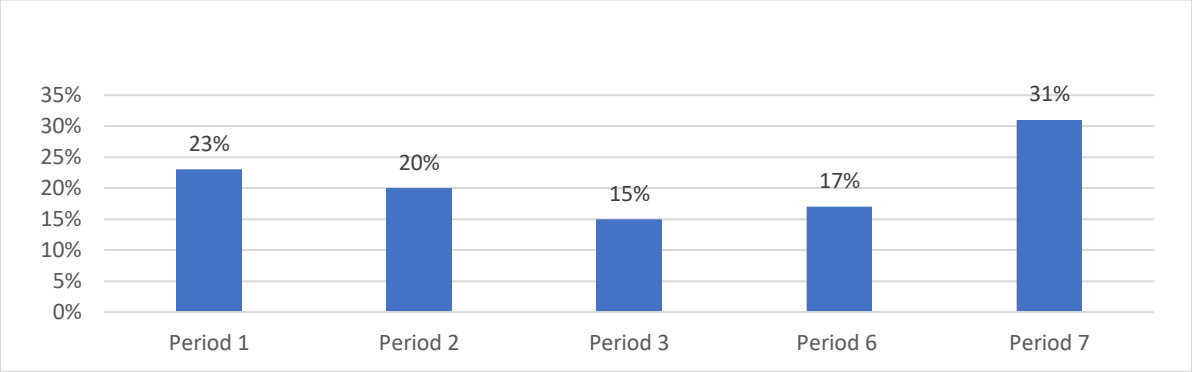

Figure 2. Average of Gains in Student Mindset Score (*n*=60).

The mindset survey is a 24 question Likert style survey where each response is scored from 1-6. The responses once scored are then added up with the sum being their mindset score. A maximum score, and complete growth mindset is a score of 144. As shown in the data all classes had an increase in their average mindset scores. This was then analyzed by conducting a normalized gain, and then generating average of gains statistical test.

First period was AP Biology which consisted of seventeen seniors, six juniors, and one sophomore. There were fourteen females and ten males. Period 1 increased from an average mindset score of 104.2 (with a standard deviation of 11.0) to 112.3 (with a standard deviation of 10.1). This is a 23% average of gains increase. This shows that not only did the overall average increase from pretreatment to post-treatment but also the variation within the data decreased from pre to post for this period. There were fourteen students that completed both the pre and post mindset survey in this class and all fourteen students showed an increase in their mindset score. The least amount of gain was from a student that increased by only two mindset points, but another student increased by as much as 33 points, and another that increased by 24. There were fourteen students that completed the pre and post assessments and 100% saw an increase in their mindset score. The normalized gains for students showed increases that ranged from 5% to

55%. There were six students that completed the pre assessment, but then were absent for the post assessment, and two other kids that missed the pre-test but completed the post-test. Their data was included in the overall class averages, but not considered when calculating normalized gains. This is consistent for all periods.

Second period was regular biology which consisted of one junior and twenty sophomore students. Throughout the course of the year there were three students that left this class and two that joined part way through the semester. There were twelve males and nine females. Second period scored an average of 101.5 on the mindset pre-assessment (standard deviation of 11.4) and an average of 109.9 on the post (standard deviation of 15.5), which is an increase of 8.4 of average student mindset score. This is an average of gains increase of 20%. Although the average increased so did the standard deviation. There were seven students that either chose not to or were absent the day we took the post assessment. There were eight students that took both the pre and post assessments. Out of those eight students one students' mindset score stayed the same, and one students' score decreased by fourteen points which was the largest decrease of any student. I will speak more about this student later in the next chapter. All six other student mindset scores increased for a total of 75% of students' mindset scores increased from pre to post-treatment.

Third period was regular biology which consisted of twenty-two students. One junior and the rest sophomore. There were nine males and eleven females. There were sixteen students took both the pre and post assessment with eleven of them showing increases in their mindset score. The five scores that decreased typically did so by a small margin. For example, one score decreased from a 133 to a 129, and another from 114 to 111. The five scores that decreased did

so by relatively small values of two, three, four, eight, and thirteen. Even with this said there was still an increase of growth mindset scores from 69% of students in this period. Although there were five students that showed slight decreases in their mindset score, the average of gains or the entire class was still 15%. The average student mindset scores increased from 107.7 (standard deviation of 10.9) to 114.2 (standard deviation of 13.8).

Sixth period was a regular biology class consisting of twenty-two students. Three of them were juniors and the nineteen of them were sophomores. Eight of them were female and fourteen of them were male. There were nine students that were either absent or chose not to take the pre or post treatment mindset assessment. Out of the remaining ten students 100% of them showed a positive increase in their growth mindset score. The average mindset score of the pre-assessment was 102.4 (standard deviation of 4.3) which increase to an average of 109.5 (standard deviation of 6.3). This showed an average of gains of 17%. Period six also showed the least amount of standard deviation in both the pre and post assessments.

Seventh period was regular biology class consisting of twenty-three students. Two students were freshman, one was a junior, and the remaining were sophomores. There were six students that completed the pre but not post assessment, and two that only completed the post assessment. This was again due to absences during those days. Out of the twelve students that completed both the pre and post assessment all but two showed an increase in their mindset score. One student decreased from 129 to 117 and another had a slight decreased from 99 to 96. Even with two students' scores decreasing this class saw the largest increase in the average of gains compared to any class with a gain of 31%. There was an increase in mindset score from 83% of the students in this period. The pre-treatment assessment average mindset score was

105.2 (standard deviation of 15.2) and the post treatment assessment average mindset score of 117.8 (standard deviation of 17). Seventh period showed the largest standard deviation in both the pre and post assessments.

These mindset results were great to observe, and I was obviously expecting and hoping for this, but was not completely confident that it would happen. As discussed in the conceptual framework, possessing a growth mindset can have long term implications for a student learning and student wellness, so to see this growth in every class was a success in my eyes. There were only eight out of sixty students that did not increase their growth mindset score, thus nearly 90% of students increased their mindset score. The decrease of mindset score in those eight students were by margins of two, three, three, four, eight, twelve, thirteen, and fourteen, respectively, thus half of the students that decreased in their mindset score did it by values of four or less.

In conjunction to getting a number that represents the students' mindset scores, they also had a chance to elaborate on why they think they scored how they scored. The prompt at the end of the mindset survey was: Do you think the description of your mindset matches the way you think and feel? Which parts are true for you and which are not? Explain your thinking.

The following are some quotes by students that support and elucidate the trends that were shown by the increase of mindset scores from pre-treatment to post-treatment. The quotes are in response to the prompt and are taken from students that scored in the G3 (Mindset score of 108-19), G4 (Mindset score of 120-131), or G5 (Mindset score of 132-144).

> I think that everyone is not born with a set intelligence, and that it can be increased. I always strive to learn more, and I feel more accomplished when I work through something that was hard as opposed to something that came easily. I do feel sad when I don't do well when I work hard, but I know that with time and practice I will get better at the things I want to improve on.

I love how this student highlights the importance of time and practice in regard to the importance of growth. Those are two vital aspects of growth that we learned about during our mindset lessons. Another student stated "Yes, I do think that people can increase their intelligence. I think that it is much more important to learn and enjoy it, then always try and do perfect. While this is hard I try to follow this value." I think that students seeing the importance of learning over performance is so important. Especially in the age of high stakes testing, learning material for a test, then forgetting about it right after is common practice. So, it was great to see this student emphasize the importance of learning. This next quote is from a student that scored a 124 on his post assessment. Unfortunately, he was not present for the preassessment to see how his response would have changed but here was reply to the prompt when he complete the post-treatment survey: "Yes. Because I used to think that if you weren't born with talent you wouldn't be able to learn it. Which is totally the wrong way to think about it like that. Instead you should be thinking of ways to get good at it and not self-pity yourself."

This students' response supports the overall trend in data that the mindset of students increased from pre to post-treatment. It shows that a student who had never heard about growth mindset, and possessed a very fixed mindset view of talent and skill, can change after being taught about growth mindset.

This next response was one of my favorites to read. It tied together the lessons of growth mindset that we went over in class to all of the potential applications of it for the rest of your life.

> It definitely does match how I feel / think. I always enjoy stuff that's challenging for me to do. Earlier this year, I took a class on guitar. Before hand I had never even held a guitar. Now I can play with ease and know quite a few songs. I feel that improvement is always happening wherever I go or whatever I do. I hope to show after the summer break that I can play the ukulele. In the words of Shuzo Matsuoka: Never give up!

This student then proceeded to do a quick, but very good sketch of a cartoon character that I did not recognize. He labeled it: “Chopper from One Piece. The most grit-filled character.” Clearly this student had been exposed to growth mindset in one form or another in the past, but it still strongly supports the trend in the data. This student increased his mindset score from 122 to 138 which is a normalized gain of 71%. This shows that the treatment did not only help students who possessed a fixed mindset but also helped students who already possessed a strong growth mindset.

I would like to also include some of the responses from students that had a decrease in their mindset score from pre to post assessment. The first is from a student that scored a 102 (G2) on the pre-treatment assessment and then scored an 88 (G1) on the post treatment assessment. Their response on the pretreatment assessment was as follows:

> I think that it’s pretty accurate for me. I like to learn things and do well and will put in effort to do so, and although messing up discourages me quite a bit, I still use my failures as a learning experience and work harder next time. I do tend to strive for perfection and get sad if I don’t get it, so it’s a little off but the learning experience is also important to me. Probably like a 90% match.

This is their response from the post-treatment assessment:

> Sort of. I do believe that you can change your intelligence and grow with effort and I do challenge myself in order to get smarter and learn more. My intelligence and grades are very important to me. I think what threw off my score a bit is my fear of failure. I tend to beat myself up if I’m not perfect in everything. I do believe intelligence can be changed, I just have some internal issues and fears to get past.

This student showed a high level of consistency with various aspects of these responses. On both responses this student included a section about perfection which is a final product, not a process. “I do tend to strive for perfection and get sad if I don’t get it” was the statement in the

pre assessment followed by “I tend to beat myself up if I’m not perfect in everything.” As discussed in the conceptual framework, people who possess a fixed mindset tend to focus on performance, outcomes, result, and not looking bad, as opposed to those who possess a growth mindset who focus on the process of getting better, learning, and growing. People that possess a fixed mindset typically see effort as not useful, they look at challenges as threats, they easily get discouraged by their mistakes, and they respond negatively to feedback. This then leads to a decrease in learning and growth because it takes away from them embracing challenging situations that could help them learn, because they don’t want to risk showing that they are not “perfect”. This student would typically be put in the category of being a “high achiever” and received a 97% and 94% on their quarter 1 and quarter 2 grades respectively. So it was not as if this mindset led to poor performance from an academic perspective, in fact it could have increased academic performance, but we must look at the student as a whole, and what is the cost of chasing this “perfection”? This student was medically excused from school for a number of weeks during the semester because they reported suicidal thoughts. In my experience this is an occurrence that is becoming more and more common in our youth today. Too much emphasis placed on “performance” and “testing” and not enough emphasis placed on learning and growing. This leads to students seeing their results as a direct reflection of themselves that is unchangeable, not as a marker or indicator for what aspects they may need to focus more on in the future. This student has since returned to class and seems to be doing well which is amazing, but is it worth thinking about how their mindset could have played a role this. It is also worth acknowledging that mindset can change, and how this student could use this as an opportunity to learn from this, grow, and move forward in their life. I feel like their final sentence of their post-

treatment response ends on a hopeful note “I do believe intelligence can be changed, I just have some internal issues and fears to get past.” I want to substitute the phrase “get past” to “grow through” for them.

Here is another example of a student who possessed a fixed mindset. They were absent for the pre-assessment but scored an 80 on the post assessment. This was the second lowest mindset score out of all surveys both pre and post, with the lowest being a student that scored a 77 on the pre but then grew to a 102 on the post.

> I do think I can change but I do not see the logic for it. I will learn new things for when it is needed then forget it when I find it useless. I do not think I am capable, nor do I necessarily want to be. I think if I were, I would take away a chance meant for someone else who is better then I.

This was quite a unique response, which matches up to the unique student that constructed it. This was an awesome human that I enjoyed many conversations with. They would often hang out in my room during lunch, and I have had many conversations with them. In those conversations they shared how they had a history of depression, were currently on a number of medications, and there was clear evidence of many past occurrences of self-harm on this student’s arms.

I know that these were not the only two students in my classroom who were suffering from depression and suicidal thoughts, and I know that there are a multitude of factors that play into the vastly complex realm of behavior and depression, but I did find it worth noting that two of the students that scored the lowest on the mindset score also happen to suffer from depression. This observation is also consistent with the literature on the topic as discussed in the conceptual framework.

The response shown below is from a student that scored a 111 on the mindset pre-assessment which falls under the category of G3. Unfortunately, they did not complete the post-treatment assessment due to being absent that day. So according to the Likert survey he possesses a fairly strong growth mindset, but his response does not align with that which is quite interesting.

> This description somewhat matches me. I don't really think intelligence itself can be increased. But I think you can always learn more and become more capable. Even if I'm learning a lot, I get demotivated very quickly if I don't perform well. Many things come very easily to me, so when something doesn't it can be hard to stay motivated. I don't really believe in "talent" Peoples brains work differently so certain things may come easier to some then others, but I wouldn't say you're naturally talented at it.

The slightly contradictory nature of the mindset score and the free response makes for an interesting dilemma, and to really dive into the complexity of it I think we would have to agree upon the definitions of some words, for example they state "I think you can always learn more and become more capable," but also state "I don't really think intelligence itself can be increased." It would have been nice to interview this student to flesh out some more details about what he meant, but they were unfortunately not selected during stratified random sampling.

The results I presented above, in conjunction with student interviews and student written responses, provides evidence that students mindsets can and did change from pre-treatment to post-treatment.

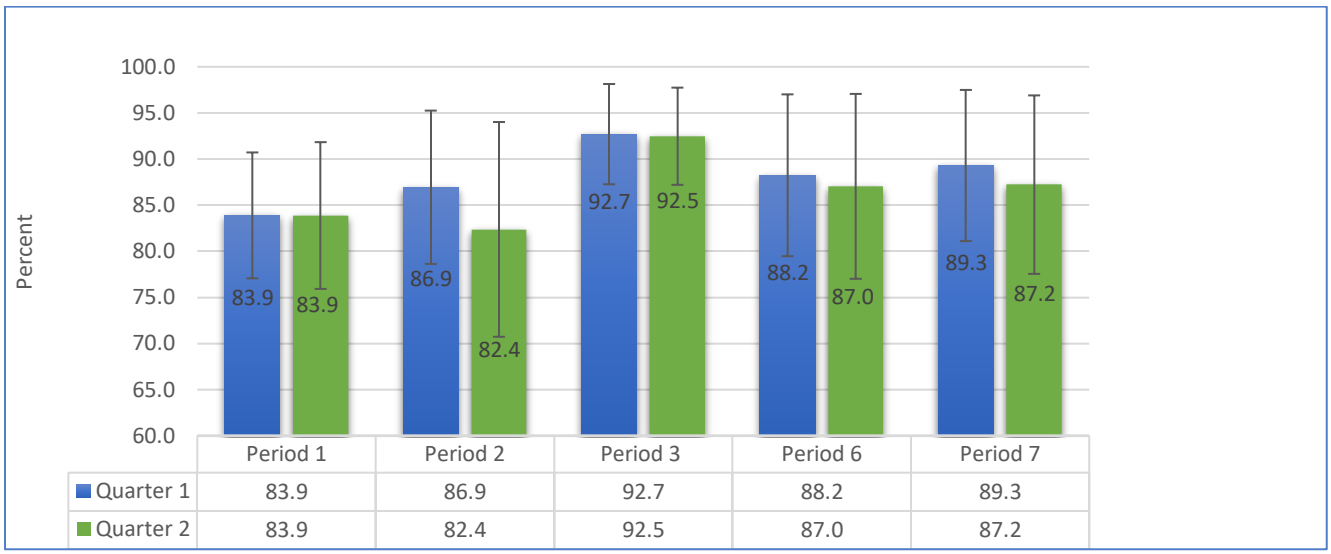

Figure 3. Average Quarter 1 and Quarter 2 grades (*n*=60, SD shown as whisker bars).

The second question I investigated was how does student mindset affect student performance and growth throughout a school year? To try and answer this question I looked at students' quarter one and quarter two grades. I also looked for any correlation between a students' mindset coming into my class compared to their first quarter grades. I ran a Pearson correlation test, and then completed a t-test to derive a p-value on all periods. There was no significant correlation between a students' initial mindset score and their performance in my class, nor was there any significant correlation between mindset score and growth from quarter one to quarter two. Figure 3 includes the scores of all of the students that completed both of the pre-treatment mindset survey and the post-treatment mindset survey. It does not include students that missed one or both of the surveys.

Period 1 which was AP biology had a quarter one and quarter two average of 83.9 (*n*=14), but as you can see there was an increase in the standard deviation of scores in quarter two from 6.8 to 8.0. The pre-treatment mindset score average of period one was 104.2 which

increased to 112.3 for the post-treatment average. Although there was growth in student's mindset scores there was no change in the average student scores from quarter one to quarter two. A Pearson correlation test was run on the pre-treatment mindset scores of students and their quarter one grades which resulted in a correlation coefficient of 0.11, which shows a slight correlation between the two variables. Once a correlation coefficient was found, I then performed a t-test which would allow me to derive the p-value. The t-test for period 1 pre-treatment mindset score and quarter one grades resulted in a t value of 0.38. Using this number then I calculated a p-value of 0.70 which means that there was little predictive power of a students' mindset score coming into the class and their quarter 1 grade. Students that entered my class with a higher mindset score did not necessarily perform better than students with a lower mindset score. There was no significant correlation between students' pre-treatment mindset scores and quarter one grades.

Period two students had an average quarter one grade of 86.9 (n=8) and an average quarter two grade of 82.4 with standard deviations of 8.3 and 11.6 respectively. The mindset scores average increase from 101.5 to 109.9 from pre to post-treatment. Although the mindset score of students increased on average the actual grades of the students decreased. When looking at the correlation coefficient of pre-treatment mindset scores and quarter one grades a value of .33 was calculated. This resulted in a t-value of 0.92 and a p value of 0.38 which means there was no correlation between students' pre-treatment mindset scores and their quarter one grades.

Period three students had an average quarter one grade of 92.7 (n=16) and an average quarter two grade of 92.5. The standard deviation remained quite consistent with 5.4 in quarter and 5.3 in quarter 2. There was a high population of students in this period who would be

considered “high achieving” and had a more rigorous course load. I believe this was due to the course schedule only offering certain AP and honors classes during certain periods. The quarter one and quarter 2 average scores did not increase although the average mindset score increased from 107.7 pre-treatment, which was the highest average of any class, to 114.2 post-treatment. A correlation coefficient of -0.03 was found, with a t test resulting in -0.12. This was the only class that had a negative correlation, albeit very small, between pre-treatment mindset scores and quarter one grades. A p-value of 0.90 was then calculated, which means that there was no significant correlation between the pre-treatment mindset scores and quarter one grades.

Period six students had an average quarter one grade of 88.2 and a quarter two average of 87.0 (n=10). The standard deviation increased from 8.8 to 10.0. Their mindset scores increased from 102.4 pre-treatment to 109.5 post-treatment. A correlation coefficient of -0.14 was calculated when looking at pre-treatment mindset scores and quarter one grades. This suggests a slight negative correlation between mindset score and grade. A t-value of -0.42 was calculated which resulted in a p-value of 0.68, which suggests that there was no significant correlation between students’ pre-treatment mindset scores and their quarter one grade.

Period seven students had an average of 89.3 for their quarter one grades (n=11) which slightly decrease to 87.2. Their pre-treatment mindset score average was 105.2 which increase to 117.8. A correlation coefficient of 0.08 was calculated when looking at pre-treatment mindset scores and quarter one grades. A t-value of 0.28 was calculated which resulted in a p-value of 0.78, which suggests that there was no significant correlation between student pre-treatment mindset scores and their quarter one grade.

The third question I wanted to address in my project was how does student mindset affect their overall wellness? As you will see there was a positive increase of wellness in students for a number of different categories. After collecting the pre- and post-treatment data I performed a Chi Squared analysis to assess the statistical significance of the potential independence between the two data sets. I also analyzed the % change in responses, and change in mean, median, and mode. The wellness assessment consisted of 49 Likert style questions rated on a score from 1 = Never to 4 = Usually. I focused my data analysis on only a portion of the questions given in the survey. The pretreatment assessment consisted of 85 responses from students in all my classes. The post-treatment assessment consisted of only 74 responses, due to a large number of students being absent for a variety of events on the day students completed it. Due to the sensitive nature of some of these questions the IRB required that students submit them anonymously, meaning that I could not look at an individual growth or change from pre to post, so I instead focused on the entire group. In the future I would like to be able to see individual student change and growth.

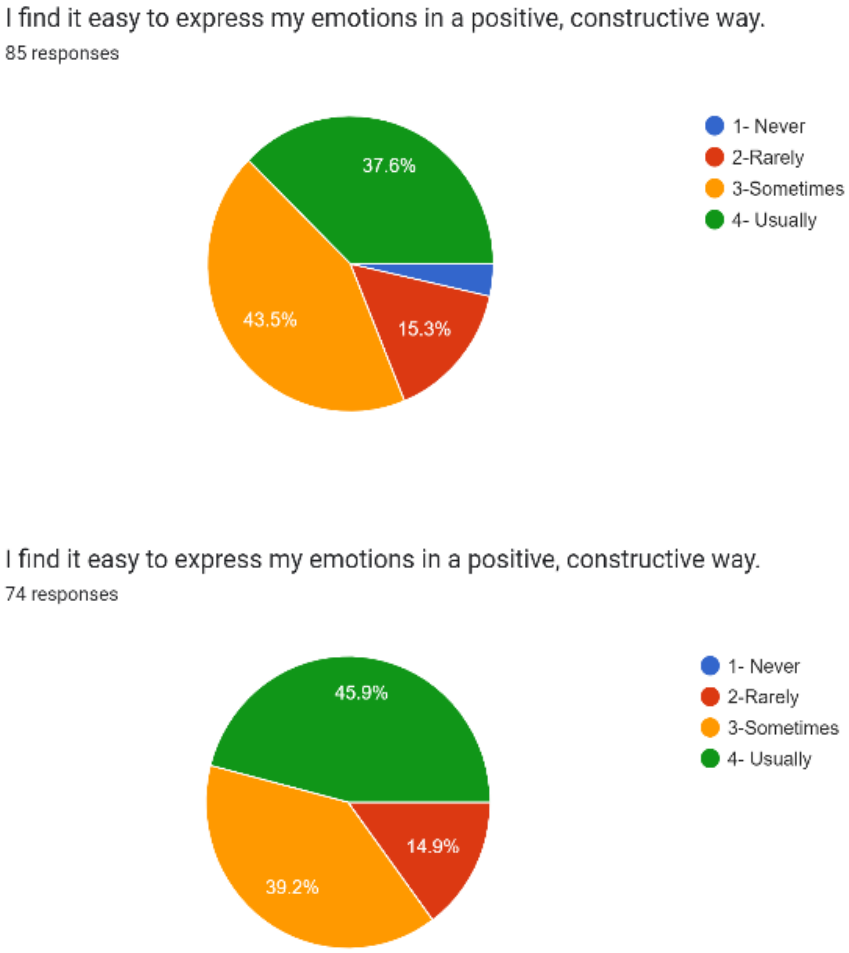

Figure 4. Pre (Top. n=85) vs Post (Bottom. n=74) treatment responses to the statement: I find it easy to express my emotion in a positive, constructive way.

There was an increase from 37.6% to 45.9% in students that responded 4 = Usually. Not only was there a positive 8% shift in the number of 4 = Usually responses, but also a decrease in the number of students that responded 1 or 2. After treatment there were zero students who responded with a one as opposed to three in the pretreatment who responded with a one. The mean of student scores went up from 3.15 to 3.31 from pre to post assessment. The mode changed from a 3 on the pretreatment assessment to a 4 on the post treatment assessment. This

data resulted in a Chi Square value of 3.45 which is less than a critical value of 7.81 so we must accept the null hypothesis that the two pie chart results are not independent. Although we saw change there was no statistical significance between the pre and post assessment.

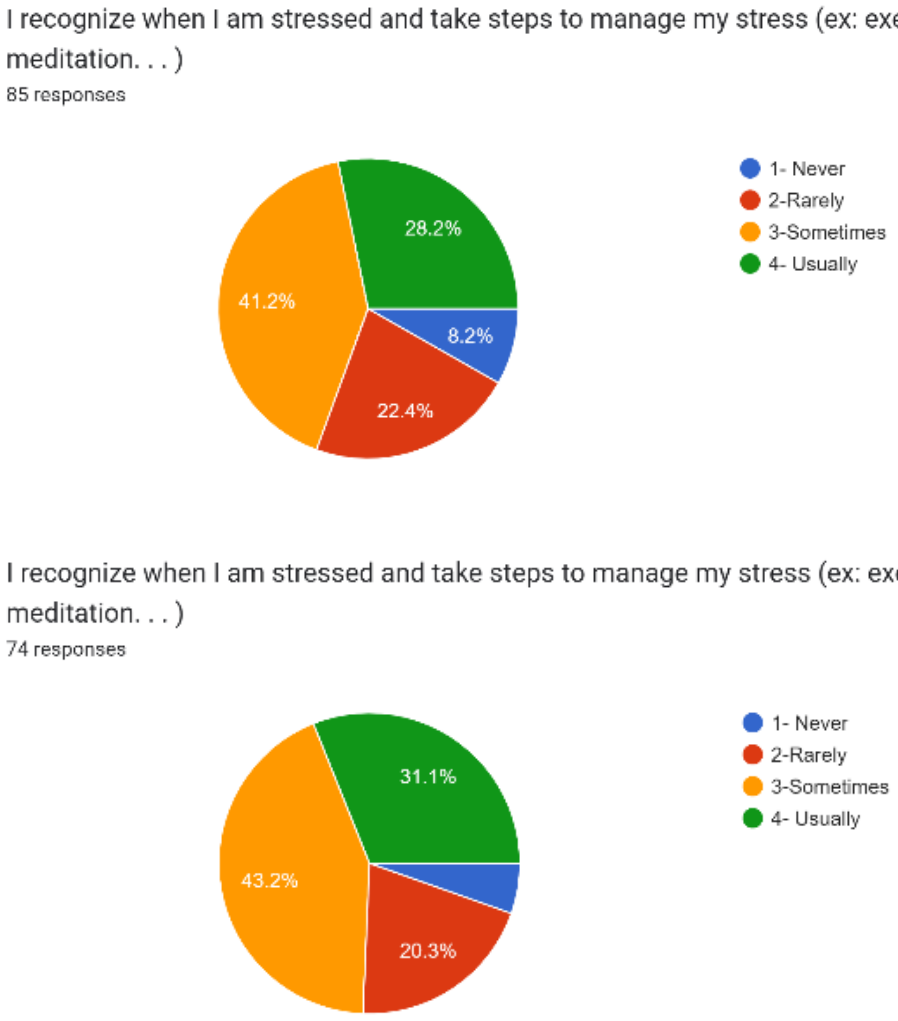

Figure 5. Pre (Top. *n*=85) vs post (Bottom. *n*=74) treatment responses to the statement: I recognize when I am stressed and take steps to manage my stress (ex: exercise. quiet time, meditation.)

The mean score for the pre-assessment was 2.89 which increased to 3.00 in the post assessment. What struck me when looking at this data (i.e., Fig. 5) is that there was a decrease

in the percent of students that scored a one or two and an increase in the percent of students that scored a three or four. Although there was a positive trend in the data for this category, I would have liked to see a greater increase in student scores. This data resulting in a Chi Square value of 0.68 which means there is no significant difference between our pre and post data (i.e., they were not independent).

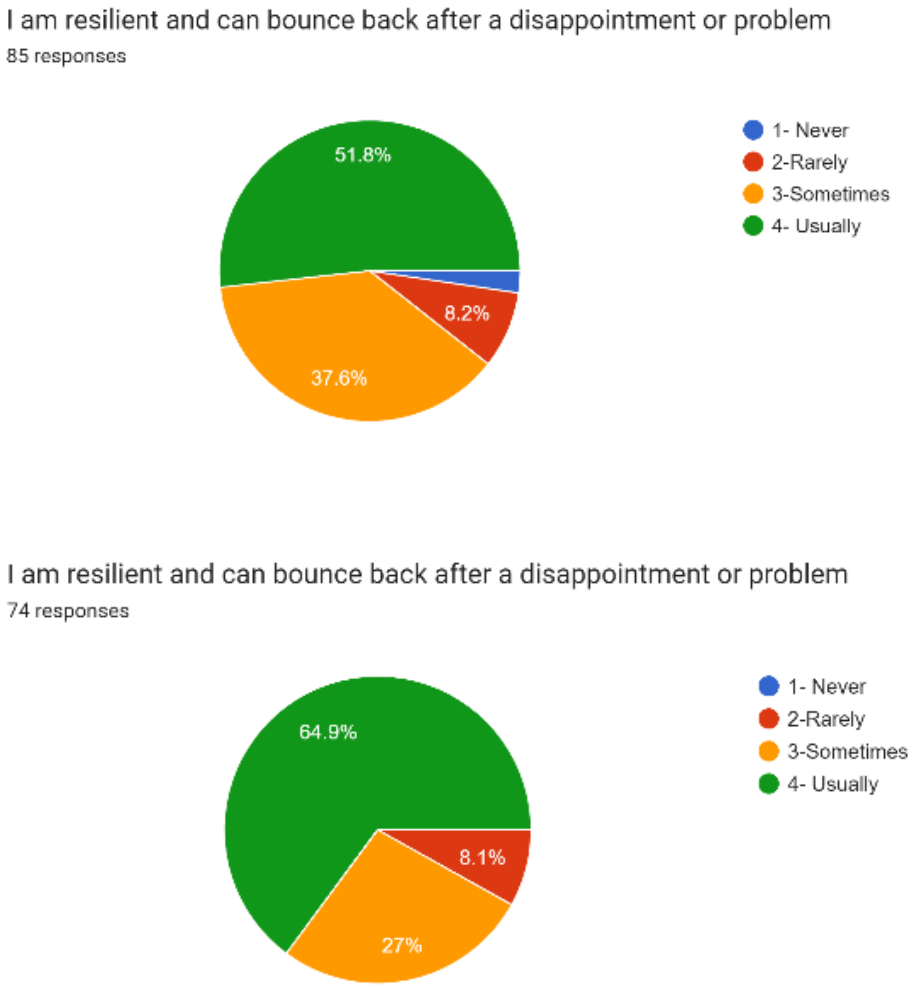

Figure 6. Pre (Top. *n*=85) vs post (Bottom. *n*=74) treatment responses to the statement: I am resilient and can bounce back after a disappointment or problem.

Being resilient is something that was directly addressed in the treatment, so it was great to see this data. The mean score increased from 3.38 to 3.57. The number of responses for 4 = Usually increased from 51.8% to 64.9%. Resiliency and being able to "bounce back" after a disappointment or problem is a foundational aspect of possessing a growth mindset. So, to see growth in the mean as well as a 13.1% increase in 4 = Usually responses was great. This data resulted in a chi square value of 4.28 so we must accept our null of no difference.

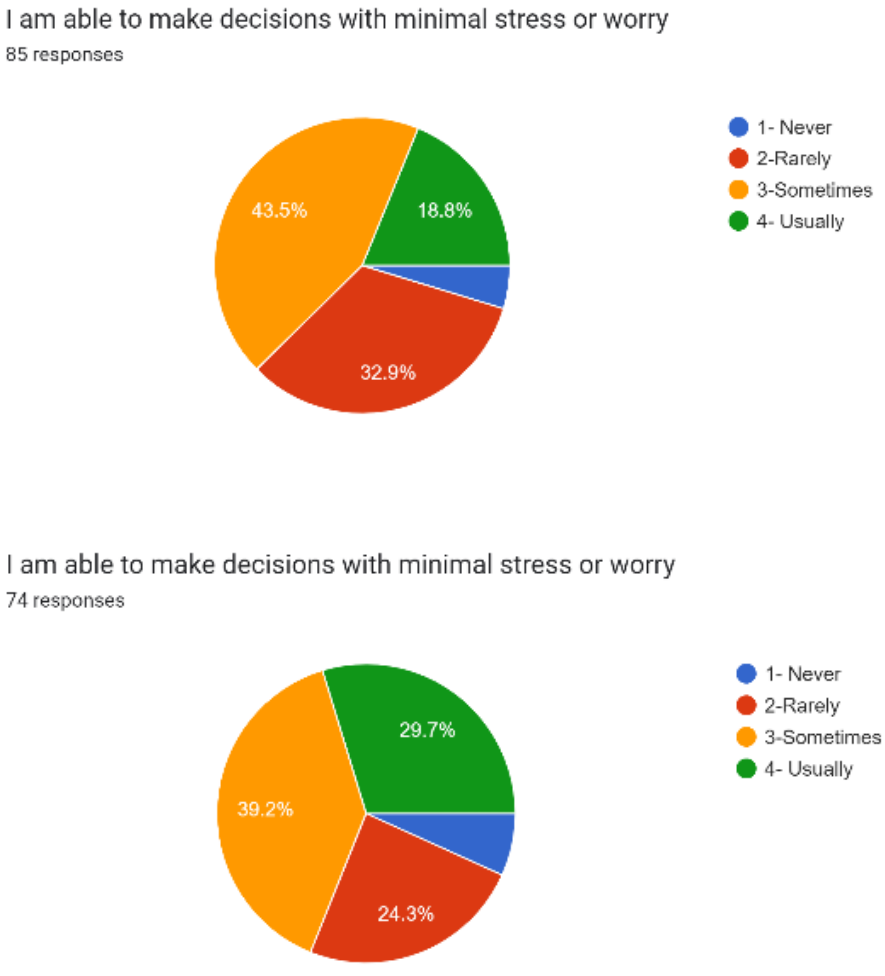

Figure 7. Pre (Top. *n*=85) vs post (Bottom. *n*=74) treatment responses to the statement: I am able to make decisions with minimal stress or worry.

The mean score increased from 2.76 to 2.91 from pre to post. There was also a growth 18.8% to 29.7% of students responding 4 = Usually. Students that responded 2 = Rarely decreased from 32.9% to 24.3%. The data does not show independence from pre to post after running a chi squared test.

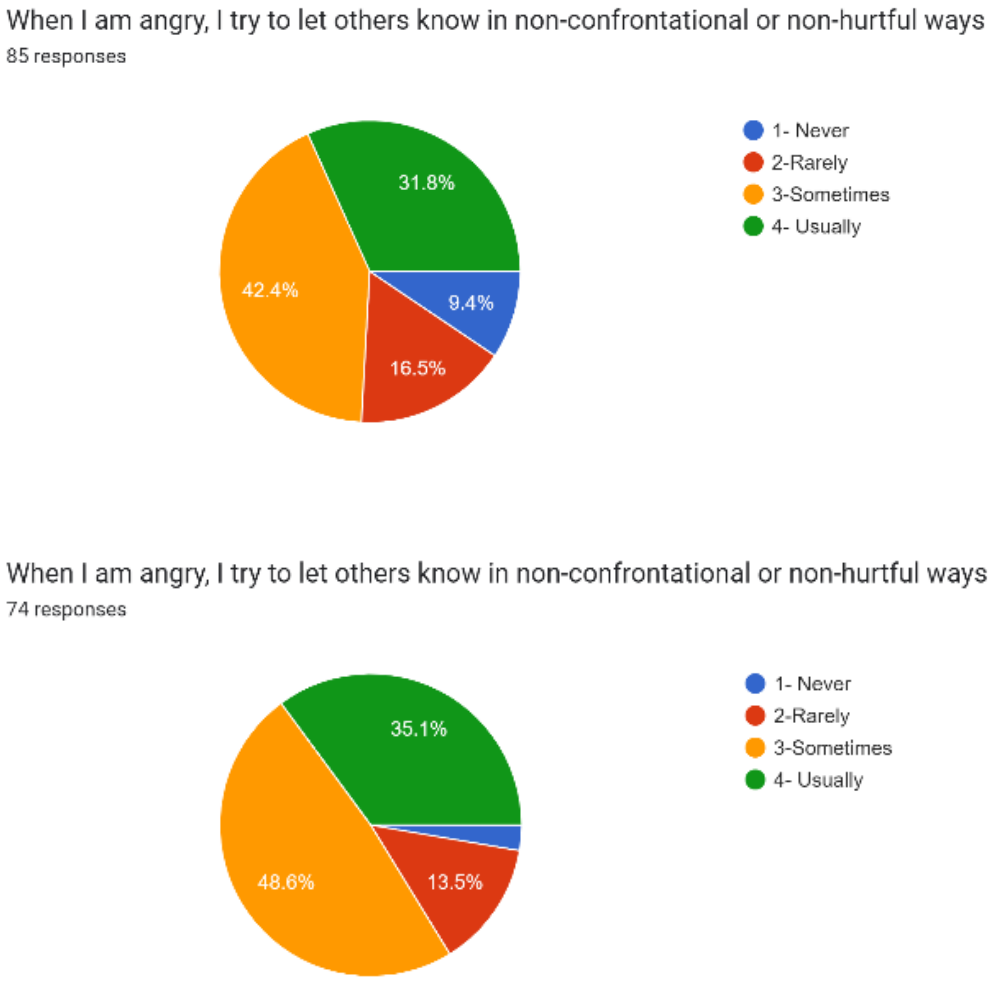

Figure 8. Pre (Left. *n*=85) vs post (Right. *n*=74) treatment responses to the statement: When I am angry, I try to let others know in non-confrontational or non-hurtful ways.

The responses in both 3 = Sometimes and 4 = Usually increase from 42.4% to 48.6% and from 31.8% to 35.1% respectively. There was also a decrease from 9.4% to 2.7% of students that

responded with a 1 = Never. The mean score from pre to post assessment increased from 2.96 to 3.16.

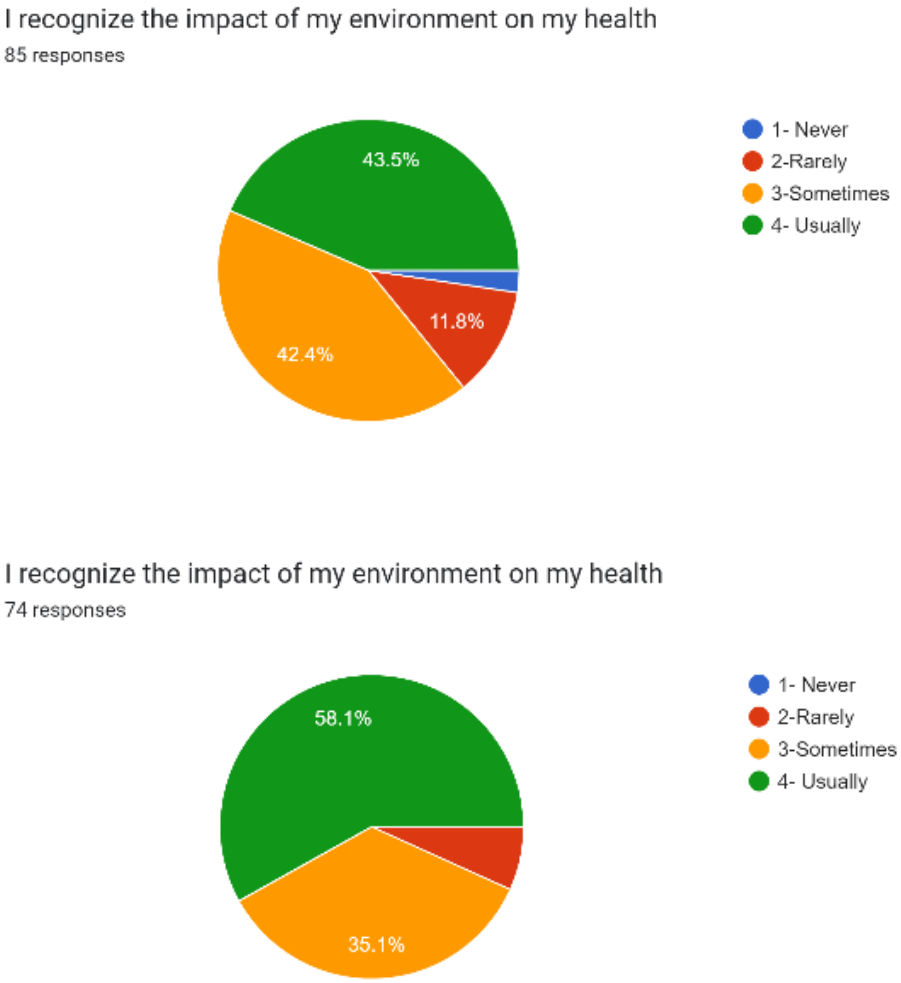

Figure 9. Pre (Top. *n*=85) vs post (Top. *n*=74) treatment responses to the statement: I recognize the impact of my environment on my health.

There was an increase from 43.5% to 58.1% of students that responded 4 = Usually. The median moved up from a 3 to 4, and the mean changed from 3.27 to 3.51 from pre to post. This data resulted in a chi squared value of 4.9 which is nearing the critical value of 7.8 but we still must accept the null hypothesis of no difference.

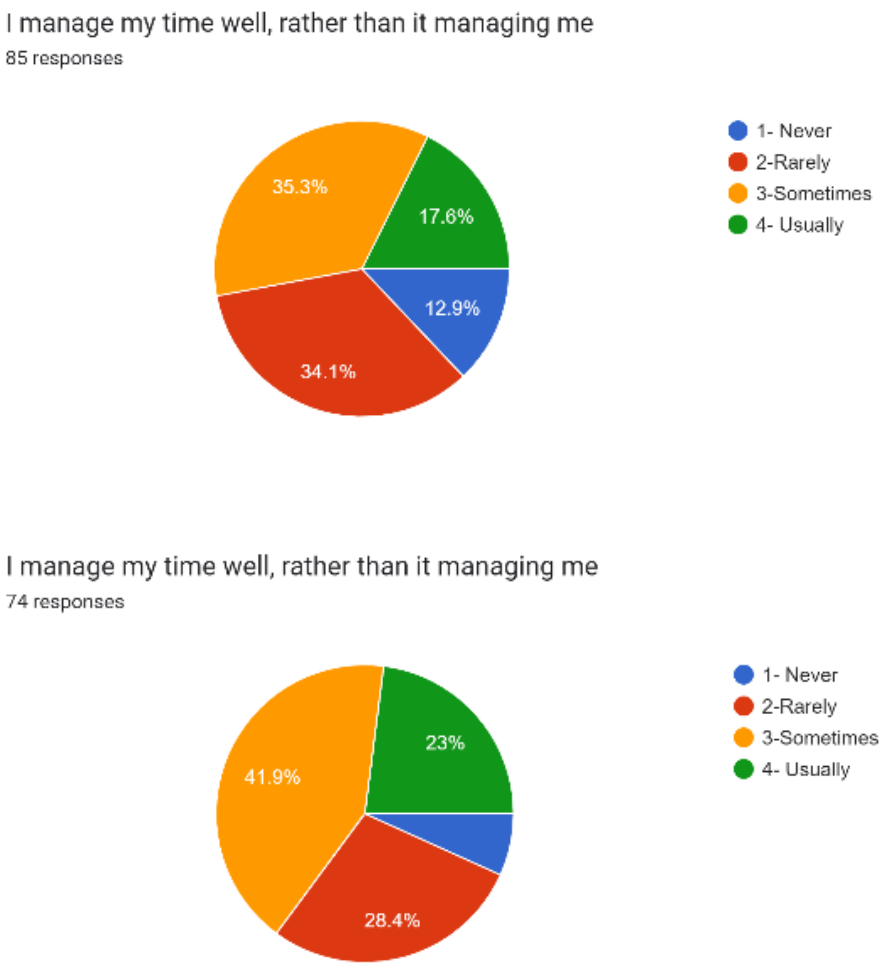

Figure 10: Pre (Top. *n*=85) vs post (Bottom. *n*=74) treatment responses to the statement:I manage my time well, rather than it managing me.

The number of students that responded 1 = Never or 2 –=Rarely decrease from 47.0% to 35.1% from pre to post assessment, showing a large amount of movement of students in these two categories. The median and mode stayed at a 3 for both tests but the mean increased from 2.57 to 2.81.

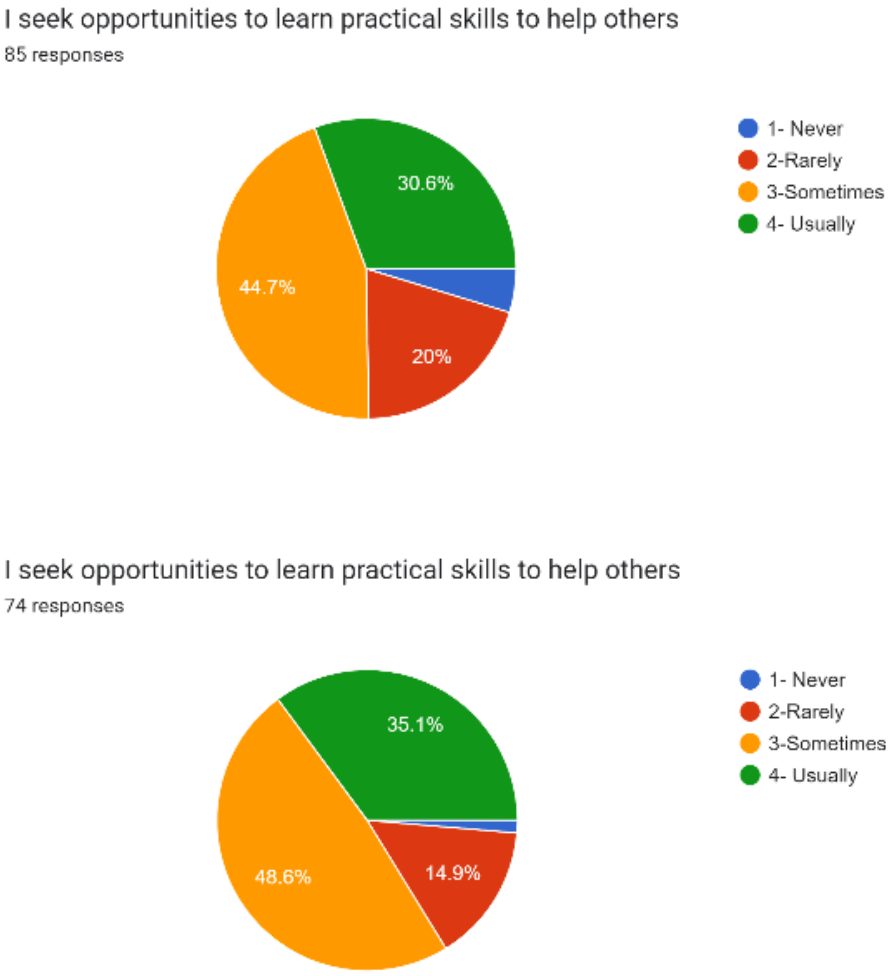

Figure 11: Pre (Top. *n*=85) vs post (Bottom. *n*=74) treatment responses to the statement: I seek opportunities to learn practical skills to help others

In this question we see an awesome trend in the data. Not only do we see a decrease in the percent of student responses for 2 = Rarely at 20% and 1 = Never 4.7% to 14.9% and 1.4% respectively, we also see an increase from 30.6% to 35.1% in students that responded 4 = Usually. This indicates a positive shift in students "seeking opportunities to learn" which is characteristic of students possessing a growth mindset.

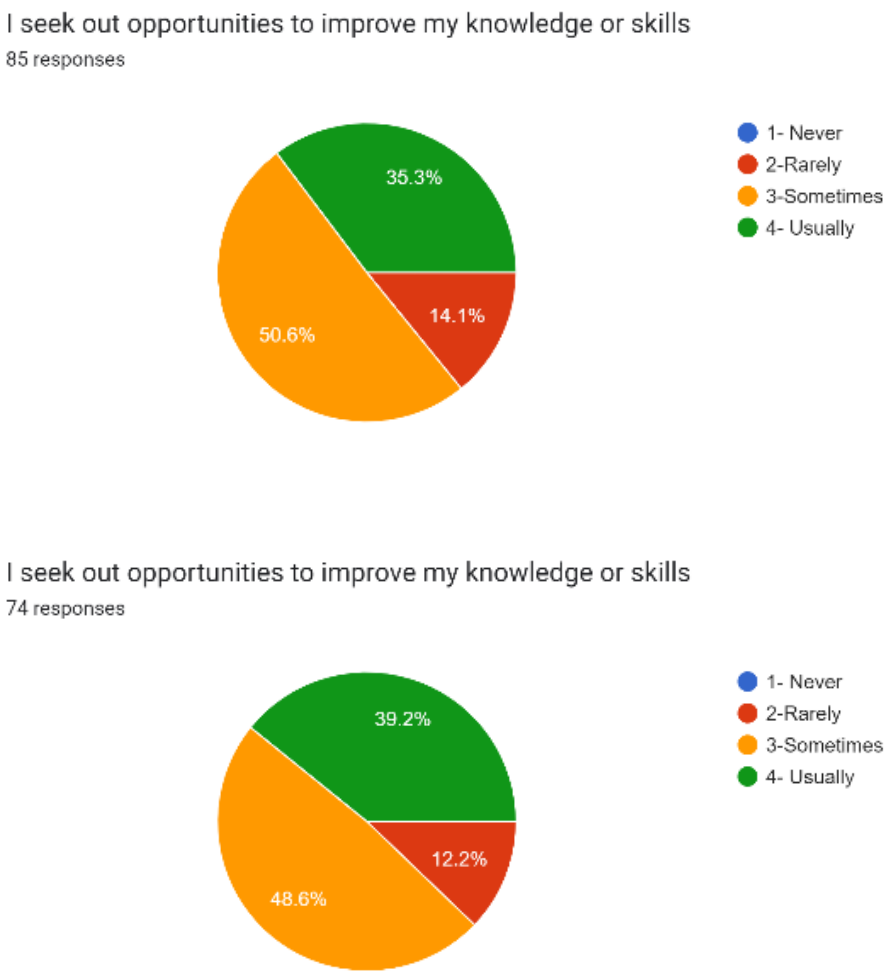

Figure 12. Pre (Top. *n*=85) vs post (Bottom. *n*=74) treatment responses to the statement: I seek out opportunities to improve my knowledge or skills.

A slight increase from 35.3% to 39.2% in students that responded 4 = Usually, and a slight decrease from 14.1% to 12.2% in students that responded 2 = Rarely is great, but I really would have liked to have seen a larger change in data for this topic. An average increase from 3.21 to 3.27, and medians and modes remaining at 3, gives me little to celebrate, and lots to ponder.

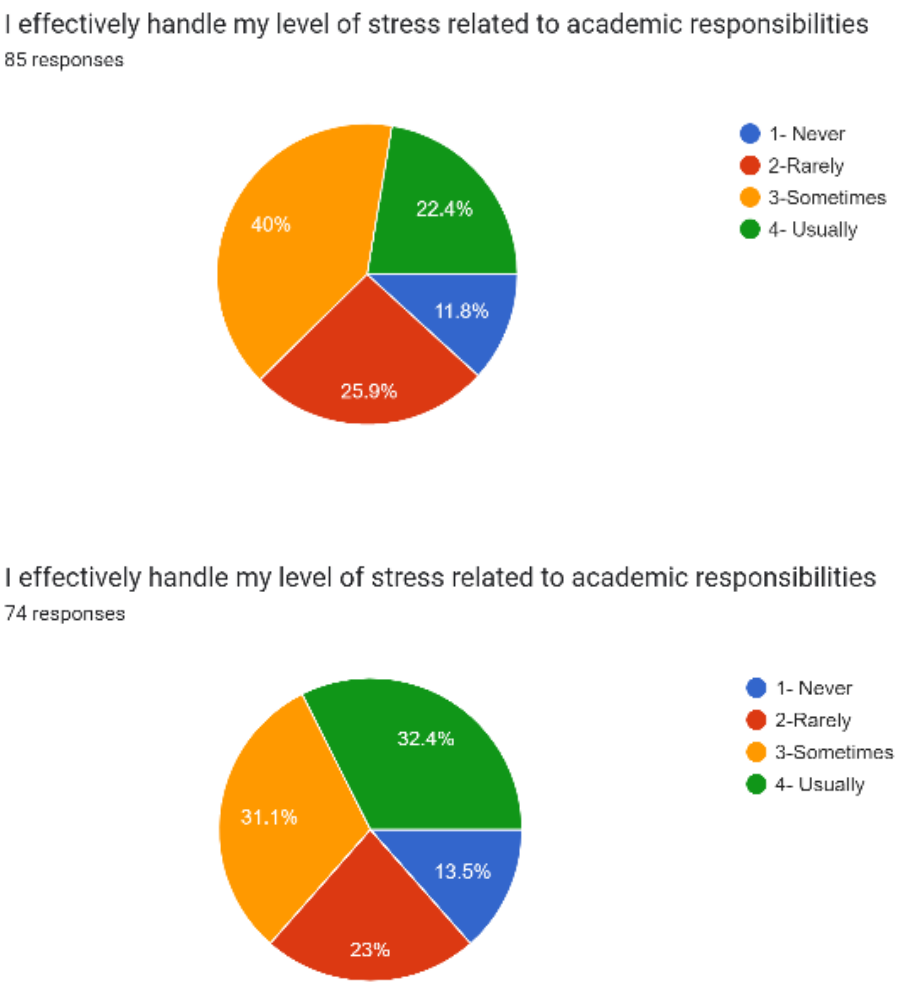

Figure 13. Pre (Top. *n*=85) vs post (Bottom. *n*=74) treatment responses to the statement: I effectively handle my level of stress related to academic responsibilities.

There was a 10% increase in students that responded 4 = Usually, which is great, but to still see 37.7% (pre) and 36.5% (post) of students respond “Rarely” or “Never” about their ability to effectively handle stress related to academic responsibilities is shocking. Over a third of the students feel like they can never or rarely handle academic stress that is placed upon them. I found this to be nauseating. Does this say something about the kids in my class, or the current academic structure of our times and the stress that we place upon them as a society and system?

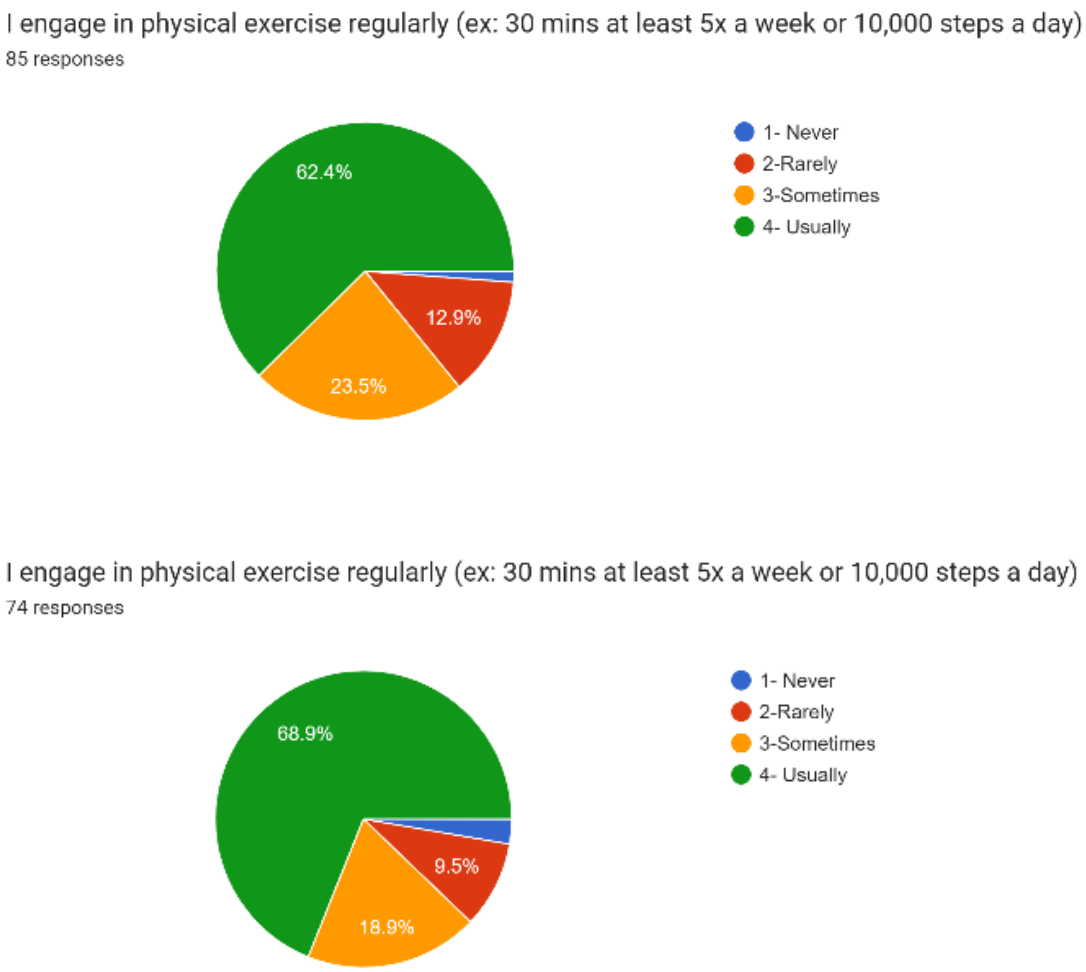

Figure 14. Pre (Top. *n*=85) vs post (Bottom. *n*=74) treatment responses to the statement: I engage in physical exercise regularly (ex: 30 mins at least 5x a week or 10,000 steps a day)

There was an increase in 4 = Usually responses of 6.5%, and a decrease of both 3 = Sometimes and 2 = Rarely by 4.6% and 3.4% respectively. One thing to consider when looking at these results is the time of the year the assessments were given. Missoula Montana had snow on the ground from the start of November until April this year. So, although the data does show a slight trend in the positive direction, one must consider the timing of the assessments. It is

estimated that up to 5% of people who live in northern states experience Seasonal Affective Disorder. This could potentially have impacted the pre to post data as well.

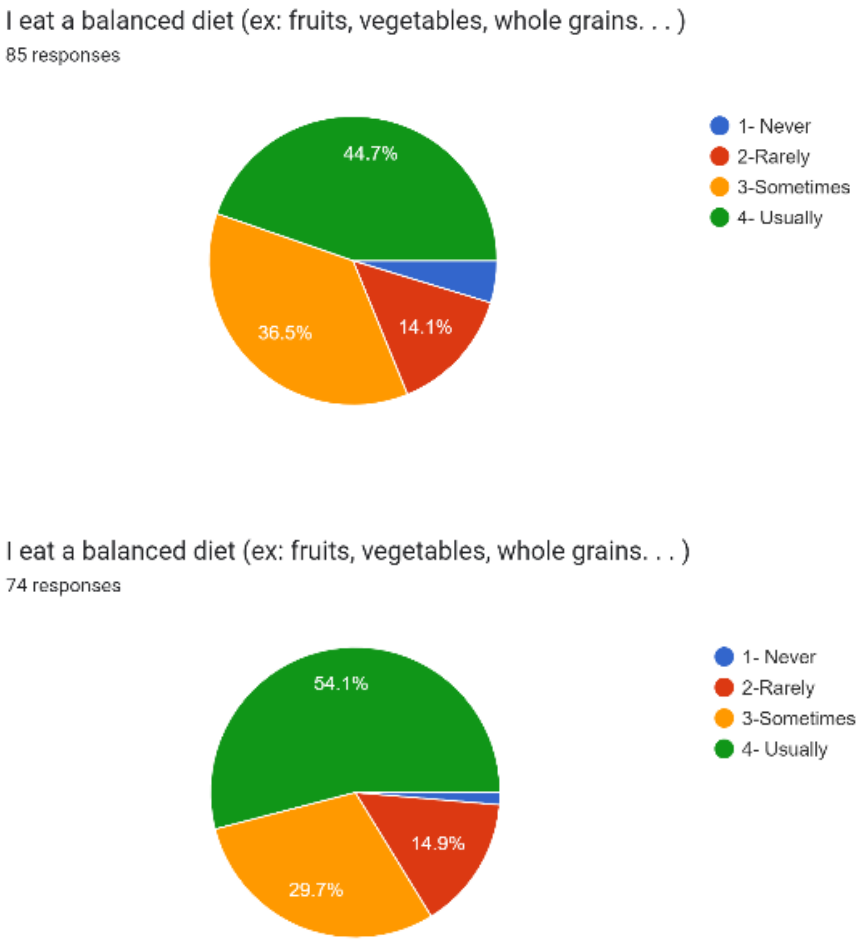

Figure 15. Pre (Top. *n*=85) vs post (Bottom. *n*=74) treatment responses to the statement: I eat a balanced diet (ex: fruits, vegetables, whole grains…)

This was something that I did not expect to see any change in, but there was nearly a 10% increase in students who responded 4 = Usually. In class we discussed how environment affects phenotype, and a large part of our environment is our diet and what we put into our bodies. The sophomores also take a health and wellness course where they cover diet and exercise.

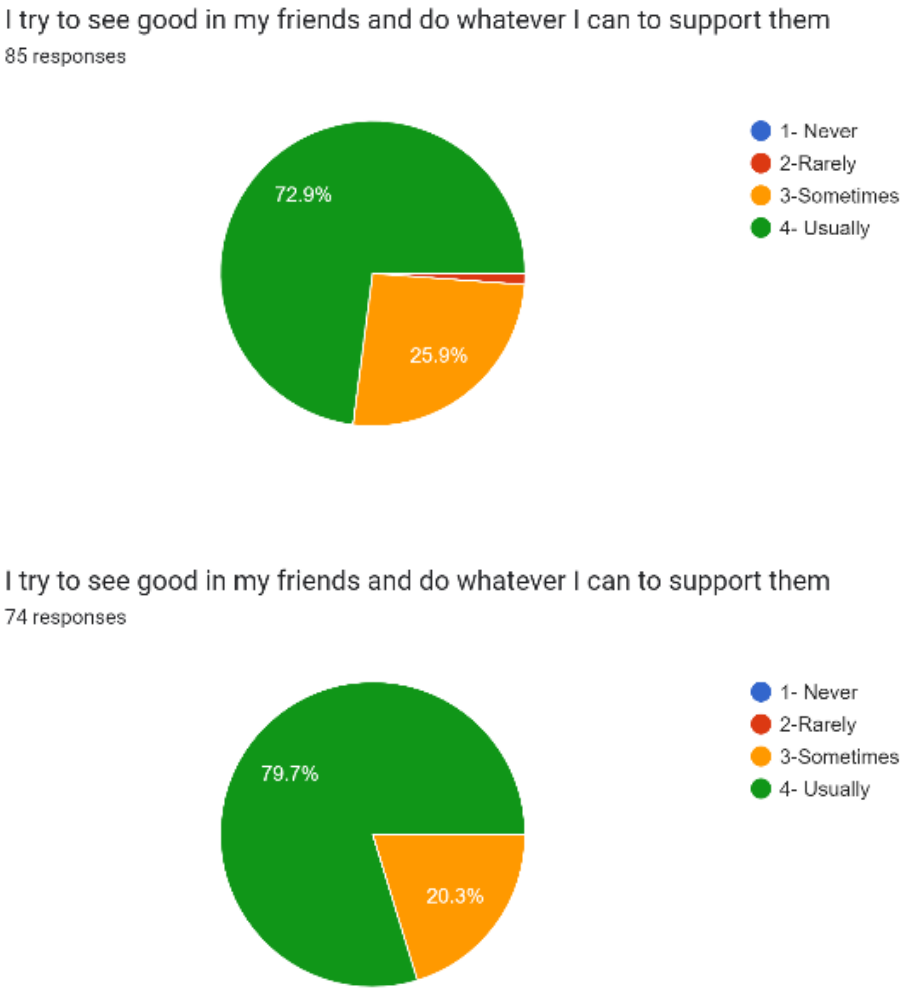

Figure 16 Pre (Top. *n*=85) vs post (Bottom. *n*=74) treatment responses to the statement: I try to see good in my friend and do whatever I can to support them.

Although not a huge increase it was still nice to see a gain of almost 7% for 4 = Usually responses. As well as an elimination of students that responded 2 = Rarely.

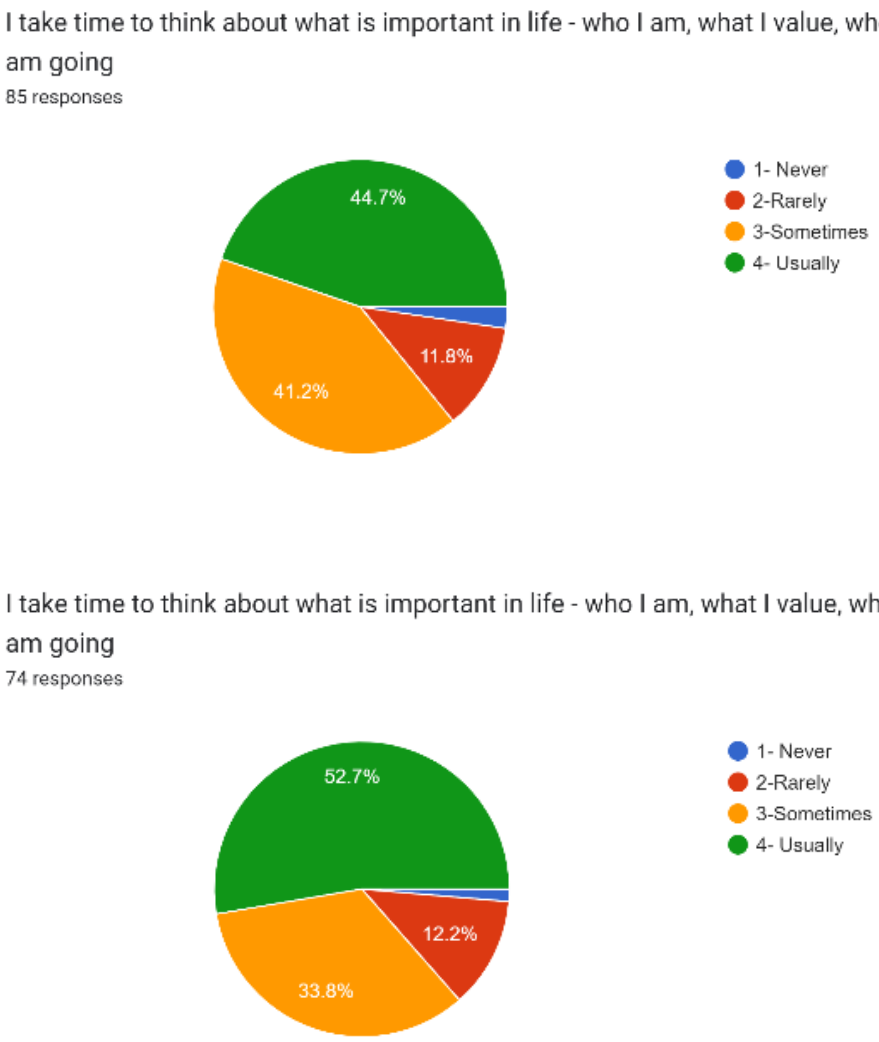

Figure 17. Pre (Top. *n*=85) vs post (Bottom. *n*=74) treatment responses to the statement: I take time to think about what is important in life – who I am, what I value, where I fit in, and where I am going

The number of students who responded 4 = Usually increased from 44.7% to 52.7%.

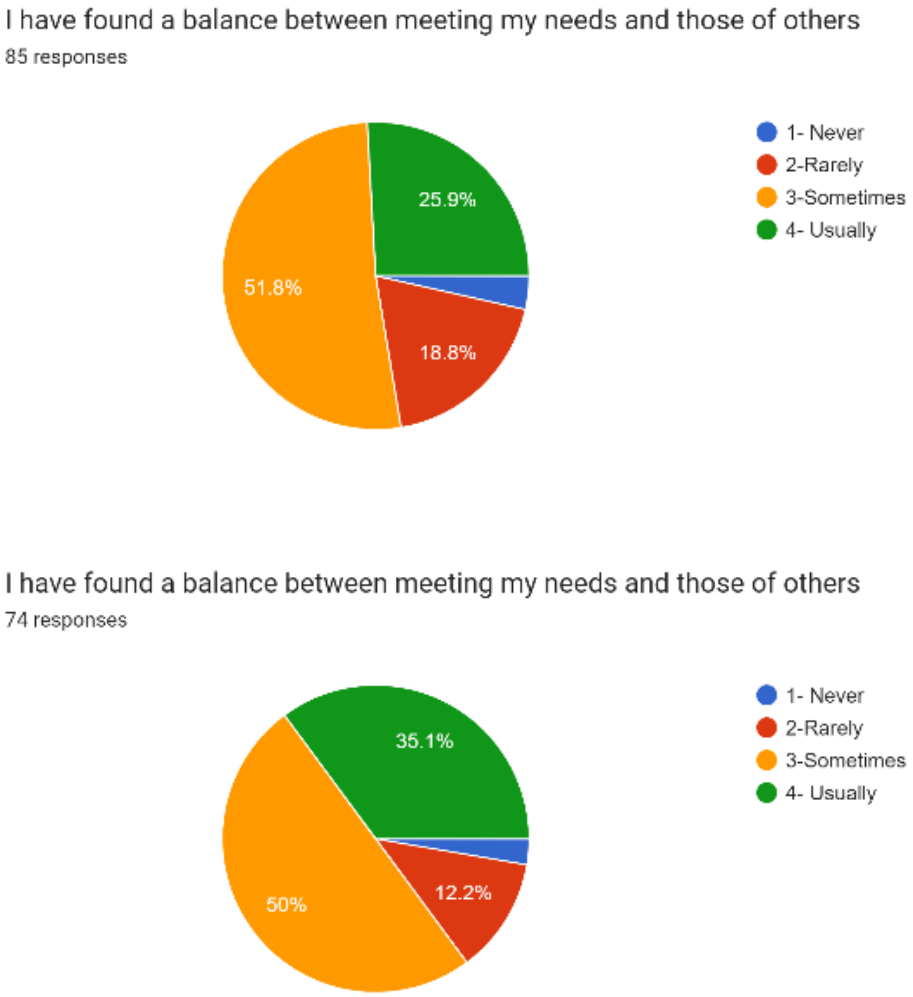

Figure 18. Pre (Top. *n*=85) vs post (Bottom. *n*=74) treatment responses to the statement: I have found a balance between meeting my needs and those of others.

There was nearly a 10% increase in students that responded 4 = Usually as well as a 6.2% decrease in students that responded 2 = Rarely.

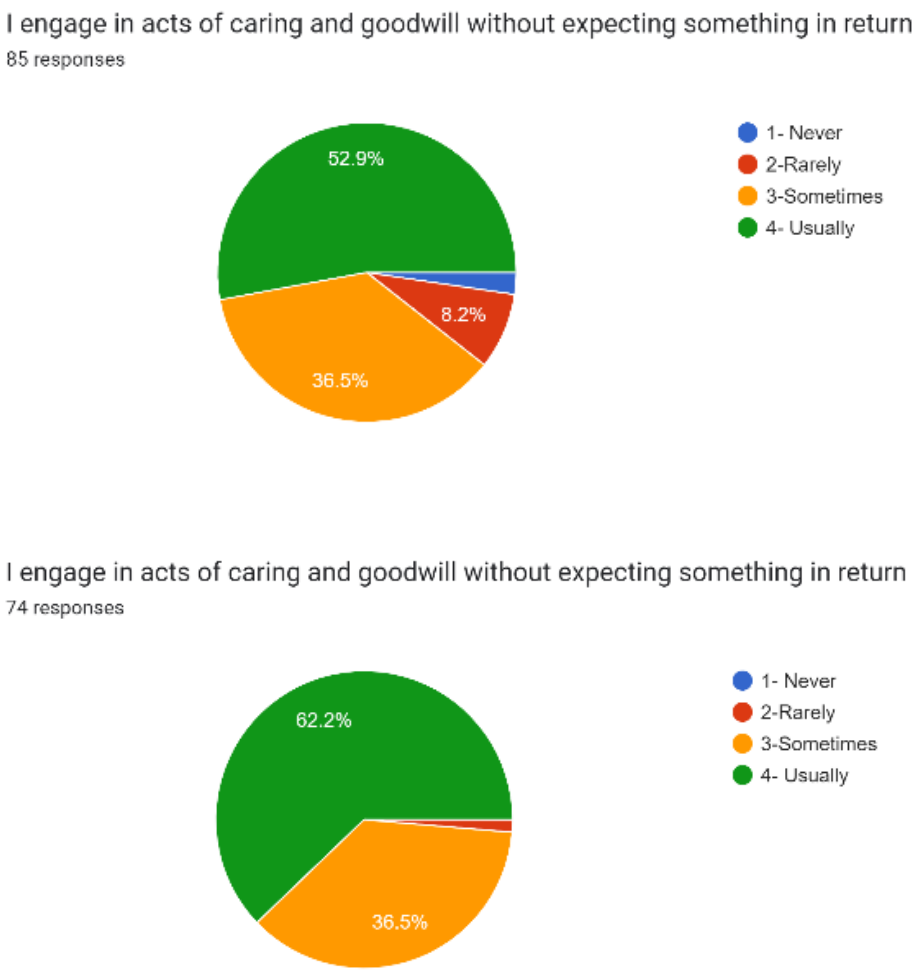

Figure 19. Pre (Top. *n*=85) vs post (Bottom. *n*=74) treatment responses to the statement: I engage in acts of caring and goodwill without expecting something in return.

It warmed my heart to see this shift in student responses. There was nearly a 10% increase in students that responded 4 = Usually, as well as an elimination of students that responded 1 = Never, and a near elimination of students that responded 2 = Rarely. No I can't prove that my treatment had this effect, nor is this "statistically significant" but it was great to see none the less.

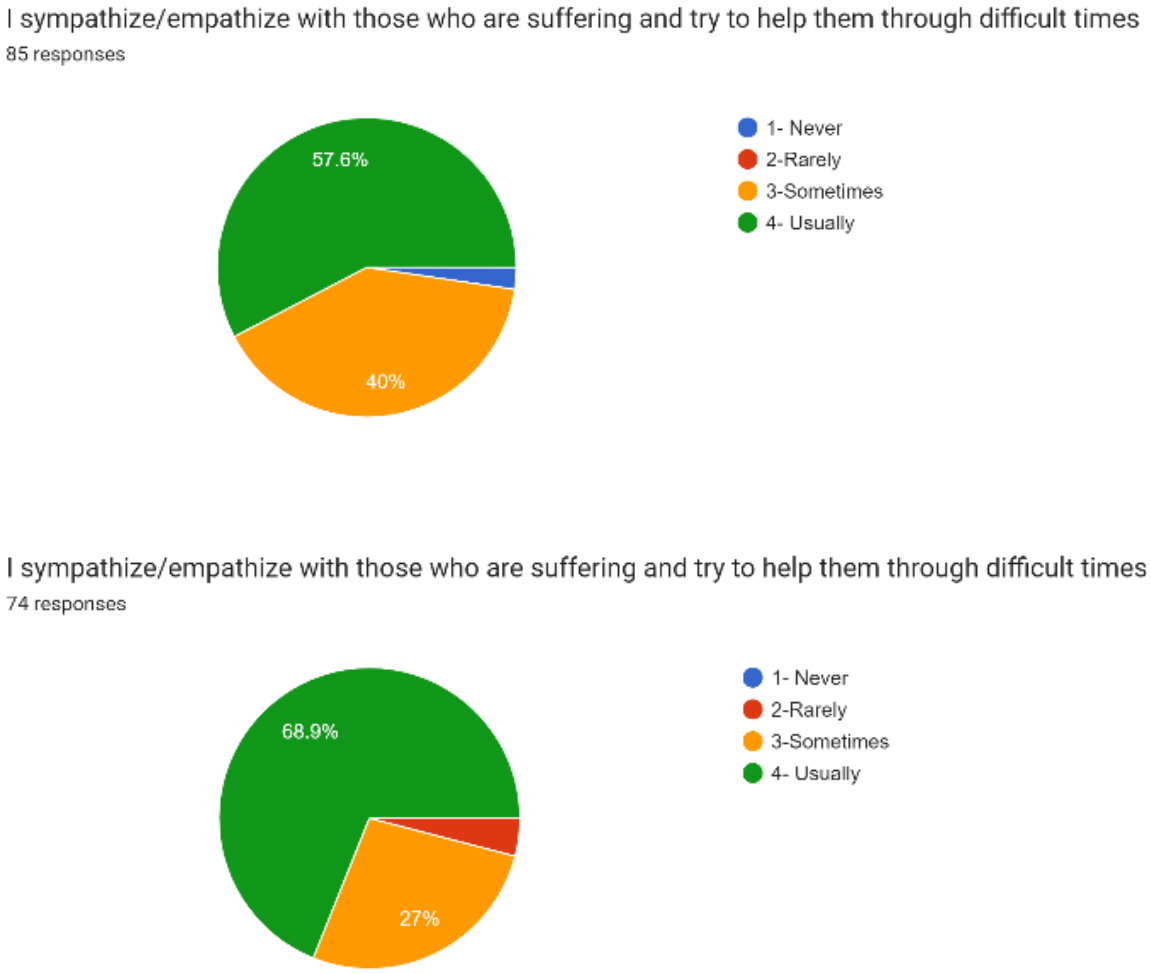

Figure 20. Pre (Top. *n*=85) vs post (Bottom. *n*=74) treatment responses to the statement: I sympathize/empathize with those who are suffering and try to help them through difficult times.

This was another awesome response to see. There was an 11.3% increase of students who responded 4 = Usually as well as an elimination of the students that responded 1 = Never.

After taking the wellness pre-assessment students were given the option to respond to their results. The first prompt was: What domains did you score highly in? Why do you think you scored highly in them? The second prompt was: Which domains did you score low in? What do you think you could do to improve your score in this domain? There was a large variety of

responses to these two prompts with many of them that showed characteristics of a fixed mindset. One student simply replied, “I don’t think I can change my knowledge.” Another stated, “Occupational and emotional awareness were the ones I scored the lowest in. I believe this happened because these are things that I have no control over, and I find it hard to be comfortable with them. My grades are something I have very loose control over and that makes me nervous. Same with my emotions.” And yet another student stated, “The knowledge domain, I don’t think I can change my knowledge.” The student saying this while reading and writing and using words that at one point during their life they had no “knowledge” of struck me as ironic. These were three examples of students possessing a fixed mindset before being exposed to the treatment, but there were many examples of student responses that were indicative of possessing a growth mindset. One student stated, “I scored well in the physical wellness section because I believe in self-care and that the only person on life who will decide your future is yourself.” So as shown by the data as well as the student responses students came into the class with a variety of mindsets and levels of wellness.

Next, I wanted to examine how the responses to the same prompts about student wellness differed after exposure to treatment. One student replied, “(I scored low in) the relationships and mental ones, I need to work on setting boundaries.” This response is evidence that the student possesses a growth mindset. “I need to work” shows that they believe they can change but they also know that it will take work. I love this. A different student had a response of the same essence, “I scored low in emotional wellness. I will improve through therapy and through learning to understand my feelings better.” This student acknowledges the areas they could

improve upon, emotional wellness, as well as identifying the means to their improvement, through therapy and through learning to understand my feelings better.

CHAPTER FIVE

CLAIMS, EVIDENCE AND REASONING

Claims From the Study

My first claim is that mindset can change. I can make this claim because of the strong evidence collected previously from researchers around the globe, as well as the literature that has been published on the topic (Blackwell, 2007; Dweck, 2007; Dweck, 2016). I can now make this claim more confidently because I have my own empirical evidence to support it. Nearly 90% of students that completed the pre- and post-treatment mindset survey increased their mindset score. There was an average of gains in every single class with the lowest being 15% and the highest being 31%. Not only did I have a large amount of quantitative data, but I also generated a large amount of qualitative data to support this claim. One student said after being exposed to the treatment of mindset lessons, "I used to think that if you weren't born with talent you wouldn't be able to learn it. Which is total the wrong way to think about it like that. Instead you should be thinking of was to get good at it…" During student interviews I asked students the question: How did you feel about the "Kaizen" or growth mindset activities and lessons we did in class? One student replied to this by saying, "I think Kaizen is definitely something that everyone should do. It should just be an everyday thing to do". Another student said, "I like them. It shows that someone can grow in just a little bit of time, especially if they keep certain habits." I then asked them how could I teach kids about growth mindset better in the future and they responded by saying, "I think just keep the main point. Trying to grow you brain, grow your health, grow everything." These responses were not isolated to a handful of students. The vast

majority of students were fully engaged during the mini lessons and many of them chose an activity to kaizen for the rest of the year. Some students did wall sits, some improved their drawing and sketching ability, some students read, some students learned how to complete a Rubik's cube, some worked on their balance and coordination, and others did push-ups and hand stands. Although there were some students that just sat at their desks and didn't engage in anything, most students used the "Kaizen time" at the start of every period to play and learn about themselves and what they are capable of. This is always cool for me to see, and I will continue teach students about kaizen and growth mindset for the rest of my career. There was one response that I think embodies what I love about growth mindset. This student simply put, "I could always improve in all of the domains." Possessing a growth mindset is not about being dissatisfied with who you currently are, but rather recognizing that you are who you are because of your past growth, while simultaneously acknowledging the fact that you can improve in all aspects of your life if you choose to do so. This perspective of growth mindset is not intended to make you feel that you are not "good enough" right now, but rather empower you to become who you want to be. This is where Wabi-Sabi can come in. During student interviews two students, independently of each other, both mentioned the lessons where I introduced Wabi-Sabi and Ikigai, when asked if they could apply any of the growth mindset lessons to their future. Wabi-Sabi, the appreciation and acceptance of the imperfect and the impermanent, can be a balancing force and help ground Kaizen practitioners who otherwise could become frustrated when their final product is not perfect, even after deliberate effort to make it so. Kaizen, and growth mindset, is about incremental and continual improvement, not perfection and Wabi-Sabi can be a useful reminder of this.

My second claim is that after being exposed to a treatment of growth mindset lessons, the wellness of my students increased in a number of different aspects. Before this project I would never have been able to make this claim about my students, but now after collecting pre- and post-treatment data about student wellness I can claim it with confidence. Not only is this claim supported by the evidence I have collected but it is supported by published literature (Alvarado, 2019; Schleider, 2016; Yeager, 2014,). There was growth in student resiliency and ability to sympathize and empathize with others that are suffering. There was a decrease in students' stress involved with decision making, and an increase in students' ability to effectively handle academically related stress. There was an increase in students' engaging in regular physical activity and even students' reported eating habits. I think that at the end of the day this is what I wanted most out of my project. Can I show students the importance of embracing a growth mindset and how it can affect all the different aspects of their life in a positive way? Can we practice and exercise it in class so that they are ready and prepared so when life throws something unexpected at them, and they have the ability to deal with a tough situation? Will they be able to learn and grow through it? Will they use the failures and losses as guideposts for their future success and wins? Or will they ignore the lessons that come along with struggle? These are all things that I try and cover in my "little life lessons" throughout the year so it really was heartwarming to see growth of my students in so many different facets of life.

Value of the Study and Consideration for Future Research

If someone was to perform a similar study in the future, it would be really nice to look at individual change of student wellness scores. I was disappointed, but understood why, the IRB

said that the student wellness surveys must be completed anonymously. This was not how I intended the project to be initially.

I think one aspect that I am curious about is if these growth mindset gains persist over time. If I have this same group of kids a mindset assessment next year how would they score? Would their mindset revert back to their initial score? Would it continue to increase? This would be interesting to look at. What is the lasting effect of the treatment? As soon as they leave for the summer will they forget about "Kaizen" and growth mindset or has a seed been planted? How will they approach difficulties and obstacles in the future? I think the most important metric to look at for any country, school, or even teacher would be long term happiness, life satisfaction, contentment, enjoyment or some other popular synonymy. So although the wellness survey addressed some aspects of this, I think that it could be beneficial for students to contemplate and even come up with what they think would be considered as a "successful" or "happy" life. I know this might be too much, and fretting about the future is never a good thing, but I do think that it could be impactful if it was at minimum openly discussed.

Impact of Action Research on the Author

I have been teaching students about mindsets and Kaizen for about seven years and Wabi-Sabi and Ikigai for the last five. Each year trying to improve upon the lessons and activities done in class, while at the same time knowing that they weren't going to be perfect, but confident that they were going to be better. There were many aspects of this project that felt familiar because I had done them before, but never before had I gathered so much data. This was awesome, and a ton of work, to analyze and pick apart but I am so glad that I did because now I have some tangible evidence on the impact of teaching students about mindsets. It is not just

"some article by some author in some journal published twenty some years ago". Now I at least have some skin in the game. I have gathered data, and seen both quantitative and qualitative improvements. This will not only help me teach this more effectively in the future, but more importantly I think it will be a very powerful tool to show my future classes. I can actually show them how my previous students' mindsets changed over the course of the year and also how some aspects of their wellness changed over the course of the year. I can show them that embracing a growth mindset had a positive impact on students' ability to cope with stress, be more resilient, and improve their physical wellness, and show them the data to back it up. This project has taught me that my students enter my class with a large variety of mindsets and an even larger variety of factors contributing to their overall wellness. The majority of those factors I have no control over, but I now know that I can have an impact on students' mindset, and mindsets, can have a large impact on long term overall wellness (Alvarado, 2019; Schleider, 2016). This is something I plan to focus on more in future classes. Only in the last couple of years have I started to tie together growth mindset and wellness, and this project has given me more confidence to continue to move in that direction and incorporate all aspects of life under the umbrella of factors that can be affected by mindset.

Learning about mindsets and how they can affect your life has helped me personally in many ways. It has helped me persist and be gritty through uncertain and difficult times, but also it has helped me create a life full of purpose, joy, and happiness. It has taught me many lessons which have made me a more empathetic and compassionate student, teacher, and human. I am very grateful for this, and plan to share these lessons with my future students.

Humans are both story tellers, and story believers. Science, Kaizen, Wabi-Sabi, and Ikigai have become the story I tell and the story I believe.

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APPENDICES

APPENDIX A

MEASURE YOUR MINDSET SURVEY

Measure Your Mindset Survey

This is a research project being conducted by Sam Dixon in conjunction with Montana State University. The purpose of this project is to investigate the effects of teaching growth mindset to students. The research advisor is Walter Woolbaugh and his email is walter.woolbaugh@ecat1.montana.edu should you have any questions. The contact for the Montana State University Institutional Review Board is irb@montana.edu should you have any questions. Responses to this survey will be anonymous. Final results in my paper will only provide overall results and not any individual identifying information. Participation is voluntary and you can choose to not answer any questions you do not want to answer and/or you can stop at any time. Participation or non-participation will not affect a student's grades or class standing in any way. Proceeding with the survey/interview/questionnaire indicates your consent to participate.

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
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. (My students will not have to do this because I will be putting this entire 24 question survey into google forms. So all they will have to is log onto their district account and take the survey)

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	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.
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	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.
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	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
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	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.
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	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

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.

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

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APPENDIX B

PRINCETON U-MATTER SURVEY

This is a research project being conducted by Sam Dixon in conjunction with Montana State University. The purpose of this project is to investigate the effects of teaching growth mindset to students. The research advisor is Walter Woolbaugh and his email is walter.woolbaugh@ecat1.montana.edu should you have any questions. The contact for the Montana State University Institutional Review Board is irb@montana.edu should you have any questions. Although you must log in using your email, I will be removing any identifying information before looking at responses. So responses to this survey will be anonymous. Final results in my paper will only provide overall results and not any individual identifying information. Participation is voluntary and you can choose to not answer any questions you do not want to answer and/or you can stop at any time. Participation or non-participation will not affect a student's grades or class standing in any way. Proceeding with the survey/interview/questionnaire indicates your consent to participate.

Emotional Wellness: understanding your own feelings and expressing emotions in a constructive way, and having the ability to deal with stress and cope with life's challenges				
	Never	Rarely	Sometimes	Usually
1. I find it easy to express my emotions in positive, constructive ways	1	2	3	4
2. I recognize when I am stressed and take steps to manage my stress (e.g., exercise, quiet time, meditation)	1	2	3	4
3. I am resilient and can bounce back after a disappointment or problem	1	2	3	4
4. I am able to maintain a balance of work, family, friends and other obligations	1	2	3	4
5. I am flexible and adapt or adjust to change in a positive way	1	2	3	4
6. I am able to make decisions with minimal stress or worry	1	2	3	4
7. When I am angry, I try to let others know in non-confrontational or non hurtful ways	1	2	3	4

Total _____

Environmental Wellness: recognizing the interactions between yourself and your environment (natural and social), responsibly using available resources, and fostering a safer and healthier environment for others				
	Never	Rarely	Sometimes	Usually
1. I recognize the impact of my actions on my environment	1	2	3	4
2. I recognize the impact of my environment on my health	1	2	3	4
3. I am aware of and make use of campus health, wellness, and safety resources	1	2	3	4
4. I practice environmentally conscious behaviors (e.g., recycling)	1	2	3	4
5. I seek out ways to improve the social environment at Sentinel High	1	2	3	4
6. I contribute towards making my environment a safer and healthier place	1	2	3	4
7. I surround myself with people who support me in my journey of being healthy and well	1	2	3	4

Total _____

3

Intellectual Wellness: engaging in creative and mentally-stimulating activities, expanding your knowledge through cultural, artistic, or skill-based learning, and sharing knowledge and skills with others				
	Never	Rarely	Sometimes	Usually
1. I am curious and interested in the communities, as well as the world, around me	1	2	3	4
2. I search for learning opportunities and stimulating mental activities	1	2	3	4

3. I manage my time well, rather than it managing me	1	2	3	4
4. I enjoy brainstorming and sharing knowledge with others in group projects or tasks	1	2	3	4
5. I enjoy learning about subjects other than those I am required to study/in my field of work	1	2	3	4
6. I seek opportunities to learn practical skills to help others	1	2	3	4
7. I can critically consider the opinions and information presented by others and provide constructive feedback	1	2	3	4

Total _____

Occupational Wellness: getting personal fulfillment from your job or academic pursuits, and contributing to knowledge and skills, while maintaining a school-life balance				
	Never	Rarely	Sometimes	Usually
1. I get personal satisfaction and enrichment from my studies	1	2	3	4
2. I believe that I am able to contribute my knowledge, skills, and talents at school	1	2	3	4
3. I seek out opportunities to improve my knowledge or skills	1	2	3	4
4. I balance my social life and academic responsibilities well	1	2	3	4
5. I effectively handle my level of stress related to academic responsibilities	1	2	3	4
6. My work load is manageable	1	2	3	4
7. I explore paid and/or volunteer opportunities that interest me	1	2	3	4

Total _____

Physical Wellness: making choices to avoid harmful habits and practice behaviors that support your physical body, health and safety				
	Never	Rarely	Sometimes	Usually
1. I engage in physical exercise regularly (e.g., 30 mins at least 5x a week or 10,000 steps a day).	1	2	3	4
2. I get 6-8 hours of sleep each night	1	2	3	4
3. I protect myself and others from getting ill (e.g., wash my hands, cover my cough, etc.)	1	2	3	4
4. I abstain from drinking alcohol;	1	2	3	4
5. I avoid using tobacco products or other drugs	1	2	3	4
6. I eat a balanced diet (fruits, vegetables, low-moderate fat, whole grains)	1	2	3	4
7. I get regular physical exams (i.e., annual, when I have atypical symptoms)	1	2	3	4

Total _____

Social Wellness: building and maintaining a diversity of supportive relationships, and dealing effectively with interpersonal conflict				
	Never	Rarely	Sometimes	Usually
1. I consciously and continually try to work on behaviors or attitudes that have caused problems in my interactions with others	1	2	3	4
2. In my romantic or sexual relationships, I choose partner(s) who respect my wants, needs, and choices	1	2	3	4
3. I feel supported and respected in my close relationships	1	2	3	4

4. I communicate effectively with others, share my views and listen to those of others	1	2	3	4
5. I consider the feelings of others and do not act in hurtful/selfish ways	1	2	3	4
6. I try to see good in my friends and do whatever I can to support them	1	2	3	4
7. I participate in a wide variety of social activities and find opportunities to form new relationships	1	2	3	4

Total _____

5

Spiritual Wellness: having beliefs and values that provide a sense of purpose and help give meaning and purpose to your life, and acting in alignment with those beliefs				
	Never	Rarely	Sometimes	Usually
1. I take time to think about what's important in life – who I am, what I value, where I fit in, and where I am going	1	2	3	4
2. I have found a balance between meeting my needs and those of others	1	2	3	4
3. I engage in acts of caring and goodwill without expecting something in return	1	2	3	4
4. I sympathize/empathize with those who are suffering and try to help them through difficult times	1	2	3	4
5. My values are true priorities in my life and are reflected in my actions	1	2	3	4
6. I feel connected to something larger than myself (e.g., supreme being, nature, connectedness of all living things, humanity, community)	1	2	3	4
7. I feel like my life has purpose and meaning	1	2	3	4

Total _____

6

Calculate Your Score

Wellness Dimension	Ideal Score	Your Score
Emotional Wellness	28	
Environmental Wellness	28	
Intellectual Wellness	28	
Occupational Wellness	28	
Physical Wellness	28	
Social Wellness	28	
Spiritual Wellness	28	

Scores of 20-28: *Outstanding! Your answers demonstrate that you're already taking positive steps in this dimension of wellness. You're improving your own well-being and also setting a good example for those around you. Although you achieved a high overall score in this domain, you may want to check for low scores on individual items to see if there are specific areas you might want to address. You might also choose to focus on another area where your scores weren't so high.*

Scores of 15-19: *Your behaviors in this area are good, but there is room for improvement. Take a look at the items on which you scored lower. What changes might you make it improve your score? Even a small change in behavior can help you achieve better health and well-being.*

Scores of 14 and below: *Your answers indicate some potential health and well-being risks. Review those areas where you scored lower and review resources provided in today's Wellness Resources handout to help you develop and set achievable goals.*

APPENDIX C

IRB EXEMPTION

Hello Dixon, Sam,

Your protocol was reviewed by the IRB and has been approved.

PI: Dixon, Sam
Approval Date: 11/17/2022
Title: What are the effects of teaching growth mindset research to my students?

Protocol #: 2022-389-EXEMPT
Review Type: Exempt Review
Expiration Date: 11/17/2027

Work described under this protocol may now commence. The PI is responsible for ensuring that the protocol accurately describes research practices being conducted.

> Review Category designation determined by the IRB can be found in the final section of your protocol.
> IRB-stamped active Consent Forms are attached within your protocol where applicable.
> Any changes must be submitted via Amendment prior to implementation.
> Per the Common Rule, research only requires Interim (annual) Review by the IRB if 1) it was reviewed via Full Committee or 2) is sponsored by the FDA.
> All research is subject to post approval monitoring.
> All protocol types must be renewed 5 years after approval.
> Inform the IRB once your research is complete so that the protocol may be inactivated.

Please contact your IRB Program Manager with any questions or if you are in need of assistance. Thank you for your diligence in the care of human subjects research participants.

Institutional Review Board for the Protection of Human Subjects | Office of Research Compliance | Montana State University

Access your protocol anytime at https://montanaprod.topazti.net//Elements?emailLink=11%2c102%2c8563.

APPENDIX D

INTERVIEW QUESTIONS

Interview Questions:

1. How do you feel about your ability to grow, learn and improve?
    a. Why do you think that way?
    b. Have your thoughts about this changed since learning about mindset?
    c. Why do you think you originally felt that way about yourself?

2. How do you feel about your ability to change your physical, mental and overall wellness?
    a. Why do you think that way?
    b. Have your thoughts about this changed since learning about mindsets?
    c. Why do you think you originally felt that way about yourself?

3. What did you think or feel about the “Kaizen” / growth mindset activities and lessons we did in class?
    a. Is there something that you learned that you might use in the future?

4. How do you think I could teach kids about growth mindset better in the future?
    a. Any specific things that you liked or did not like?