AN ABSTRACT OF THE THESIS OF

Keiko C. P. Bostwick for the degree of Master of Arts in Interdisciplinary Studies in Psychology, Psychology, and Statistics presented on April 23, 2015.

Title: The Effectiveness of a Malleable Mindset Intervention in an Introductory Psychology Course.

Abstract approved:

_____

Kathryn A. Becker-Blease

Students who believe that their intelligence is able to grow over time (malleable/ growth mindset) perform better on measures of academic success than students who believe that intelligence is a fixed trait that cannot be changed (fixed mindset; Dweck, 2000). Previous research on the effectiveness of mindset interventions have demonstrated a causal connection between a malleable mindset and increases in end of term cumulative grade point average (Aronson, Fried, & Good, 2002) and performance on standardized math exams (Blackwell, Trzesniewski, & Dweck, 2007). The present study tested the effectiveness of a malleable mindset intervention in an applied higher education setting. Furthermore, the intervention itself was designed to be sustainable, low cost, and easy to implement in a large-lecture college course. Students enrolled in an introductory psychology course (n=278) were randomly assigned to receive one of three letters after the completion of their first midterm exam. The messages in the letters were centered on either promoting a malleable mindset, a fixed mindset, or thanking students for their class attendance and participation. Additionally, a manipulation check was administered nine weeks post-

intervention to see if students read their letter and remembered its take-home message. At the end of the term, between-group differences on measures of post-intervention academic success were assessed. In line with our hypotheses and previous research, students in the malleable mindset condition outperformed students in the fixed mindset condition on two measures of post-intervention academic success. This effect was stronger for those students who passed the manipulation check at the end of the term. Therefore, the intervention design was an effective way to promote a malleable mindset to students and increase academic success in higher education.

Keywords: academic achievement, academic success, mindset, theories of intelligence, higher education.

The Effectiveness of a Malleable Mindset Intervention in an Introductory Psychology Course

by
Keiko C. P. Bostwick

A THESIS

submitted to

Oregon State University

in partial fulfillment of
the requirements for the
degree of

Master of Arts in Interdisciplinary Studies

Presented April 23, 2015
Commencement June 2015

Master of Arts in Interdisciplinary Studies thesis of Keiko C. P. Bostwick presented on April 23, 2015.

APPROVED:

Major Professor, representing Psychology

Director of the Interdisciplinary Studies Program

Dean of the Graduate School

I understand that my thesis will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my thesis to any reader upon request.

Keiko C. P. Bostwick, Author

ACKNOWLEDGEMENTS

The author expresses sincere appreciation to the following individuals:

Kathryn Becker-Blease, Ph.D., for fostering my intellectual curiosity, my critical thinking, and my humor for all these years. You've been a great mentor and I truly appreciate the contributions you've made to my academic career.

Frank Bernieri, Ph.D., for inspiring me to study Psychology in 2009 and for taking the time to challenge my ideas.

Virginia Lesser, Ph.D. and Michelle Swift, Ph.D., for their support as committee members.

My fellow graduate students Amy Bonnett, Nicole Martin, Shana Needham, Alyssa Raymond, Ameer Almuaybid, Victoria Braun, Nathan Herdener, Angus Kittelman, Katy Krieger, Pamela Lundeberg, Jamie Naylor, Birken Noesen, and Christian Sinnott for the intellectual debates, the impossible research proposals, and the laughter that filled Reed 117.

My close and extended family, for reminding me that home will always be there for me.

Andrew DeWitt for his patience, love, and support during this process. You have always been there to inspire me when I lost my way, support me when I was losing hope, and to celebrate with me when I succeeded.

Finally, my parents, Charles and Barbara Bostwick, for being an integral part in my academic career. This thesis is dedicated to the countless hours you have spent raising and nurturing me, the unconditional love that you provide, and all the encouragement you give me when a goal seems too far out of reach.

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

LIST OF FIGURES

LIST OF TABLES

Chapter 1 – Introduction

Statement of the Problem

Psychological research on how people develop and learn across the lifespan has been present for over a century. Even in the late 19th century, researchers like Hermann Ebbinghaus were teaching themselves nonsense syllables in order to demonstrate and better understand the process of learning and forgetting information. Psychology continues to contribute to a foundational understanding of how people learn, including in the realm of formal education. Recent findings have demonstrated the benefits of retrieval practice as a learning technique (Roediger & Karpicke, 2006), the unprofitable role of emotional interest in textbook readings (Harp & Mayer, 1997), the long-term benefits of distributive over massed practice (Cepeda, Pashler, Vul, Wixted, & Rohrer, 2006), and the power of a student's theory of intelligence as he or she approaches a learning activity (Dweck, 2000). Yet, it seems that every where you look there are tools being marketed to students (e.g. pre-highlighted textbooks, adaptive quizzes, etc.) and "best practices" being recommended by instructors (e.g. teach to your students' learning styles, left brain/ right brain activities, etc.) that are loosely based on psychological science and are often promoted without proper testing using experimental designs or with disregard to the lack of evidence available. Across educational domains, we continue to see psychological research be misapplied in the classroom.

In order to truly increase positive student learning outcomes empirical research in applied higher-education classrooms is necessary. This research provides students, instructors, and institutions of higher education the tools they need to create

beneficial learning experiences and produce students who are qualified in their disciplines. Researchers must find ways to increase retention rates, the number of students who graduate on time, student motivation to learn, and the knowledge students retain after leaving college.

To increase these positive outcomes, research in higher education should follow a sequence of events. First, there must be correlational research focused on establishing predictive variables of academic success in higher education. For example, research in personality traits (Barchard, 2003; Chamorro-Premuzic & Furnham, 2003; Paunomen & Ashton, 2013), student sleep habits (Taylor, Vatthauer, Bramoweth, Ruggero, & Roane, 2013), standardized test scores and high school grade point average (GPA; e.g. Sawyer, 2013), and parent/guardian socioeconomic status (Niu, & Tienda, 2013) has been found to be valuable predictors of student academic achievement and success in college. By demonstrating strong relationships between variables and positive student outcomes, institutions are better able to identify successful students in the application process and increase the likelihood of academic success in their students. Second, researchers must determine any causal connections between these predictors and academic success. Creating interventions that have the potential to alter variables in students allow researchers to establish a causal relationship, and determine if the interventions themselves provide students with a greater chance of academic success. Finally, it is important that researchers exploring causal connections also take demonstrated laboratory findings and test them in applied settings using appropriately rigorous experimental research designs. Without this final step, we can never determine if the results from the laboratory

translate to meaningful differences in learning outcomes in the classroom and valid benefits for a university. After all, it is one thing to say that people retain more words when they have been tested on them as opposed to when they have simply read them over and over again; it is another thing to claim that this would result in a better cumulative GPA or academic outcomes. Without applying laboratory findings to actual classrooms, claims of meaningful differences cannot be truly established.

The number of variables that can be effectively manipulated in applied settings is much fewer than the vast number of predictors of academic achievement in higher education. Often, interventional research focused on increasing academic success is involves efforts aimed at increasing students' academic readiness for college (Knaggs, Sondergeld, & Schardt, 2015) and making high school courses more similar to college courses in order to aid the transition to higher education (Kirst & Venezia, 2006). Thus, if students are more academically prepared for the rigorous coursework that universities offer, it is likely that they will have a higher chance of success. However, while these interventions based on academic preparedness are useful before students enter the university system, the benefits of implementing them when students are already enrolled may not produce valuable gains in academic performance. Research in educational interventions that can be implemented in higher education and be effective during, rather than before, students' college careers would better enable institutions to increase academic success.

Research in social psychological interventions to increase academic success informs universities of why there are variations in academic outcomes between students who enter the university with the same ability levels, prior knowledge, and

academic preparedness. An example of such an intervention is the aim to alter student attribution processes to failure and difficulty with academic course work. Early correlational research found a relationship between different attributional processes, or theories of intelligence, and academic performance in both middle school and higher education students (Dweck, 2000). When students attribute an increase in effort to a lack of inner, unchangeable ability (entity theory of intelligence; fixed mindset) they are more likely to respond helplessly and either give up or choose an alternative task that is well below their ability level (Dweck, 2000). These students are focused on demonstrating their mastery of material in order to confirm their self-perceived intellectual ability rather than learning new things. However, when students understand that knowledge can be acquired over time and interpret effort as an opportunity to learn something new and develop greater skills (incremental theory of intelligence; malleable mindset), they are more likely to persist through the difficulty. Therefore, students who enter higher education with the same abilities, skills, and prior knowledge would differ in their likelihood of graduation and academic achievement based on their theory of intelligence. The more students believe that knowledge comes from sustained effort and hard work rather than an unchangeable inner trait, the more likely they are to persist through difficult concepts and learn more material. Therefore, it would be most beneficial if research informed universities and students of how to alter these attribution processes in order to increase university retention and positive academic outcomes through mindset interventions. Furthermore, these interventions are especially effective when they are

implemented during the transitional education periods, such as moving from high school to higher education (Walton, 2014).

The present study sought to determine the effectiveness of a simple and sustainable mindset intervention in a large lecture introductory psychology course. While previous mindset intervention research has looked at the effectiveness of orienting students toward a malleable mindset using intensive eight week training sessions (Blackwell, Trzesniewski, & Dweck, 2007) and 30-minute webinars (Yeager, Walton, Ritter, & Dweck, 2013b), a minimal and passive malleable mindset intervention has yet to be tested in an applied setting. Therefore, the procedure used in the present study was specifically designed to be a low-cost, easy to implement, and sustainable malleable mindset intervention. The use of such a minimal design would allow researchers to establish a baseline effect and lead to a greater understanding of the incremental value of increasing intensity and length of the intervention. Additionally, the effectiveness of this intervention will be assessed in the environment in which it would be most commonly applied – a large lecture classrooms in higher education. Implementing such a test at a school like Oregon State University (OSU) allows researchers to determine the effectiveness for a wide range of ability levels, rather than on student samples at elite universities where student abilities are often limited to the upper range and greater student resources (both financial and support) are available. In the large lecture classrooms commonly encountered at schools like Oregon State University, it would be optimal to be able to administer a low cost, easy to implement, and quick intervention that would not take

away from class time. Therefore, there is a need to test the effectiveness of sustainable mindset intervention on this student population.

Chapter 2 – The Academic Success Equation

In 1958, Fritz Heider proposed a formula for analyzing another's interpersonal behavior. He stated observers understand another's actions by assessing three major components of the acting party: ability, motivation, and environment (i.e. X=f(ability x motivation x environment); Figure 1.1). In this equation, ability is defined as a person's skills that allow for the completion of an action, motivation as the person's intent to complete an action, environment as the external setting that allows the action to be completed, and the outcome (X) as the observable action of the other person. By understanding each of these factors separately, observers are better able to interpret the meaning behind the action and predict and influence future behavior.

Figure 1.1

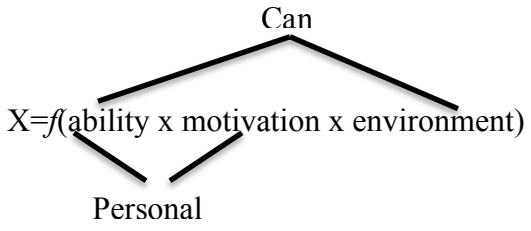


Figure 1.1: Original Interpersonal Processes Equation (Heider, 1958)

The equation can be rearranged in two ways in order to better understand the unique contributions of each factor. In the first arrangement, both ability and motivation are seen as personal contributions to an outcome while environment is a component that remains outside of the direct control of the acting individual. The formula is reduced to: X=f(personal contribution x external contribution), where personal contribution = ability x motivation (Figure 1.1). From this arrangement we conclude first, that personal contribution is not always enough for an action to be

reached. Second, the interaction of personal contribution and environmental factors must be greater than or equal to X in order for the desired action to be completed. Finally, that there can be negative effects of either factor. That is, even though an individual has more than the required personal contribution the action may fail if the environment is a hindrance.

The second arrangement is to reduce the formula to factors of can and motivation (X=f(can x motivation); Figure 1.1), where can is the product of ability and environment. An action can only be completed if the setting is right (i.e. the individual has the ability to complete the action and the environment is appropriate) and the intent or motivation to complete it is there. Two additional conclusions are drawn from this arrangement. First, the less optimal the setting, the higher motivation needs to be in order to complete the action. Second, an action will not occur if there is no intent to complete it even if all other factors of the equation are present. Therefore, motivation is a necessary hinge upon which the outcome rests.

While this equation was originally used in the interpersonal context to better understand how individuals draw meaning from action, the equation itself can be applied to a variety of contexts, including academic success in higher education. When the equation is applied to this context it allows researchers, institutions, students, and policy makers to understand academic success as a question that can be studied empirically. Here, ability is defined as an individual's academic knowledge, motivation as intent or effort exerted to reach an academic goal, the environment as other external factors that contribute to academic success, and the outcome (X) as academic success itself. If we extend the conclusions drawn from Heider's (1958)

original equation, it is clear that each of the three components is necessary in order to ensure that positive learning outcomes for students are achieved and that each of the components has the potential to influence the outcome negatively. Furthermore, the operationalization of each of the factors changes in response to the operationalization of the outcome variable "academic success." For example, universities may be interested in a student's decision to remain at a university, making the outcome variable "X" in this equation student retention. Therefore, the factors that contribute to X may include aspects of financial security (environment), desire to earn a degree (motivation), and remaining in good academic standing (ability). Each of these factors interacts with one another in order to produce a product, and similar to the interpersonal process equation, the product of the factors must be at least equal to the outcome in order for the action to succeed (Figure 1.2).

Figure 1.2

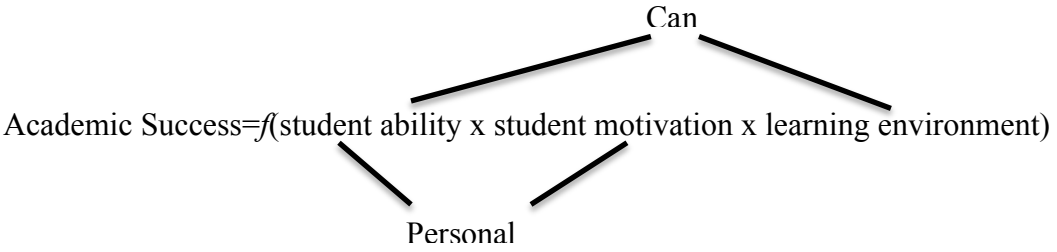


Figure 1.2: The academic success equation

While there are a variety of interconnected outcomes of interests to researchers in higher education (e.g. matriculation, retention), learning outcomes among students is one of the most valuable variables to consider. Instructors want to ensure that students are learning the relevant material and will be able to apply it to new settings in their future careers. Additionally, students are often concerned with

maintaining their GPA in order to retain university and state scholarships and to continue in their degree coursework. Therefore, research that looks directly at increasing student academic performance as measured by exam performance and university GPA informs instructors and students of how to influence meaningful differences in measurable academic outcomes tied to student learning. Thus, in order to influence student academic success, researchers must consider the impact of learning environments, student academic ability, and student motivation for learning.

Creating Good Learning Environments

In order to optimize the environmental component of the academic success equation, universities must first provide for students at the most basic level. In other words, they must provide the means for students to learn by hiring competent employees to manage both the day-to-day functions of the university as well as its long-term goals and aspirations, hire experts in different fields in order to instruct students and create lesson plans to convey accurate and relevant material in a subject, and certain student activities and support services must be planned and maintained in order to provide structure and support for all students. Examples include departments associated with financial assistance and food services that ensure students have access to emergency funds and adequate nutrition. Second, students contribute to the environmental component by actively choosing which university to attend, which organizations and clubs to join, which discipline to study, and which courses to enroll in. By being an active decision maker in this process, students are exerting control over their own environment by making decisions that presumably will lead to better outcomes like academic success or more learning. Furthermore, when problems in the

environment arise students are able to seek out university services that provide answers or solutions to their concerns. For example, students who are having difficulty with academic course work may seek out or be referred to academic support services. These services provide students with tutors, study strategies, and additional contacts that they can use in order to raise their academic performance. In this interaction, universities are able to optimize student environment at both a general level (e.g. students have knowledgeable instructors or a means to learn material) and at an individual level (e.g. this student needs help in algebra). Research in educational environments that promote academic performance have informed universities of some seemingly meaningless variables that result in meaningful differences in learning outcomes amongst students.

First, researchers found that not only is there a correlation between where a student sits in a lecture hall and their end of course grades, there is actually a direct causal connection between the two (Perkins & Wieman, 2005). Students in an introductory physics for non-science majors course were randomly assigned to sit either at the front, middle, or back of a large lecture classroom for the first half of a semester. For the second half of the course, researchers rotated the seat assignments so that students originally up front were moved to the back and vice versa. At the end of the term, researchers found that attendance was highest for students who were originally assigned to sit at the front of the class, even after they were moved to the back of the room in the second half of the semester. Furthermore, the number of As and Fs received by the closest and furthest group differed significantly. Over a quarter (27%) of the students who were originally assigned to sit in the very front of the class

received As while only 18% of the students who were assigned to sit in the back did so and 12% of students sitting in the back received Fs while this grade was received by only 2% of those originally sitting in the front (Perkins & Wieman, 2005). Seat selection is a small component of an academic environment that can result in meaningful differences in student learning.

Second, students' note-taking methods can have a significant impact on the amount of information students retain over time. Mueller and Oppenheimer (2014) found that students retain more information when lecture notes are taken by hand rather than on a laptop. Participants were randomly assigned to either take notes by hand or with a laptop that was disconnected from the Internet while watching a 15-minute lecture on a topic that was interesting yet uncommon knowledge. Thirty minutes after the end of the lecture participants were given a test of both factual and conceptual knowledge presented. While both conditions performed equally well on factual content presented in the lecture, those in the written notes condition performed significantly better than those in the laptop condition on conceptual and applied questions. An analysis of the participants' lecture notes revealed that those in the laptop condition wrote significantly more words than those in the written condition, but there was also more word-for-word overlap with the actual lecture. The researchers concluded that while the quantity of the words laptop users are able to record are significantly greater, the quality of those notes are not the same. This is due to the deeper level of encoding reached when notes are taken by hand. In other words, even though hand writing limits the amount of information students are able to record it forces them to process the information being presented so that they are able

to choose the main points of a lecture. When students take notes electronically they are more likely to simply transcribe the lecture and record it word for word rather than process and understand the information. Mueller and Oppenheimer (2014) even took this a step further and instructed some students in the laptop condition to avoid lecture transcription and instead focus on the main points. Even when students were directly told to avoid this behavior, laptop note-takers continued to transcribe rather than record the main points of a lecture. The students in the written note condition continued to outperform those in either the original laptop condition or the instructed laptop condition on later tests of conceptual understanding.

By being informed by and applying psychological science to the classroom, universities are able to promote academic achievement through environmental variables. As seen in both of these studies, the environment in which students learn can have a meaningful impact on academic performance and they are often controllable in individual classrooms or by university policies. Thus, research in the environmental factor of the academic success equation can promote positive student outcomes.

Assessing Academic Ability

In order to optimize ability in higher education universities must determine selection criteria for their ideal student. For any job or position, a candidate must have the ability and prior training to fulfill the tasks set before him or her. Therefore, when selecting potential students for an incoming cohort, a university must assess the intellectual ability of its applicants. If universities accepted students without the intellectual ability to complete a bachelor's degree, retention and graduation rates

would plummet. Additionally, these students would incur more debt due to the additional remedial course work that they would be required to complete in order to complete their degree. Psychological research has focused on both the intellectual and non-intellectual predictors of academic success

High School GPA and Standardized Test Scores

Universities use both high school grade point average (HSGPA) and standardized test scores as predictors of an applicant's academic performance in higher education. Similar to the use of grade point averages in higher education, HSGPA is usually based on a four-point scale that reflects the grades a student earned in his or her high school course load. However, letter grades received at one high school are not necessarily the same as letter grades received at another. Due to these differences in academic rigor across high schools, standardized tests such as the Scholastic Assessment Test (SAT ®) or the American College Testing Assessment (ACT®) were developed in order to compliment HSGPA and allow universities to compare applicant ability between high schools and between students with similar HSGPAs. The predictive validity of standardized test scores on cumulative college GPA and degree attainment consistently sits at about r=.45 (Hezlett et al., 2001 as cited in Schmitt et al. 2009), with higher predictive values for outcomes closer to high school graduation such as first year GPA and first year retention (Kuncel, Hezlett, & Ones, 2004). Additionally, predictive validity of standardized test scores remain robust even after controlling for factors like socioeconomic status (Sackett, Kuncel, Arneson, Cooper, & Waters, 2009).

When used in conjunction, both HSGPA and standardized test scores continue to be the greatest predictors of academic success in higher education (Bridgeman, McCamley-Jenkins, & Ervin, 2000). While some studies that indicate that HSGPA is a better predictor of academic success in higher education than the ACT or SAT (Richardson, Abraham, & Bond, 2012) there are other studies that claim that even when HSGPA is accounted for, standardized test scores offer incremental predictive validity for later academic achievement in higher education (r=0.08; Korbin, Patterson, Shaw, Mattern, & Barbuti, 2008). Therefore, it is uncommon for a university to only consider one of these scores when determining the intellectual ability of an applicant. The predictive validity of incorporating both HSGPA and standardized test scores lies in the range of r=.44-.5 (Bridgeman et al. , 2000; Schmitt et al., 2009) and it is most beneficial to use both predictors as indicators of later academic success.

Personality and Grit

While intellectual predictors as measured by HSGPA and standardized test scores can account for a significant portion of the variance in student academic success (Schmitt et al., 2009), there remains a large proportion of unexplained variance. After the first academic year of a new cohort, universities find that while some students succeed, others fail and that the differences in student outcomes are not entirely predicted by intellectual capability. That is, students who do not succeed through or past their first year of college are not necessarily of a lower level of academic ability or readiness than those that do succeed. The 2009 freshmen class at Oregon State University lost 17% of its students by the end of the first year and

another 16% of students were lost between years two and four. By the end of their fourth year only 32% of the initial 2009 cohort of freshmen left OSU with a degree, leaving more than a third (35%) to continue the pursuit of their degree or to leave the university at a later date (Oregon State University Office of Institutional Research, 2012). It is important to remember that student reasons for leaving the university are not necessarily mutually exclusive as there are often relationships between factors such as health, family responsibilities, financial hardships and academic performance. Sometimes student barriers to academic success begin with factors like the lack of financial support that eventually lead to poorer performance in academic coursework and academic probation. However, while there are some students who leave for financial purposes, health reasons or familial emergencies, there are still students who are simply failing to perform in this new academic setting even though they posses the intellectual capability necessary to reach their academic goals. Therefore, while it is necessary to assess an applicant's academic capability, it also seems necessary to study other predictors of student success that offer additional predictive information about incoming students. There must be other factors that contribute to successful degree completion in higher education and the evidence suggests a need to measure them in the application process.

Oregon State University is well aware of the disadvantages to only considering an applicant's academic capability. The most recent Common Data Set published by OSU's Institutional Research Department (2014) lists other applicant features such as character and personal qualities, volunteer experience, and work experience as just as important in the application process as standardized test scores.

Even though high school GPA remains the most important component of an application (Oregon State University, 2014), individual student experiences that are independent of the academic capabilities carry a lot of weight. By asking applicants to provide evidence of their work and volunteer experience and their individual character and then using this information in the decision process, OSU is utilizing non-intellectual predictors of academic success.

Research in social and personality psychology has tried to assess the value of using personality traits as predictors of success in higher education. Chamorrow-Premuzic and Furnham (2003) completed two longitudinal studies in which they gave participants a few measures of personality and then followed their academic performance over the course of three years in higher education. Researchers measured a variety of academic outcomes including scores on five three-hour exams taken within the three-year degree, the end of degree final project and absenteeism from weekly seminars. Both neuroticism and conscientiousness were significant predictors of all three measures. Students who were more neurotic performed worse on exams (r=-.35, p<.01) and had lower final project scores (r=-.25, p<.05). On the other hand, students high in conscientiousness performed better on the same measures of academic success (r=.39, p<.01; r=.36, p<.01) and had significantly fewer absences from weekly seminars (r=-.24, p<.05). Furthermore, both of these personality traits were able to predict academic performance above and beyond the ability variables used in the study.

Another example of such a psychological component is grit (Duckworth, Peterson, Matthews, & Kelly, 2007) defined as the perseverance or passion for long

term goals. Grit has been shown to account for an additional 4% of the variance in academic performance outcomes after controlling for IQ and personality traits like conscientiousness. In fact, when SAT scores were held constant, grit continued to be a significant predictor of college GPA (r=.34, p<.001). Finally, in a series of research studies conducted at West Point Military academy, measures of grit were highly predictive of student retention at the end of intensive physical workout periods over the summer (Duckworth et al., 2007).

It seems clear that intellectual ability is not the only determinant of retention, graduation and academic achievement nor is it the only measurable variable that should be considered in an admissions decision. In order for universities to optimize the selection process for their students, they must also consider non-intellectual predictors of academic success that provide incremental predictive value to measures of cognitive ability (i.e. standardized test scores and HSGPA). Therefore, a combination of intellectual, non-intellectual, and environmental factors contribute to student academic outcomes in the academic success equation.

Optimizing Motivation

Finally, the ability to succeed in higher education would be irrelevant if there were no underlying motivation or desire to do so on the student's behalf. Looking back to the second arrangement of the academic success equation (X=f(can x motivation); Figure 1.1), we see that just because the environment for learning is created and the student possesses the ability to learn new information, this does not mean that the outcome is guaranteed. Earning a degree or grade is not merely dependent on the student's ability, the learning environment and chance

circumstances. In order to accomplish academic success as defined by receiving a bachelor's degree, earning a desired grade, or learning new information, a student must exert effort and demonstrate intent or desire for the outcome.

There has been a vast amount of research in optimizing student academic motivation (Rowell & Hong, 2013; Wigfield & Wentzel, 2007). Variables such as goal orientation (Ames & Archer, 1988; Steinmayr, Bipp, & Spinath, 2011), self-efficacy (Niemiec & Ryan, 2009), and social belongingness (Walton & Cohen, 2011), are all predictive of student engagement and motivation in academic settings. In other words, academic motivation rises when students desire learning and mastery of material rather than the achievement of an external standard (e.g. "I just want to get an A," or "I want to be better than Sally."), it rises when students feel as though their hard work and effort pays off in the face of challenges, and it rises when students feel as though they belong to a larger community of learners.

Steinmayr et al. (2011) evaluated the incremental predictive validity of goal orientations on academic performance above and beyond cognitive ability and personality traits in a sample of high school students. While intelligence (β= .2, p<.001) and personality traits like neuroticism (β=-.11, p=.01), extraversion (β=-.08, p=.05), and conscientiousness (β=.26, p<.001) were highly predictive, student self-reported ratings of their desire to learn (β=.11, p=.01) continued to explain some of the variance in high school GPA. On the other hand, self-reported work avoidance goals (e.g. "In school, it is important for me to do as little work as possible") were negatively associated with academic success (r= -.11, p<.01). It is clear that when

students are intrinsically motivated to learn new things it has a substantial benefit on their academic performance.

Walton and Cohen (2011) demonstrated the effectiveness of a brief social belonging intervention on first-year college students. Participants were asked to read the experiences of senior college students who were getting ready to graduate. In the treatment group, participants read about how these seniors were initially worried about fitting in to the college setting. However, over time, they were able to make new friends and felt a greater sense of belonging to the university community. In the control condition, participants read about graduating seniors' political and social views. At the end of their senior year in college, African Americans in the treatment group had significantly higher GPAs than African Americans in the control group. Therefore, when students feel a greater sense of belonging to the university and know that their concerns about the transition to higher education are shared amongst other people, their academic achievement benefits.

In the academic success equation the first two variables, environment and ability, require a lot of preparation and planning that can span years. Universities are constantly generating new projects to optimize student learning in the form of new classroom buildings, student support services, and faculty searches. Even online universities generate degree programs that take a significant amount of time and planning. This translates to waiting years to see the positive academic success return on these endeavors. For example, the planning and funding that needs to be gathered before a new classroom building is opened and usable is substantial. Similarly, aims at increasing ability in students often need to start well before they reach higher

education. When students enter higher education with vast differences in ability, it is likely that those who entered with the most knowledge will also leave with the most knowledge. This is because the more prior knowledge someone has coming in to a course, the greater his or her ability to learn new knowledge and incorporate it into the already existing framework. Therefore, efforts to increase ability when students are already struggling in higher education may not produce enough of a result to actually benefit students academically. However, in the area of targeting student motivation, social psychological interventions are often able to produce immediate and lasting positive effects in academic performance (Yeager & Walton, 2011). By altering psychological processes and constructs such as student attribution process in their academic achievements, instructors are able to increase the motivation component in the academic success equation leading to immediate and meaningful differences in positive outcomes for students.

Chapter 3 – Theories of Intelligence

What are theories of intelligence?

While intellectual ability and environmental factors matter, the way students think about the nature of their intelligence matters just as much. A theory of intelligence is the way individuals understand their intellectual ability, how it develops over time, and the variables that predict intellectual accomplishments (Dweck, 2000). On one end of the continuum are entity theorists (said to have a fixed mindset) who believe that intelligence is a concrete ability that is unchangeable. In other words, some people are born smart and others are not and there is little one can do to change their intellectual ability. On the other end are incremental theorists (who have a malleable mindset) who believe that intelligence is a malleable property that can grow and change over time (Dweck, 2002; Dweck & Leggett, 1988; Dweck, 2000). This is not to say that incremental theorists believe that every individual has the same capabilities as the next or that the same levels of effort produce the same results across all individuals. Rather, they believe that through hard work and effortful learning, knowledge can be acquired and intelligence can grow (Dweck, 2000).

Developmental Aspects

The difference in theories of intelligence between individuals has been associated with the types of praise they received as children (Dweck, 2002). When children are continuously praised for their ability, rather than their effort, they begin to attribute their accomplishments to inner and innate traits. Over time, these children come to believe that task completion holds a dichotomous outcome based on their

level of inner ability – they either can or cannot complete it. However, when children are praised for their effort it teaches them to attribute their success to their adjustable levels of hard work, leading them to develop an incremental theory of intelligence. Therefore, when an incremental theorist faces a task, the outcome is not entirely decided by how much ability he or she has, but is instead dependent on how much effort is put in to the process and how much knowledge they have at the time of the task. Even if maximum effort is exerted and the task cannot be completed, incremental theorists know that it does not mean the same outcome will occur in the future. Instead, incremental theorists know that intelligence is flexible in nature, that learning takes time, and that their ability levels can grow.

As an example, imagine a playroom where a child sits at a table to play with a difficult or novel puzzle. After some time all of the pieces are in their correct placeholders and the child proudly alerts his parents. Parents who give trait praise would direct a child's attention to their intellectual ability (e.g. "Wow! You're so smart!"). On the other hand, parents who give effort praise would emphasize the role of hard work in the accomplishment (e.g. "Wow! You must have worked very hard on that!"). The point of the parent's statement in both scenarios is to congratulate the child for an accomplishment, to give praise, and perhaps to encourage future activities. However, the deeper meaning behind each of the praise statements leads children to draw different conclusions about the source of their accomplishment. In trait praise the child is being told to draw a causal connection between the accomplishment and their inner ability while no attention is given to the effort or the work put in to the completion of the task. This attribution process encourages the

child to perceive little control over the outcome of the task. In other words, he was successful because he was born that way. In effort praise the child instead sees the source of the accomplishment as the amount of work he put in to the task. Therefore, he perceives a high level of control over the outcome and is able to understand that his hard work has paid off.

Over time, an attribution pattern is developed that explains any task outcome, including both accomplishments and failures. While both entity and incremental theorists understand that tasks are an assessment of their ability levels, this assessment is much more threatening to an entity theorist because any failure indicates a lack of ability that cannot be changed. For incremental theorists, the assessment allows them to understand where their current ability level resides but they still understand that there exists potential to change and develop skills over time (Dweck, 2000).

This attribution pattern of accomplishment is also reinforced by goal setting behavior (Dweck & Leggett, 1988; Robins & Pals, 1988; Mueller & Dweck, 1998). Entity theorists complete a task in order to demonstrate their ability levels. Therefore, the outcome goals they hold are tied to performance in order to gain positive judgments surrounding their accomplishments, both from themselves and from other people (Mueller & Dweck, 1998). The most secure way to accomplish this would be to only perform tasks that are easy, have been performed before, or in which there is little chance or failure. When a task is easily completed, entity theorists perceive their ability levels as high. However, when the task is difficult they demonstrate a helpless response because it is perceived as an indication of low ability. On the other hand,

incremental theorists set goals based on learning and increasing competence (Mueller & Dweck, 1998). Therefore they are commonly interested in challenging material that can teach them new things, regardless of whether they perceive their ability as high or low (Dweck & Leggett, 1988). Incremental theorists know that they can learn something new - it just takes time, effort, and practice.

How Mindset Affects Academic Performance

These patterns of attribution and goal setting are of critical importance in the domain of academic success where students face challenges and assessments on a regular basis. While students with similar ability levels but with either mindset perform similarly on tasks that are easily accomplished, different response patterns and levels of academic achievement begin to emerge once a challenge is faced. If a student believes that academic coursework or assessments are an indication of unchangeable inner ability, then exhibiting signs of effort and struggle equates to a possibility that their ability level is not high enough – regardless of the level of difficulty of the task itself (Henderson & Dweck, 1990). This fixed mindset leads students to avoid challenges that could teach them new concepts and instead encourages them to actively choose tasks that are below their ability level (Dweck & Leggett, 1988). On the other hand, students with a malleable mindset are not threatened by exhibiting effort in front of others because it has no tie to an unchangeable trait. Malleable mindset students interpret challenge and effort as an indication of potential growth.

While there likely exists a small subset of people who go through academic careers unchallenged due to their high intellectual ability, this is not the case for the

majority of students. For the small subset, a fixed mindset would not be harmful to their intellectual pursuits because if no challenge arises, no effort needs to be exerted, and no helpless response can occur. However, for most people there are key transitional points in education where there are significant increases in academic rigor and student responsibility. Namely, the transitions between elementary school and middle school and high school and college often prove to be difficult periods for academic success. It is at these transitions that students begin to diverge in academic performance based not on their prior academic achievements and ability, but on their theory of intelligence.

Correlational Research

Researchers have observed differences in academic performance between entity and incremental theorists, especially across difficult education transitions (Henderson & Dweck, 1990; Blackwell et al., 2007; Dweck & Sorich, 1999). One study in particular assessed middle school students' mindsets before they transitioned from elementary school to middle school and then tracked their math performance for the next three years (Blackwell et al., 2007). At the end of the eighth grade year, students who initially held a malleable mindset performed 5% better on average on a standardized math exam than those with an initial fixed mindset. Henderson and Dweck (1990) found the same pattern of achievement in another sample of middle school students. Once students entered middle school, those with an incremental mindset performed just as their elementary school test scores would have predicted while those with an entity mindset continuously underperformed.

Researchers have also demonstrated that the differences in academic achievement are independent of other psychological constructs like confidence or the perceived value of academic success. Dweck and Sorich (1999) found no differences in the perceived value of academic achievement for either mindset that could drive their differing levels of academic success. Instead, student achievement was predicted by the belief that growth in intellectual ability was possible. While students with different mindsets set different goals for themselves and may have different aspirations in their educational pursuits, the value they place on their education does not differ. In Henderson and Dweck's (1990) study, they furthered their understanding of student mindset by asking students to report their level of confidence in their intellectual ability. They found that both incremental and entity mindset children were just as likely to be confident in their intelligence yet their confidence was not a significant predictor of their middle school achievement. Therefore, praising students for their abilities does not lead to a higher level of self-confidence and does not translate to increases in academic achievement. In fact, entity theorists are more likely to be ashamed of a poor GPA while incremental theorists with the same GPA commonly expressed the desire to try harder (Robins & Pals, 1998). This is further demonstration the attribution pattern typical of each mindset. Entity theorists believe that their performance, as measured by their GPA, is a reflection of their inner ability. If their GPA is high, entity theorists perceive their ability as high but if their GPA is low it indicates a deficit in their intelligence. This thinking is further evidenced by entity theorists' unwillingness to enroll in remedial coursework in higher education (Hong, Chiu, Dweck, Lin, & Wan, 1999). Hong et al.

(1999) found that when students were told that they had high language ability, fixed mindset and malleable mindset students did not differ on their willingness to enroll in a remedial language skills course. However, students with a fixed mindset who were told they had low ability students were significantly less willing to seek remedial help than those with a malleable mindset. For entity theorists, enrolling in a remedial course is evidence of their lack of ability and is an activity that should be avoided.

Intervention Literature

It is clear that students who hold a malleable mindset are more resilient in the face of obstacles and are more able to persist through challenges than their fixed mindset counterparts (Dweck, 2000). Finding ways to manipulate student mindset, allows researchers to be able to draw causal connections between mindset and academic success and provide students with ways to increase or maintain academic achievement across difficult transitions in their education.

One of the earliest approaches to manipulating student mindset was to provide students with reading material that resembled articles in popular magazines on properties of the brain (Hong et al., 1999). In this study, researchers hoped to demonstrate that manipulating a student's mindset would alter their willingness to take a remedial course. It was hypothesized that participants who were given a malleable mindset would be more likely to take the remedial course than participants in the fixed mindset condition. For the intervention, malleable mindset participants read an article teaching them about the importance of environmental factors on intellectual development while those in the fixed mindset conditions read an article arguing that intelligence was largely due to genetic components. After reading the

article, participants were asked to summarize the information in their own words and to state the pieces of evidence they thought to be the most important. Participants then took an intelligence test and the researchers either told participants that their performance was satisfactory or that they had scored in the bottom 20th percentile of undergraduate students. After the feedback was given, participants were given a choice of activity while the researcher prepared for the next phase of the experiment: to complete tutorial exercises that would improve performance on intelligence tests or to complete an unrelated and easy task. Participants in the malleable mindset condition were just as likely to choose the remedial intelligence test task regardless of the feedback they received from the researcher (Feedback: satisfactory=77%, low performance = 73%). Additionally, participants in the fixed mindset condition who had been told their intelligence test performance was satisfactory were also just as likely to choose the remedial intelligence test task (67%). However, only 13% of the participants in the fixed mindset condition who had been given low performance feedback chose to complete the remedial work. When entity theorists see a task as challenging or threatening to their perceived inner ability, it is avoided. However, incremental theorists continue to hold interest in learning tasks even when their ability levels are perceived as low.

Other researchers have used similar design in their intervention methods (e.g. Blackwell et al., 2007; Aronson, Fried, & Good, 2002). Blackwell et al. (2007) succeeded in altering the mindsets of middle school students over the course of eight intensive sessions focused on study strategies. All students were taught basic study skills that would help them succeed academically. However, some students were

randomly assigned to also receive information about brain plasticity and ways their intellectual ability changes over time. Blackwell et al. (2007) tracked student achievement scores in math throughout the semester and found that students in the malleable mindset group performed significantly better than those in the control group on post-intervention math achievement scores.

Using a less intensive design, Aronson et al. (2002) was able to alter college student mindset by teaching participants about either the malleability of the brain or how an individual's success comes from unique underlying strengths and weaknesses. Participants were then asked to use this information to write letters to younger students who were struggling with the transition to middle school (in reality, these letters were never intended for anyone). At the end of the academic quarter, participants in the malleable mindset condition had a GPA .24 (6%) points higher on average than participants in the control condition.

Finally, there have been attempts to create standardized interventions that could be easily administered to large groups of people at one time (Yeager, Walten, Ritter, & Dweck, 2013b as cited in Yeager, Paunesku, Walton, & Dweck, 2013a). Researchers tested the effectiveness of a brief 30-minute intervention delivered to an incoming cohort of university freshman over the Internet imbedded in their orientation material. Participants were randomly assigned to either a growth mindset group in which they learned about how their intelligence and "college know-how" would improve over time or to the control group where students were told about the layout of their new city. Participants were then asked to write a summary of the segment. At the end of the first semester of college, 64% of the students in the growth

mindset group earned at least 12 academic credits while only 61% in the control group did so.

The researchers in these studies have demonstrated that not only is it possible to alter student mindset through carefully constructed interventions, but that these interventions lead to meaningful differences amongst students in educational domains. Across all studies, participants in the malleable mindset conditions demonstrated gains in academic achievement as measured by credit hours earned, end of term GPA, and performance on standardized test scores.

Common Intervention Design

It is important to note that the intervention designs used in these studies have key commonalities. First, there is typically a "saying is believing aspect" central to all of the interventions (Blackwell et al., 2007, Aronson et al., 2002; Hong et al., 1999; Yeager et al., 2013b; Good, Aronson, & Inzlicht, 2003; Walton, 2014; Wilson, Damiani, & Shelton, 2002). Participants are first taught about the plasticity of the brain or some comparable material (control group) and are then instructed to formalize the material in their own words. Some studies ask participants to write letters to future students, teaching them about how knowledge can grow through hard work and effort (Aronson et al., 2002) while other studies ask participants to restate the message in their own words (Blackwell et al., 2007). Having the participants complete some sort of writing or proclamation of the message utilizes an active approach to intervention design. This way, researchers ensure that the message was read, the participants understood the message, and that there is deeper encoding and processing of the intervention message (Walton, 2014).

The second commonality is that these interventions occurred at key moments in educational transitions when students would be most susceptible to the intervention (Walton, 2014). All of the studies described are on populations of students transitioning to middle school or to higher education. Since these are the moments that students are most likely to encounter challenges, they are highly receptive of the messages in the intervention. Once the intervention is administered, students are able to use new attribution patterns in their upcoming challenges resulting in meaningful differences in future academic performance.

While mindset intervention studies typically include both of these components, it is possible that the timing aspect of the intervention is more important that the active approach. The use of a passive intervention design for attribution interventions is limited in the research. One study (Paunesku, 2013) tested the effectiveness of adding brief sentences of encouragement aligned with a malleable mindset at the top of a free online content provider website. As participants learned about new topics, they saw a malleable mindset message, no message, random science facts, or a standard encouragement (e.g. “Just do your best’). Paunesku (2013) then measured the number of subject areas participants became proficient in (as measured by the online content provider) and found that those who received a malleable mindset encouragement message became proficient in 3% more of the subjects areas they attempted. Using this design, it is likely that instead of altering general underlying attributional processes, the passive intervention may target specific attributions in particular contexts. Therefore, participants in Paunesku’s (2013) study who received the malleable mindset message were encouraged to

continue to do their practice problems one at a time, leading to more subject area proficiencies. Thus, while incorporating a “saying-is-believing aspect” is the typical mindset intervention design, a passive approach may still produce meaningful effects if the timing of the intervention is still meaningful.

Chapter 4 – Present Research

Researchers examined the effectiveness of implementing a minimally intrusive malleable mindset intervention in a large-lecture introductory psychology course. Participants in this study were randomly assigned to receive a malleable mindset, fixed mindset, or customer appreciation (control) letter attached to the answer key for the first midterm exam immediately after the completion of the exam. The intervention utilized a passive design as none of the participants received any instruction to read the letter and participants were never asked to repeat or restate any of the information they read. Each of the letters had a strong emphasis on their corresponding message and was similar in length, presentation, and format. The malleable mindset letter encouraged students to work harder and persist through difficult times, the fixed mindset letter told students to focus on their individual strengths instead of their weaknesses, and the consumer appreciation control letter thanked students for their course attendance and participation. At the end of the term (nine weeks post-intervention) a manipulation check of the letters' content was administered at the end of the final exam in order to better understand how many students both read and retained their letter's message throughout the quarter.

In addition to testing the receptiveness to the letters, the impact of the malleable mindset letter was compared to both the fixed mindset and control groups in order to establish any meaningful differences between study conditions on academic success. Academic success was measured by exam performance on three post-intervention cumulative midterms and the cumulative final exam.

Hypotheses

Hypothesis 1 - Students who receive a malleable mindset letter will earn higher scores on post-intervention measures of academic success than students who received either a fixed mindset or control letter.

Hypothesis 2 - The effects of the intervention letter would be stronger for those students who retained their intervention message through the end of the quarter, as measured by passing the manipulation check on the final exam.

Chapter 5 - Methodology

Participants

Students in an introductory psychology course (*n*=278) at a mid-sized northwestern university in the spring quarter of 2014 participated in our intervention as part of their course curriculum. The majority of the participants were female (68%) and three students did not to identify with either gender (1.0%). No other demographic data was collected for this project. In order to participate in the intervention, participants must have attended the first midterm of the course. There were six students who completed the course but did not attend the first midterm (2%) and were not included in the analyses for this project.

Materials

Measures of prior psychology knowledge, academic ability, academic achievement in introductory psychology, and social psychological variables were collected for each participant. Additionally, three similarly length letters were used for intervention administration.

Academic Ability

Information on student academic ability included highest ACT score, highest SAT score, and highest math placement score. Research assistants converted ACT scores to their concurrent SAT scores using the conversion table published on the ACT website (ACT, 2008).

Prior Psychology Knowledge

Twenty-four multiple-choice questions related to introductory psychology were given to participants on the first day of class as a pre-test. No students were

aware of the pre-test before the day it was given. Participants were not given feedback on their answers to the questions and were not shown their pre-test scores at any time throughout the term. All exam packets and scantrons were collected at the end of the exam.

Academic Achievement in Introductory Psychology

Participant scores on four midterms and one final exam measured academic achievement in introductory psychology. All midterm exams consisted of 48 content questions and two extra credit questions. The final exam consisted of 95 content questions and five extra credit questions. All analyses in the present study exclude the extra credit questions.

Pre-Intervention Midterm Score (Midterm One). The first midterm exam score was recorded for each participant and was used as the only measure of pre-intervention academic success in introductory psychology.

Post-Intervention Midterm Average (P-IMA). Each midterm exam score post-intervention (n=3) was recorded for each participant. All midterm exams were cumulative and varied in the number of chapters covered. Researchers calculated the P-IMA score for every participant by averaging participants' post-intervention midterm scores. Due to the structure of the course, participants were allowed to drop their lowest midterm score. Therefore, the number of exams used to calculate this score varied by participant. For example, some participants only completed two post-intervention midterm exams while others completed all three.

Final Exam. The final exam covered all textbook chapters of the course and included the same 24 pre-test questions participants encountered at the beginning of the term.

Social Psychological Variables

The first online homework assignment of the quarter required participants to complete an online survey. The following measures were included in the survey:

Theories of Intelligence Scale (Dweck, 2000): The scale consists of eight items to measure participants' belief of the malleability of intelligence. Higher scores on this variable indicate a greater endorsement of malleable intelligence. Items are rated on a 1 (Strongly Disagree) to 6 (Strongly Agree) likert type response format. An example item would be: "No matter who you are, you can significantly change your intelligence level." (α=.92 for the current sample).

Short GRIT Scale (Duckworth & Quinn, 2009): Asks participants to respond to twelve items to measure the level of GRIT of a participant. Higher scores on this variable indicate more GRIT. Items are rated on a 1 (Not at all like me) to 5 (Very much like me) likert type response format. Example item: "I have achieved a goal that took years of work." (α=.80 for the current sample).

Perceived Stress Scale (Cohen, Kamarck, & Mermelstein, 1983): Fourteen items to measure the amount of perceived stress a student was experiencing at the beginning of the term. Higher scores on this scale indicate higher levels of perceived stress. Items are rated on a 1 (Never) to 5 (Very Often) likert type response format. Example item: "In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?" (α=.83 for the current sample).

Short Self-Compassion Scale (Raes, Pommier, Neff, & Gucht, 2011): Twelve items to measure the degree of self-compassion a participant feels. Higher scores on this scale indicate higher levels of self-compassion. Items were rated on a 1 (almost never) to 5 (almost always) likert type response format. Example item: "When I feel inadequate in some way, I try to remind myself that feelings of inadequacy are shared by most people." (α=.79 for the current sample)

Ten-Item Personality Inventory (TIPI; Gosling, Rentfrow, & Swann, 2003): Ten items to measure the big five personality traits (Openness, Neuroticism, Conscientiousness, Agreeableness, and Extraversion; 2 items each). Each item on the scale had two adjectives associated with a particular personality trait. Higher scores on each pair of items indicate more of that personality trait. Participants responded to statements on a 1 (Disagree Strongly) to 7 (Agree Strongly) likert type response format. An example item for Agreeableness: "Sympathetic, warm." (Extraversion α=.754, Conscientiousness α=.454, Neuroticism α=.643, Agreeable α=.152, Openness α=.385, for the current sample)

Intervention Materials

After the first midterm two weeks into the course, participants were randomly assigned to one of three conditions for the intervention based on the version of their midterm exam. As participants completed the exam, they turned in their scantron forms at the front of the room and either the course teaching assistant or instructor handed the participant the answer key to the exam. All students were instructed to keep their exam packets so that they could use the answer key to understand the questions they got correct and incorrect. The intervention letters were stapled to the

top of the midterm answer key. Participants who took version A of the exam were given a malleable mindset letter, those with version B were given a fixed mindset letter, and those with version C received a control letter. Each letter contained a small visual graphic in the top left hand corner, a notable quote relating to the letter condition across the top of the page, and the actual intervention message for the student signed by the instructor of the course.

Malleable Mindset Message (219 words; Appendix A). This letter told students that the human brain continued to learn new skills well into adulthood. Therefore, even when students face difficult situations, they can still overcome them with hard work and dedication. The notable quote used in this letter was, "Hard work beats talent when talent doesn't work hard" – Tim Notke

Fixed Mindset Message (213 words; Appendix A). This letter told students that every individual has different strengths and weaknesses. Therefore, students should focus simply on their strengths in order to carry them through difficult situations. The notable quote used in this letter: "It's not how smart you are, it's how you are smart!" – Howard Gardner

Control Message (203 words; Appendix A). This letter thanked students for their continued participation and attendance in the course. The notable quote used in this letter: "Silent gratitude isn't much use to anyone." – G. B. Stern

Procedure

Researchers obtained IRB approval. On the first day of class all students enrolled in the first section of introductory psychology 202 completed a 24-item pretest exam in order to assess prior knowledge of psychology. Students had

approximately one hour to take the exam. All exams were collected and scored by the course teaching assistant. Students were never given the answers to the pre-test or any feedback on how well they performed. During that same week, students were required to complete the first online homework assignment (79.87% actual completion rate) through their online course management software. The assignment included measures of personality (TIPI), self-compassion (SSC), theories of intelligence (ToI), perseverance (GRIT-S), and perceived stress (PS). Some of this data was used in subsequent lectures that related to course topics in order to aid student understanding of the material. Table 5.1 contains an outline of the course and intervention schedule.

Table 5.1 *Introductory Psychology Weekly Schedule*

Week	Course Activities	Measured Of
1	Pre-Test	Prior Psychology Knowledge
	Online Homework 1	Student Psychological Variables
	Content	
2	Midterm 1	Pre-Intervention Midterm
	Intervention Stapled to Answer Key	
3	Content	
4	Midterm 2	Post-Intervention Midterm
5	Content	
6	Midterm 3	Post-Intervention Midterm
7	Content	
8	Midterm 4	Post-Intervention Midterm
9	Content	
10	Content	
11	Final Exam	Post-Intervention Exam

Nine days after the initial pretest, students took the first midterm exam for the course. The exam covered content from the first two chapters in the course textbook as well as any lecture material presented during the course meetings. After

completing the exam participants handed their scantrons to either the instructor or the teaching assistant and were able to keep their exam packet for future study material. The instructor or teaching assistant then handed students the answer key to the exam along with the intervention letter stapled to the top. Participants were randomly assigned to each study condition based on the version of the exam they took. Participants with version A of the exam (n=93) received a malleable mindset message, those with version B (n=94) received a fixed mindset message and those with version C (n=91) received the control letter. In no way were students instructed or required to read the letter.

Each participant's grade for all subsequent exams in the course was recorded. In addition, three questions at the end of the final exam assessed the success of the intervention letter manipulation. Participants were asked to recall the message that had been present in their letter received after midterm one. Responses were in a multiple choice format with three choices corresponding to each of the messages in the letters, one choice indicating that the participant did not read or remember the letter at all, and the final choice being that the student did not receive a letter or take the first unit exam. The other two questions probed for each participant's interpretation of the letter's message and the degree to which the participant felt nagged or bothered by the message he or she received.

Chapter 6 – Results

Correlations

There were no significant correlations between participant initial mindset, self-compassion, or perceived stress at the beginning of the term and measures of academic performance (i.e. pre-test, midterm one, post-intervention midterm average, final exam; all *p*= ns). However, GRIT scores were predictive of better academic performance (Table 6.1). Even after controlling for prior psychology knowledge (pre-test scores) and SAT scores, GRIT continued to be predictive of final exam grades (*r*=.167, *p*=.03), though it was not predictive of post-intervention midterm average (P-I.M.A; *r*=.108, *p*=.163).

Table 6.1 – Correlations

	Mindset	Self-Compassion	Perceived Stress	Grit
Pre-Test	-.110	-.023	-.03	.187**
Midterm 1	-.091	.029	-.098	.241***
P-I.M.A.	-.035	.023	-.081	221**
Final Exam	-.009	.025	-.073	.287***
Course Grade	-.043	.019	-.083	.253***

***p<.001; **p<.01

Entire Intervention Group (Whole Sample)

Nearly all exam scores (SAT, pre-test, midterm one, average post-intervention midterm, and final exam) across the three letter groups passed tests of normality. The one exception was midterm one score for the control group (Sharpio-Wilk=.952, *p*=.01). An examination of the histogram and Q-Q plots of midterm one scores for the control group revealed a small negative skew in the distribution, therefore the data was not transformed because it is still approximately normally distributed. An

analysis of the homogeneity of variances indicated that there was equality of variance for all dependent measures ($F(2,183)=.741\text{-}2.639$, all $p>.215$).

The mean of post-intervention midterms was calculated for every participant (P-IMA). Due to the structure of the course, students were allowed to drop their lowest midterm score. Therefore, the number of exams used to calculate this score varied by participant. In some cases, participants took all three post-intervention midterms. However, some students (n=25, 9%) took only two additional exams. There were no differences on final exam score ($t(258)=.872$, $p=.384$), post-intervention midterm average ($t(258)=1.304$, $p=.194$), or midterm one exam score ($t(258)=.546$, $p=.585$) between students who took all subsequent post-intervention midterms and those who missed an exam. Additionally, intervention condition was not predictive of missing a post-intervention midterm (Malleable=10% missed one post-intervention midterm; Fixed=14%; Control=10%). Therefore, the average post-intervention midterm score was used as a valid measure of subsequent post-intervention exam performance for all participants.

In the entire participant sample (n=278), 93 students were given the malleable mindset letter, 94 were given the fixed mindset letter, and 91 received the control letter. One-way analysis of variance revealed no pre-existing pre-intervention group differences in SAT scores ($F(2, 237)=.254$, $p=.776$), pre-tests taken on the first day of class ($F(2,250)=1.026$, $p=.36$), nor exam performance on the first midterm ($F(2,275)=1.253$, $p=.287$; Table 6.2; Figure 6.1). Therefore, there were no pre-existing group differences in college readiness, prior psychology knowledge, or academic performance on the pre-intervention exam (midterm one). The number of

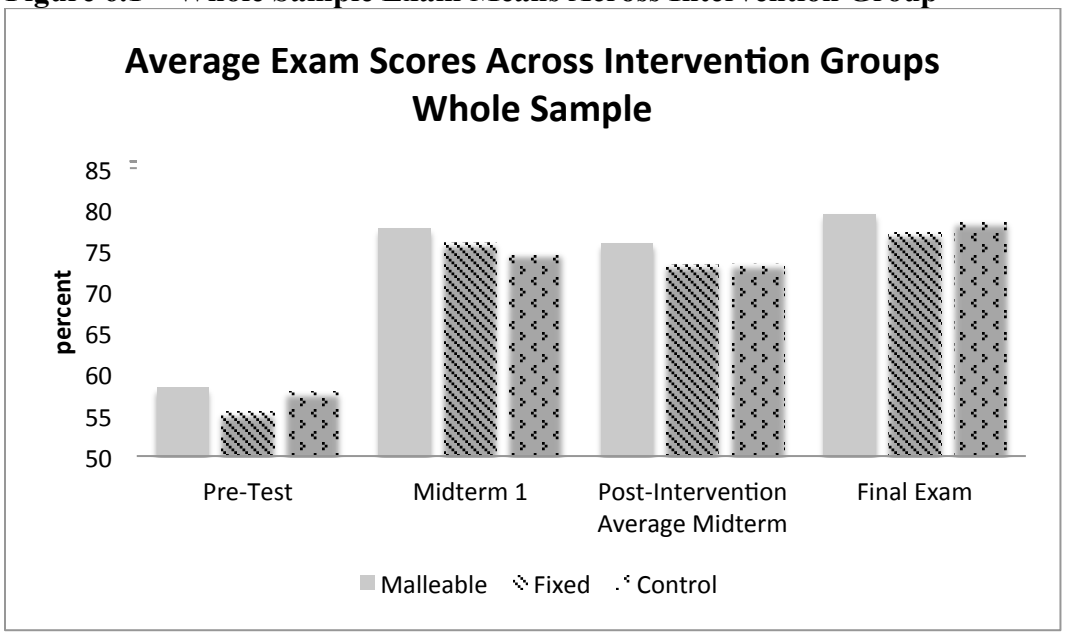
students who Drop/Failed/Withdrew (DFW) from the course after the intervention was given was recorded. Students were recorded as failing the course if they received an F as their overall final course grade. There were no group differences in (DFW) rates across groups (Malleable=5.4%, Fixed=4.3%, Control= 4.4%) throughout the term.

Table 6.2 – Entire Intervention Group (Whole Sample)
Means (Standard Deviations)

	SAT	Pretest	Midterm 1	P-I.M.A.	Final Exam
Malleable	1580.51(221.6)	58.29 (13.7)	77.63(11.5)	75.85(10.4)	79.42(9.7)
Fixed	1565.83(241.7)	55.36(14.6)	75.96(13.6)	73.35(10.9)	77.12(11.3)
Control	1554.42(223.3)	57.88(14.8)	74.69(12.8)	73.38(9.9)	78.47(10.0)
Total	1567.00(228.7)	57.17(14.35)	76.10(12.7)	74.19(10.5)	78.3(10.4)
N	240	253	278	276	260

SAT in real score out of 2400; All other scores listed in percentages

Figure 6.1 – Whole Sample Exam Means Across Intervention Group



One-way analysis of the effects of the letters revealed no significant between group differences on P-IMA scores ($F(2,273)=1.744$, $p=.177$; Figure 6.1) nor on the final exam ($F(2,257)=1.102$, $p=.334$; Figure 6.1). However, an analysis of effect sizes

(Cohen, 1992) revealed that the letters had small effects on both P-IMA scores and final exam grades (Table 6.3). Specifically, the malleable mindset letter increased participants' P-IMA scores by about 2.5% when compared to both the fixed mindset (*d*=.23) and control (*d*=.24) groups. There was no difference between the fixed mindset and control group on P-IMA (fixed-control= 0%, *d*=-.001). Similarly, there was a 2.3% difference on final exam performance between the malleable mindset and fixed mindset groups (*d*=.22) though no meaningful difference between malleable mindset and control group was observed for this variable (malleable-control= .9%, *d*=.096).

Table 6.3 – Entire Class (Whole Sample) Effect Sizes

	Average Midterm Score			**Final Exam Score**		
	Mean Difference	% Difference	Cohen's d	Mean Difference	% Difference	Cohen's d
Malleable – Fixed	1.198	2.5%	.234*	2.195	2.3%	.220*
Malleable – Control	1.187	2.5%	.244*	.901	.9%	.096
Fixed - Control	-0.011	0%	-.001	-1.295	-1.4%	-.127

The effect size analysis indicates that there were meaningful differences between the malleable mindset and fixed mindset groups, but the study was not powerful enough to detect this effect size. In order to detect an effect of d=.23 in between the malleable and fixed mindset groups (two-sample t-test, power=.80), we would need 596 participants across the two conditions. While the effects in this study were not statistically significant, it is likely that they would have been if even one more section of introductory psychology had been included in the study.

Participants Who Passed the Manipulation Check (Subsample)

All exam scores (SAT, pre-test, midterm one, P-IMA, and final exam) across the three letter groups passed tests of normality. An analysis of the homogeneity of variances indicated that there was equality of variance for all dependent variables (all $p>.06$).

A manipulation check was administered as an extra credit multiple-choice question on the final exam. The question asked students to recall the message in their letter received two months earlier. Participants were not required to answer the question correctly in order to receive extra credit. 100% of the participants who took the final exam responded to the question. Three of the answer choices corresponded to each of the intervention letters (malleable, fixed and control), one answer choice simply stated that the participant didn't read or didn't remember the letter, and the final answer choice stated that the student didn't take the first midterm. Participants who correctly identified their letter's message are included in the following analyses (n=86; *malleable* = 39, *fixed* = 19, *control* = 28). There were some significant differences between participants who passed the manipulation check and those that did not on measures of academic performance. Those who passed the manipulation check did not have significantly higher SAT scores ($t(223)=1.553$, $p=.122$), or pre-test scores ($t(234)=1.443$, $p=.15$) indicating equal levels of academic ability and prior psychology knowledge between groups. However, those who passed the manipulation check had significantly higher midterm one scores ($t(257)=3.802$, $p<.001$), P-IMA scores ($t(257)=4.124$, $p<.001$), and final exam scores ($t(257)=3.425$, $p=.001$).

One-way analysis of variance revealed no pre-existing differences between intervention groups on SAT scores ($F(2, 73)=1.884$, $p=.159$; Table 6.4), pre-test scores taken on the first day of class ($F(2, 80)=.333$, $p=.718$), or exam performance on the first midterm ($F(2,83)=.378$, $p=.687$). Therefore, there were no pre-existing group differences in college readiness, prior psychology knowledge, or academic performance on pre-intervention assessments.

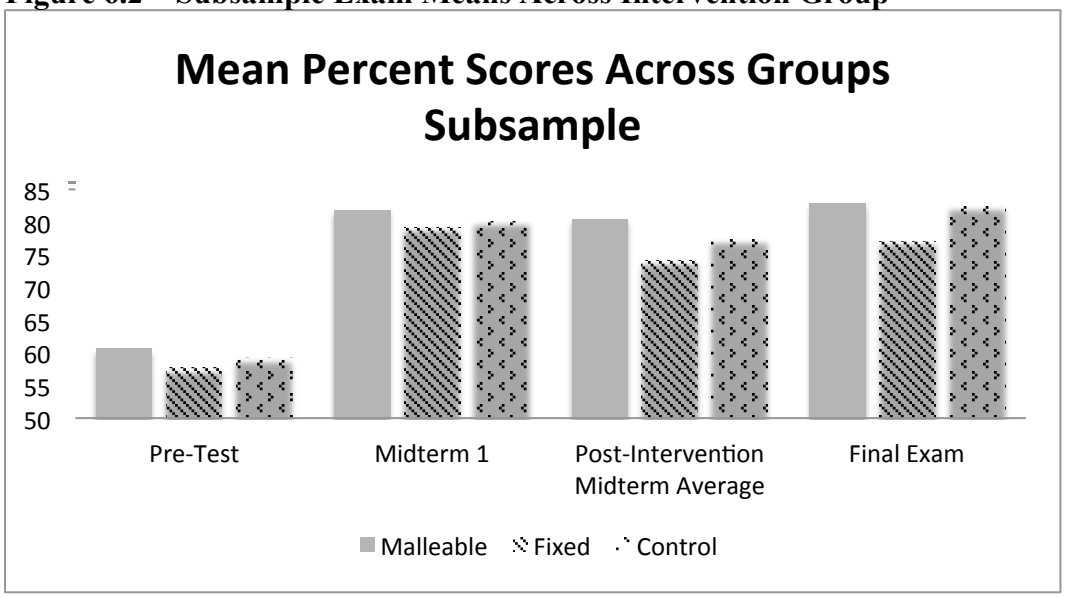
Table 6.4 – Participants Who Passed the Manipulation Check (Subsample) Means (Standard Deviations)

	SAT	Pretest	Midterm 1	P-I.M.A.	Final Exam
Malleable	1660(200.3)	60.58(11.9)	81.83(11.1)	80.40(9.3)	82.88(8.7)
Fixed	1551.67(247.4)	57.67(12.8)	79.17(14.4)	74.1(11.1)	77.06(11.2)
Control	1575.83(209.0)	59.25(13.8)	80.13(10.6)	77.37(8.3)	82.4(9.5)
Total	1607.76(217.4)	59.5(12.7)	80.69(11.7)	78.02(9.7)	81.4(9.7)
N	76	83	86	86	86

SAT in real score out of 2400; All other scores listed in percentages

An analysis of P-IMA scores revealed marginally significant between group differences ($F(2,83)=2.959$, $p=.057$). Tukey post hoc analysis demonstrated that while there were no differences between the malleable mindset (m=80%, sd= 9%), and control groups (m=77%, sd= 8%; p=.4), there were significant differences in performance between the malleable mindset and fixed mindset groups (m=74%, sd=11%; p=.049). Those in the malleable mindset group performed 6.3% better on subsequent midterms than those in the fixed mindset condition. There was also some evidence of between group differences on the final exam ($F(2, 83)=2.597$, $p=.081$). Further analysis revealed no significant differences between the malleable mindset (m=83%, sd=9%) and control groups (m=82%, sd=10%; p=.977). However, there was some evidence that the malleable mindset group outperformed the fixed mindset group (m=77%, sd= 11%; p=.08) on the final exam (Table 6.4; Figure 6.2).

Figure 6.2 – Subsample Exam Means Across Intervention Group



There were medium effects between the malleable and fixed mindset groups on the P-IMA score (*d*=.62) and the final exam score (*d*=.58). There were also medium effects between the fixed mindset and control group on both scores (*d*=-.34, *d*=-.52; Table 6.5).

Table 6.5 – Participants who Passed the Manipulation Check (Subsample) Effect Sizes

	Average Midterm Score				**Final Exam Score**			
	Mean Difference	% Difference	P-value	Cohen's d	Mean Difference	% Difference	P-value	Cohen's d
Malleable-Fixed	3.03	6.3%	.05	.62**	5.53	5.8%	.08	.58**
Malleable-Control	1.46	3.0%	.4	.34*	.458	.5%	.98	.05
Fixed-Control	-1.58	3.3%	.48	-.34*	-5.08	-5.3%	.15	-.52**

*small effect size; **moderate effect size

Unplanned Analysis

An analysis of grade improvement from the first to the second midterm revealed that of the 11 participants who improved their grade by more than two letter grades (20.4% - 29%), eight of them were in the control group. The average increase from midterm one to midterm two for the class was 1.7% *(sd*=9.4%). Therefore, it seems unlikely that the message in the control letter was truly a message that did not alter student motivation or performance. However, the increase in academic performance did not last for midterm three or midterm four. That is, the exam scores on the last two midterms were more similar to midterm one than midterm two.

If the message in the control group was non-neutral, it would limit the conclusions we could draw between the malleable mindset and fixed mindset groups. In order to further examine the effects of the intervention messages we used participants who did not pass the manipulation check as a control group for those participants who did pass the manipulation check across all three intervention conditions. If the control message was non-neutral, we would expect control group participant scores on post-intervention measures of academic success (P-IMA and final exam) to be higher for those participants who passed the manipulation check and those who did not. All of the following results demonstrate the effects of the intervention after controlling for student SAT scores.

A one-way analysis of variance revealed significant between group differences on both P-IMA ($F(5, 224)=3.82$, $p=.002$) and final exam scores ($F(5, 224)=2.75$, $p=.020$). There were significant differences on P-IMA scores within the malleable mindset group between those who passed the manipulation check

(*m*=78.8%, *sd*=1.3%) and those who did not (*m*=73.8%, *sd*=1.2%; Table 6.6). There was also some evidence of a difference between these groups on the final exam (passed*:* *m*=81%, *sd*= 1.4%, did not pass: *m*=78.1%, *sd*=1.2%). These results indicate that the malleable mindset message used in the intervention had a positive effect on participant's post-intervention academic achievement.

Table 6.6 Within Group Comparisons

Condition	Manipulation Check	P-IMA	Difference	Final Exam	Difference
Malleable	Passed	78.8 (1.3)	**5%**	81.0 (1.4)	**2.9%**
	Failed	73.8 (1.2)	***p*=.01**	78.1 (1.2)	***p*=.10**
Fixed	Passed	74.2 (1.7)	1.3%	77.1 (1.8)	-0.3%
	Failed	72.9 (0.9)	*p*=.49	77.4 (0.9)	*p*=.88
Control	Passed	76.5 (1.5)	**3.8%**	81.8 (1.6)	**5.4%**
	Failed	72.7 (1.0)	***p*=.04**	76.4 (1.1)	***p*=.01**

When the same analysis is done for participants in the fixed mindset group, there are no meaningful differences between participants who passed the manipulation check and those who did not on measures of post-intervention academic achievement. However, participants in the control condition who passed the manipulation check earned significantly higher scores on P-IMA (*m*=76.5%, *sd*=1.5%) and the final exam (*m*=81.8%, *sd*=1.6%) than those who did not pass the manipulation check (P-IMA: *m*=72.7%, *sd*=1%; Final Exam: *m*=76.4%, *sd*=1.1%). Therefore, the message in the control letter demonstrated positive effects on academic performance for students who retained their intervention message throughout the term.

Chapter 7 – Discussion

Discussion

Students with a malleable mindset have been shown to have mastery-oriented learning goals, (Dweck &Sorich, 1999), higher scores on measures of academic performance (Blackwell et al., 2007), and reduced susceptibility of stereotype threat (Aronson et al., 2002). The mechanism behind these benefits is in the pattern of attribution that students engage in after a difficult task or while trying to understand new material (Dweck, 2000; Dweck, 2002). By encouraging students to work hard, persist, and to see effort as a valuable learning experience, students are less likely to attribute their effort as an indication of lack of ability. Instead, they are able to understand that everyone needs to exert effort to learn; intelligence is not a fixed trait but is in fact one that can be altered through experience and gains in knowledge. Therefore, when students with a malleable mindset face a challenge, they become empowered rather than helpless, they exert effort rather than suppress it, they persist rather than quit, and they perform better than fixed mindset students on objective measures of academic performance. Holding a malleable mindset is an added buffer against the stress that comes with the increase in academic rigor and difficult transition to higher education.

However, not all students come to college thinking that they can grow their brain and learn new things. Instead, fixed mindset students believe that college is a time to demonstrate immediate mastery of material rather than exert effort to learn something new. For these students, the transition would be substantially more difficult than those with a malleable one due to the threatening nature of poor

performance in academic assessment. These students may be at higher risk to drop out of school or discontinue their education. Therefore, educational research on student mindset must move beyond simply understanding what it can predict and its associations with other variables and extend to interventions that induce a malleable mindset in students in order to increase their academic success. Furthermore, these interventions should be tested empirically in real-world classroom environments in order to fully understand the effects and outcomes of such an intervention.

While there have been malleable mindset interventions that have successfully increased academic achievement in college aged students in the past (e.g. Blackwell et al., 2007), no one has examined the effectiveness of using a passive and minimal design in a real large-lecture classroom. With the workload that instructors and faculty members face, it would be beneficial to examine the effectiveness of a low cost and easy to implement mindset intervention. This way, the intervention would be easily sustainable in introductory courses where there is not a lot of one on one interaction between instructors and students and where there is a high concentration of first-year students who may be struggling with the transition to higher education. The intervention examined in this study had a similar overall message to previous work (Aronson et al., 2002) and the administration of the intervention was timed specifically when students may have faced failure, increasing their receptiveness to the message. However, unlike the majority of other malleable mindset intervention studies (Walton, 2014; Wilson et al., 2002) that take an active approach to the intervention administration, the intervention itself was designed to be passive, minimal, and easily administered. Students simply received this message in the form

of a letter from their instructor stapled to the answer key of their first midterm exam with no instructions or requirements to read it.

This provides key insights to what instructors can expect when using a minimal intervention design and how students may respond to such an intervention. First, the response rate, as measured by students passing the manipulation check at the end of the term, was relatively low. Only 31% of the participants who received a letter were able to correctly identify its message at the end of the term while 39% of participants admitted to not reading the letter at all or forgetting the message. Adding directions may increase the reading and retention of the message on future participant samples. However, future research should be sure to compare response rates of students with intervention instructions to the 31% response rate found in this study. While it is unlikely, it is possible that there would not be any significant increase in response rate by adding instructor instructions because students who are the most likely to follow the instructions are also the most likely to read the message without instruction altogether.

Second, it was hypothesized that students would benefit from receiving a malleable mindset message after their first exam and that they would see gains in academic success above and beyond both the control group and the fixed mindset groups at the end of the term. In the whole participant sample there were no statistically significant differences between the malleable mindset and control groups in terms of average post-intervention midterm score or final exam score. However, there were meaningful differences between the malleable mindset and fixed mindset groups on both measures (2.5%; 2.3%). While the effects of the intervention seem

small, this is truly the difference between a student earning a B- and a B on an exam. Therefore, this effect translates to meaningful differences in course grades and contributes to a student's end of term GPA.

Finally, it was hypothesized that the effect of the malleable mindset intervention would be strengthened for the subsample of participants who passed the manipulation check at the end of the term. Again, there were no significant differences between the malleable mindset and control groups on average post-intervention midterm score or final exam score. However, the differences between the malleable mindset and fixed mindset groups were more than half a letter grade on both dependent variables (6.3%; 5.8%). This effect size is similar to effects produced by incorporating intensive active learning components into course material that require a lot of instructor time and effort (Freedman et al., 2014). If the same effects in academic performance from cumbersome active learning activities can be produced by getting students to read a 200-word malleable mindset letter, it seems that the student and instructor resources and time invested in those activities are being used inefficiently.

Many of the previous mindset intervention studies have utilized an active approach that asked participants to restate information that they received in one way or another (Blackwell et al., 2007; Aronson et al., 2002; Hong et al., 1999). Many of these researchers see this component as an essential part of the intervention process because it both ensures that participants read and understand the intervention material and allows for a deeper processing of the information (Walton, 2014; Wilson et al., 2002; Yeager et al., 2013a). While this study took a passive approach and still found

positive results, it cannot be concluded that the active approach is entirely unnecessary. No data was collected on how participants used the information in the letters after they received it. It is possible that the only reason some of the participants were able to remember the message in their letter for so long was because they found a way to use the information or pass it on to another person in ways that are similar to previous intervention methods that require participants to do so. Adding a summarization activity in conjunction with the letter may not benefit participants because it is a "saying-is-believing" activity that allows for deeper processing, but solely because it is a way to ensure that they read and understood the message.

It is also possible that when students received the malleable mindset letter, it simply encouraged them to actually use the answer key it came with to grade their first midterm exam, thereby increasing their performance on future exams. Since all of the exams in the course were cumulative, students who used their previous exams to understand review material on upcoming exams would have had an advantage. If the malleable mindset letter encouraged students to take the extra step of grading their exams themselves and using the material to study, it would have benefitted them more on future exams when compared to other students. On the other hand, the fixed mindset group would have seen the use of the answer key as a potential threat to their inner ability. Therefore, these students would be less inclined to look at the answer key and to use them as study aids for upcoming midterms.

Limitations

Even though the results suggest that implementing a passive malleable mindset intervention could be beneficial to academic performance, there were a few

major limitations to this study. First, results in unplanned analyses indicate that the control letter used in this study was not truly neutral and provided the control group with a positive boost in academic performance. Therefore, there is evidence that the control group was not truly a control group to which we can make a comparison of academic performance. Results showed no distinct differences between the malleable mindset and control groups on the dependent variables (average post-intervention midterm score and final exam score) for both the entire participant pool and the subsample of students who passed the manipulation check. These results could be interpreted in two ways. It could be possible that the control letter gave students a boost in academic performance similar to the malleable mindset message. Perhaps thanking students for their attendance and complimenting their academic ability is enough to increase their resilience and response to difficult exams. On the other hand, the results could say that the malleable mindset intervention had no effect on academic performance but there were iatrogenic effects of the fixed mindset letter. The results of the unplanned analysis on within group comparisons between participants who passed and failed the manipulation check indicate that there were no iatrogenic effects of the fixed mindset letter. Instead, the message in the control letter provided a positive boost in academic performance similar to the malleable mindset message used in this study. In fact, a question on the final exam asked participants to indicate how the message in the letter made them feel. Of the control group participants who passed the manipulation check, 61% of them indicated that the letter made them feel as though their instructor really cared about them as opposed to feeling like they had the potential to improve their grade (29%) or that they can

succeed in some – but not all – areas (11%). It is possible that if participants felt that their instructor really cared about them, they would perform better in the course than those that did not. Future research should ensure that the message in the control group is neutral and does not indicate instructor care or encouragement of any kind.

Another major limitation to the study was the incredibly low alphas in the measures of personality. Better measures would have allowed researchers to pinpoint variables that predicted the reading and retention of the letter's message (e.g. conscientiousness, neuroticism). It seems clear that participants who performed better academically were also the participants who were more likely to retain the message in the letter. This is indicated by the academic differences on the pre-intervention midterm one score, the average post-intervention midterm and final exam scores between participants who passed the manipulation check and those that did not. However, there were no differences in SAT scores or pre-test scores between the two groups. The difference on the pre-intervention exam score between those who passed the manipulation check and those that did not lead researchers to believe that participants were more likely to use the answer key and read the corresponding intervention letter if they had performed well on the first exam. It could be the case that students who performed poorly on the first exam choose to disregard the use of the answer key and therefore never read the intervention letter. If the personality tests in this study had been more reliable it would have added information as to whether or not message reading and retention was driven by personality factors (e.g. conscientiousness) or by pre-intervention exam performance.

Finally, the theory of intelligence scale (Dweck, 2000) was never re-administered to the participants. Even though meaningful differences were observed in academic performance, it would have been beneficial to demonstrate changes on the theories of intelligence measure in the direction of students' intervention message.

What the results do not mean

It is important to remember the scope and the limitations of the findings produced in this study. While the difference in academic outcomes between the malleable and fixed mindset intervention groups is meaningful, it is essential to understand that the intervention should not be taken as a cure-all approach to increasing retention and academic achievement. Students face real barriers in both their transition to and throughout their college careers. It would be blatantly rude to tell students that they could overcome the financial barriers, family emergencies, or traumatic experiences that impact their academic success by simply showing more effort in their school work and altering their attributions of failure. Therefore, the answer to increasing university retention and student academic success does not lie solely in teaching students to hold a malleable mindset. Instead, this is a tool to be used when other more basic student needs have already been met.

It would also be misleading to conclude that the malleable mindset letter in this study lead to an increase in academic performance. Due to the lack of neutrality in the control group, this conclusion cannot be drawn. Rather, the results indicate that there are benefits to promoting a malleable mindset to students over the promotion of a fixed mindset. This finding is beneficial to instructors, advisors, and the institution because it demonstrates the powerful impact that these roles play in shaping student

attitudes and attributions. If a simple letter signed by the instructor of an introductory psychology course can produce such differences in academic performance between groups, it is likely that other more salient messages in course lecture, syllabi, and readings can have similar effects. Therefore, instructors should be mindful of the mindset they promote in their own lectures and how this can influence student performance. It is clear from the results of this study that giving students a malleable mindset is more beneficial on their academic performance than giving them a fixed mindset.

Finally, the moderate effect sizes found in the subsample of students who passed the manipulation check should not be expected to increase. If instructors were to ensure that all of their students read and retained the information in the letter, it should not be assumed that even larger effects would be found. Instead, it is likely that the effect size would be similar to the one found in the current sample. Increasing the number of participants who passed the manipulation check would make the finding more robust, but it would likely not result in a larger difference between groups.

Future Directions

In addition to addressing the limitations of the current study, there are four main areas of focus that future research should address. First, researchers should manipulate the time of intervention, time of the manipulation check, letter source, and intervention delivery method in order to determine the optimal setting for such a minimal design. It is possible that more participants would have passed the manipulation check had it been given closer to the intervention. This would have

enabled the researchers to look more closely at any immediate effects of the intervention and may have provided insight into the brief increase in academic achievement in the control group. It would also be interesting to manipulate the source of the letter in future studies to determine the amount of influence different people have in student lives. For example, if the letter were to come from the mother of a student rather than the instructor of the course, would the student be more or less inclined to pay attention to the message the letter contained? Additionally, the method of intervention delivery could be altered so that students would be more receptive to it. Alternative methods of dissemination include sending the letter through email, having it embedded in a homework assignment, or adding any verbal directions to students as they receive their letters. It would also be beneficial to test the effects of adding an intervention booster later in the term. If the participants were reminded of their original message right before the final exam, it may increase the effects observed between groups due to added benefits of re-affirming the messages. Finally, the current study was conducted in the spring term of the academic school year. It is possible that many of the students who would benefit the most from such an intervention had already left the university system due to a poor transition into higher education. There could be different effects if the study had been conducted during the first academic quarter of the year when students are just beginning college.

Second, future research could determine if there are any transference effects of the intervention on academic performance in other courses or on overall GPA at the end of the term. Other studies have found substantial long-term effects of intensive two-hour interventions (Blackwell et al., 2007) and it is possible that these

long-term effects would not be present in such a minimal design. Furthermore, institutions of higher education would be interested in knowing whether or not the intervention effects transfer to other courses. For example, if a student received a malleable mindset message in their introductory psychology course, would he or she believe that this message also applied to performance in a statistics course? The transfer of the message across disciplines would be an important aspect to consider because it may be true that students could hold a malleable mindset in one course but not in the other. However, if students did apply the malleable mindset message to all of their coursework, differences in end of term and cumulative GPA could be observed. This would allow the university to implement malleable mindset interventions in key courses that all students are required to take rather than every introductory course across various disciplines.

Third, individual differences in response to the intervention are an important component of using a passive and minimal design. While there were not substantial differences between students who passed the manipulation check and those that did not on the pre-test, there were differences in post-intervention measures of academic performance. It is possible that these interventions only work for those who are highly conscientious or for the best students because they are the only students who are likely to read and deeply process the optional information being presented. In reality, these students are the ones who need the intervention the least. Future research focused on predictors of intervention receptiveness would help instructors and institutions understand how to tailor these interventions to students who most need them.

Finally, future projects should examine the effects of the intervention on specific subpopulations of students. As seen in Aronson et al. (2002), the malleable mindset message can be beneficial for groups facing stereotype threat. Therefore, it is possible that such a minimal design could benefit specific subpopulations even more than found in the current study. In particular, the minimal malleable mindset intervention may demonstrate even larger effects on women and minorities in science, technology, engineering, and math (STEM) fields due to the feelings of social isolation these subgroups may feel as well as the potential for stereotype threat to negatively effect their academic performance. It is possible that passive interventions are beneficial to some populations of students but that other subgroups would need more intense informational sessions.

Chapter 8 – Conclusion

The benefit of promoting a malleable mindset to students was demonstrated in the current study. A passive, low cost, and minimal intervention was able to produce a 2.5% difference in academic performance between the malleable and fixed mindset groups. While the number of students who actually passed the manipulation check was considerably low (31%), there were even larger between group differences on academic performance for those participants who demonstrated this retention of the intervention message at the end of the term (~6%).

It is clear that promoting a malleable mindset, even in a minimal setting, produces better academic outcomes than promoting a fixed mindset to students. It is important to understand the impacts of a fixed mindset message on academic performance because students encounter these messages all the time. Advisors, instructors, and faculty members often tell students that they are simply not cut out for a discipline or that they should focus on enrolling in courses that will boost their GPA. These messages are directly aligned with an entity theory of intelligence and can have detrimental effects on student academic performance.

The findings in this study should be considered by any persons advising or providing support for students in higher education. When students struggle with the transition to college, telling them that they just aren't math people or that they should focus on other things does not encourage them to learn. Instead, it tells students that they should not waste their time and effort on learning new material. It is important for educators, parents, and university administration to understand the implication of

their statements on student mindset and to promote malleable mindset messages in even the smallest of ways.

Furthermore, the intervention itself required no class time, was low-cost, and was easy to administer in a large lecture introductory psychology course. There are benefits of adopting such a minimal intervention design in the classroom because it is sustainable for any university professor, can be administered regardless of the course structure or content, and as demonstrated by the between group differences observed, it is an effective means of increasing student academic success.

It is common for psychological research to be misapplied in educational settings. Therefore, researchers and administrators must be mindful of the ways research is being applied in higher education as well as ways to test the effectiveness of using certain pedagogical methods or academic success interventions. By investigating ways that instructors can use psychological research to improve their students' academic success in a way that is both effective and doable, we are providing future students and instructors the opportunity to maximize their return on social psychological interventions to increase student motivation and academic success.

References

ACT®, 2008. *ACT® - SAT ® Concordance.* Retrieved from http://www.act.org/aap/concordance/pdf/reference.pdf

Ames, C., & Archer, J. (1988). Achievement goals in the classroom: Students' learning strategies and motivation processes. *Journal of educational psychology*, *80*(3), 260-267.

Aronson, J., Fried, C., & Good, C. (2002). Reducing the effects of stereotype threat on African American college students by shaping theories of intelligence. *Journal of Experimental Social Psychology, 38*, 113-125.

Barchard, K. A. (2003). Does emotional intelligence assist in the prediction of academic success?. *Educational and Psychological Measurement*, *63*(5), 840-858.

Blackwell, L. S., Trzesniewski, K. H., & Dweck, C. S. (2007). Implicit theories of intelligence predict achievement across an adolescent transition: A longitudinal study and an intervention. *Child development*, *78*(1), 246-263.

Bridgeman, B., McCamley-Jenkins, L., & Ervin, N. (2000). *Predictions of freshman grade point average from the revised and recentered SAT 1: Reasoning test* (College Board Rept. No. 2000-1). New York: College Entrance Examination Board.

Cepeda, N. J., Pashler, H., Vul, E., Wixted, J. T., & Rohrer, D. (2006). Distributed practice in verbal recall tasks: A review and quantitative synthesis. *Psychological bulletin*, *132*(3), 354-380.

Chamorro-Premuzic, T., & Furnham, A. (2003). Personality predicts academic performance: Evidence from two longitudinal university samples. *Journal of Research in Personality*, *37*(4), 319-338.

Cohen, J. (1992). A power primer. *Psychological bulletin*, *112*(1), 155-159.

Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of health and social behavior*, 385-396.

Duckworth, A. L., & Quinn, P. D. (2009). Development and validation of the Short Grit Scale (GRIT–S). *Journal of personality assessment*, *91*(2), 166-174.

Duckworth, A. L., Peterson, C., Matthews, M. D., & Kelly, D. R. (2007). Grit: perseverance and passion for long-term goals. *Journal of personality and social psychology*, *92*(6), 1087-1101.

Dweck, C. S. (2000). *Self-theories: Their role in motivation, personality, and development*. New York, NY: Psychology Press.

Dweck, C. S. (2002). Messages that motivate: How praise molds students' beliefs, motivation, and performance in surprising ways. In J. Aronson (Ed.), *Improving academic achievement* (pp. 38-60). San Diego, CA: Academic Press.

Dweck, C. S., & Leggett, E. L. (1988). A social-cognitive approach to motivation and personality. *Psychological review*, *95*(2), 256-273.

Dweck, C. S., & Sorich, L. (1999). Mastery-oriented thinking. In C. R. Snyder (Ed.), *Coping* (232-251). New York, NY: Oxford University Press.

Freeman, S., Eddy, S. L., McDonough, M., Smith, M. K., Okoroafor, N., Jordt, H., & Wenderoth, M. P. (2014). Active learning increases student performance in science, engineering, and mathematics. *Proceedings of the National Academy of Sciences*, *111*(23), 8410-8415.

Good, C., Aronson, J., & Inzlicht, M. (2003). Improving adolescents' standardized test performance: An intervention to reduce the effects of stereotype threat. *Journal of Applied Developmental Psychology*, *24*(6), 645-662.

Gosling, S. D., Rentfrow, P. J., & Swann, W. B. (2003). A very brief measure of the Big-Five personality domains. *Journal of Research in personality*, *37*(6), 504-528.

Harp, S. F., & Mayer, R. E. (1997). The role of interest in learning from scientific text and illustrations: On the distinction between emotional interest and cognitive interest. *Journal of Educational Psychology*, *89*(1), 92-102.

Heider, R. (1958). The naïve analysis of action. Chapter 4 in F. Heider, *The psychology of interpersonal relations.* New York, NY: Wiley.

Henderson, V. L., & Dweck, C. S. (1990). Motivation and achievement. In S. S. Feldman & G. R. Elliot (Eds.), *At the threshold: The developing adolescent* (pp.308-329). Cambridge, MA: Harvard University Press.

Hezlett, S. A., Kuncel, N. R., Vey, M. A., Ahart, A. M., Ones, D. S., Campbell, J. P., & Camara, W. (2001, April). *The predictive validity of the SAT: A meta-analysis.* Paper presented in symposium ("Predicting Performance: The Interface of I-O Psychology and Educational Research") conducted by D. Ones & S. Hezlett (Chairs) at the 16th annual convention of the Society of Industrial and Organizational Psychology, San Diego, CA.

Hong, Y., Chiu, C., Dweck, C. S., Lin, D. M.-S., & Wan, W. (1999). Implicit theories, attributions, and coping: A meaning system approach. *Journal of Personality and Social Psychology, 77*(3), 588-599.

Kirst, M. W., & Venezia, A. (2006). Improving college readiness and success for all students: A joint responsibility between K-12 and postsecondary education. *The Secretary of Education's Commission on the Future of Higher Education*. Retrieved from: https://www2.ed.gov/about/bdscomm/list/hiedfuture/reports/kirstvenezia.pdf.

Knaggs, C. M., Sondergeld, T. A., & Schardt, B. (2015). Overcoming Barriers to College Enrollment, Persistence, and Perceptions for Urban High School Students in a College Preparatory Program. *Journal of Mixed Methods Research*, *9*(1), 7-30.

Korbin, J. L., Patterson, B. F., Shaw, E. J., Mattern, K. D., & Barbuti, S. M. (2008). *Validity of the SAT for predicting first-year college grade point average* (College Board Research Report No. 2008-5). New York, NY: The College Board.

Kuncel, N. R., Hezlett, S. A., & Ones, D. S. (2004). Academic performance, career potential, creativity, and job performance: Can one construct predict them all?. *Journal of personality and social psychology*, *86*(1), 148-161.

Mueller, C. M., & Dweck, C. S. (1998). Praise for intelligence can undermine children's motivation and performance. *Journal of personality and social psychology*, *75*(1), 33-52.

Mueller, P. A., & Oppenheimer, D. M. (2014). The Pen Is Mightier Than the Keyboard Advantages of Longhand Over Laptop Note Taking. *Psychological science*, 0956797614524581.

Niemiec, C. P., & Ryan, R. M. (2009). Autonomy, competence, and relatedness in the classroom Applying self-determination theory to educational practice. *Theory and Research in Education*, *7*(2), 133-144.

Niu, S. X., & Tienda, M. (2013). High school economic composition and college persistence. *Research in higher education*, *54*(1), 30-62.

Oregon State University, (2013). *Retention and graduation rates for cohorts: Fall 2000 to fall 2012*. Retrieved from http://oregonstate.edu/admin/aa/ir/sites/default/files/retention-graduation-summary.pdf

Oregon State University, (2014). *Common data set 2013-2014*. Retrieved from: http://ortransfer.com/admin/aa/ir/sites/default/files/cds-2013-14.pdf

Paunesku, D. (2013). *Scaled-up social psychology: Intervening wisely and broadly in education.* Retrieved from https://web.stanford.edu/~paunesku/paunesku_2013 .pdf

Paunonen, S. V., & Ashton, M. C. (2013). On the prediction of academic performance with personality traits: A replication study. *Journal of Research in Personality, 47,* 778-781.

Perkins, K. K., & Wieman, C. E. (2005). The surprising impact of seat location on student performance. *The Physics Teacher, 43*(1), 30-33.

Raes, F., Pommier, E., Neff, K. D., & Van Gucht, D. (2011). Construction and factorial validation of a short form of the self-compassion scale. *Clinical psychology & psychotherapy*, *18*(3), 250-255.

Richardson, M., Abraham, C., & Bond, R. (2012). Psychological correlates of university students' academic performance: a systematic review and meta-analysis. *Psychological bulletin, 138*(2), 353-387.

Robins, R. W., & Pals, J. L. (2002). Implicit self-theories in the academic domain: Implications for goal orientation, attributions, affect, and self-esteem change. *Self and Identity*, *1*(4), 313-336.

Roediger, H. L., & Karpicke, J. D. (2006). The power of testing memory: Basic research and implications for educational practice. *Perspectives on Psychological Science*, *1*(3), 181-210.

Rowell, L., & Hong, E. (2013). Academic motivation: Concepts, strategies, and counseling approaches. *Professional School Counseling*, *16*(3), 158-171.

Sackett, P. R., Kuncel, N. R., Arneson, J. J., Cooper, S. R., & Waters, S. D. (2009). Does socioeconomic status explain the relationship between admissions tests and post-secondary academic performance?. *Psychological bulletin*, *135*(1), 1-22.

Sawyer, R. (2013). Beyond correlations: Usefulness of high school GPA and test scores in making college admissions decisions. *Applied measurement in education*, *26*(2), 89-112.

Schmitt, N., Keeney, J., Oswald, F. L., Pleskac, T. J., Billington, A. Q., Sinha, R., & Zorzie, M. (2009). Prediction of 4-year college student performance using cognitive and noncognitive predictors and the impact on demographic status of admitted students. *Journal of Applied Psychology, 94*(6), 1479-1497.

Steinmayr, R., Bipp, T., & Spinath, B. (2011). Goal orientations predict academic performance beyond intelligence and personality. *Learning and Individual Differences, 21,* 196-200.

Taylor, D. J., Vatthauer, K. E., Bramoweth, A. D., Ruggero, C., & Roane, B. (2013). The role of sleep in predicting college academic performance: Is it a unique predictor?. *Behavioral sleep medicine*, *11*(3), 159-172.

Walton, G. M. (2014). The new science of wise psychological interventions. *Current Directions in Psychological Science*, *23*(1), 73-82.

Walton, G. M., & Cohen, G. L. (2011). A brief social-belonging intervention improves academic and health outcomes of minority students. *Science*, *331*(6023), 1447-1451.

Wigfield, A. & Wentzel, K. R. (2007). Introduction to motivation at school: Interventions that work. *Educational Psychologist, 42*(4), 191-196.

Wilson, T. D., Daminani, M., & Shelton, N. (2002). Improving the academic performance of college students with brief attributional interventions. In J. Aronson (Ed.), *Improving academic achievement* (pp. 91-107). San Diego, CA: Academic Press.

Yeager, D. S., & Walton, G. M. (2011). Social-psychological interventions in education They're not magic. *Review of Educational Research*, *81*(2), 267-301.

Yeager, D. S., Paunesku, D., Walton, G. M., & Dweck, C. S. (2013a). How can we instill productive mindsets at scale? Retrieved from *http://scitation.aip.org/upload/PhysicsToday/print_edition_files/vol-67_iss_5_p43_1/Yeager_et_al_R_and_D_agenda-6-10-13.pdf*

Yeager, D. S., Walton, G., Ritter, G., & Dweck, C. S. (2013b). Full-scale implementation of psychological interventions at a large institution: An experimental test. *Unpublished Manuscript, University of Texas at Austin.*

Appendix A:
Mindset Intervention Letters

Malleable Letter: Midterm 1, Exam Version A

"Hard work beats talent when talent doesn't work hard"
–Tim Notke

Dear Student,

Congratulations on finishing the first midterm!

College is a difficult transition for everyone so it is important to remember that you are not alone. Know that the other students around you are going through similar situations; just remember that it gets easier with practice.

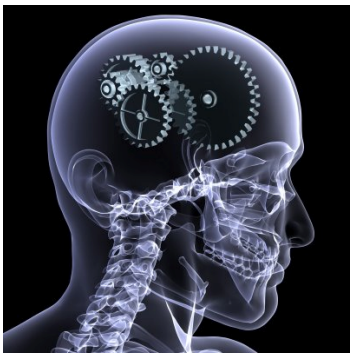
Recent research has shown that the human brain continues to learn new skills and adapt to new situations. You can overcome obstacles with persistence, hard work, and adaptability. You already have strengths and you can use those to your advantage, but you also have the ability to strengthen your weaknesses.

Every term, several students who do not do well on the first test improve on the coming tests and end up doing well in the class. We make the answer key available to you so that you can get an accurate sense of how to learn from this test and study for the next test. Using the key will reinforce what you have already learned and what you still need to learn. In particular, we recommend reading each question and all of the possible answers. For each possible answer, try to explain why each correct answer is right and why each incorrect answer is wrong. Keep going!

Sincerely,

Dr. Kathryn Becker-Blease

Fixed Letter: Midterm 1, Exam Version B



"It's not how smart you are,
it's how you are smart!"
– Howard Gardner

Dear Student,

Congratulations on finishing the first midterm!

College is a difficult transition and everyone has different strengths and weaknesses. As time goes on, you will learn how to efficiently use the abilities you already have to overcome obstacles.

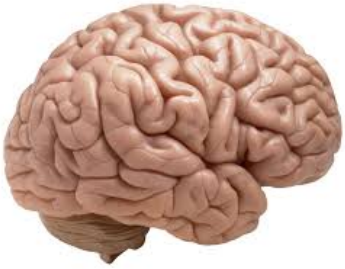
Recent research has shown that everyone different abilities. While it is important to identify your strengths and your weaknesses, the key to success is to utilize your strengths. Know that while other students may go through similar situations, everyone has to approach obstacles differently.

We have provided you with an answer key today so that you can get an accurate sense of your strengths and weaknesses in this class. Sometimes, after the first midterm, students realize that this class is easier than they expected. Other students realize it is not the class for them. As a reminder: through the end of the day tomorrow (Friday), students can drop classes without having to pay for the course and without it appearing on their transcript. In particular, we recommend reading each question and all of the possible answers. For each possible answer, try to explain why each correct answer is right and why each incorrect answer is wrong.

Sincerely,

Dr. Kathryn Becker-Blease

Control Letter: Midterm 1, Exam Version C



"Silent gratitude isn't much use to anyone."
– G.B. Stern

Dear Student,

Congratulations on finishing the first midterm!

I would like to thank you for your continued investment, attendance, and participation in this course. Often times, professors and instructors do not realize the amount of work students put in to their schoolwork. I want to ensure you that your work does not go unnoticed!

Being involved in the academic aspect of your college experience promotes a culture of academic achievement on campus. While there are many fun activities that are available to students, attending classes are one of the most important. I'd like to take the time to say thank you for being such a great student both now and in the future.

We know that there are many things outside of your control (work schedules, campus activities, illnesses, family commitments, and so forth) that affect your test performance. Because we want to help you succeed in any way we can, we make the answer key available to you. We recommend reading each question and all of the possible answers. We want to help you earn the highest possible grades so that you can fulfill your goals. Good luck!

Sincerely,

Dr. Kathryn Becker-Blease