ACCEPTANCE

This dissertation, BRIDGING THE GAP - GROWTH MINDSET RESEARCH AND EDUCATORS' PRACTICE, was prepared under the direction of the candidate's Dissertation Committee. It is accepted by the committee members in partial fulfillment of the requirements for the degree of Doctor of Education in the School of Education, Concordia University Irvine.

Blanca Quiroz, Ph.D.
Committee Chair

Catherine Webb, Ed.D.
Committee Member

Mario Carlos, Ed.D.
Committee Member

The Dissertation Committee, the Dean, and Executive Director of the Doctor of Education Program of the School of Education, as representatives of the faculty, certify that this dissertation has met all standards of excellence and scholarship as determined by the faculty.

Deborah Mercier, Ph.D.
Dean

Dwight Doering, Ph.D.
Executive Director of the Doctor of Education Program

COPYRIGHT PERMISSION AGREEMENT

Concordia University Library
1530 Concordia West

Irvine, CA 92612
www.cui.edu/library
librarian@cui.edu

I, Sheryl Tecker warrant that I have the authority to act on any copyright related matters for the work, BRIDGING THE GAP - GROWTH MINDSET RESEARCH AND EDUCATORS' PRACTICE, dated December 16, 2017, to be included in the Concordia University Library repository, and as such have the right to grant permission to digitize, republish and use the said work in all media now known or hereafter devised.

I grant to the Concordia University Library the nonexclusive worldwide rights to digitize, publish, exhibit, preserve, and use the work in any way that furthers the educational, research and public service purposes of the Concordia University.

This Agreement shall be governed by and interpreted in accordance with the laws of the State of California. This Agreement expresses the complete understanding of the parties with respect to the subject matter and supersedes all prior representations and understandings.

ACCESS RESTRICTIONS

My electronic thesis or dissertation can be made accessible via the Concordia University Library repository with the following status (select one):

✓Option 1: Provide open access to my electronic thesis or dissertation on the internet

□ Option 2: Place an embargo on access to my electronic thesis or dissertation for a given period from date of submission (select one):

□ 6 months □ 1 year □ 3 years

Permission Granted By:

Sheryl Tecker
Candidate's Name *(as appears in academic records)*

Sheryl Tecker
Signature of Candidate

5375 via Mariposa
Address

1/2/18
Date

sheryltecker@gmail.com
Phone Number or E-mail address

Yorba Linda, CA 92887
City/State/Zip

VITA

Sheryl Tecker

ADDRESS	1530 Concordia West Irvine, CA 92612 sheryl.tecker@eagles.cui.edu

EDUCATION

EdD	2017	Concordia University Irvine, CA Educational Leadership
MA	1996	California State University, San Bernardino Education Administration
MA	1991	Claremont Graduate School, CA Education
BA	1990	Stanford University, CA American Studies

PROFESSIONAL EXPERIENCE

2017 to present	Assistant Superintendent, Educational Services La Habra City School District
2014 to 2017	Director of Programs and Assessment La Habra City School District
2003 to 2014	Principal Las Lomas School and Las Positas School La Habra City School District

BRIDGING THE GAP - GROWTH MINDSET RESEARCH AND EDUCATORS' PRACTICE

by

Sheryl S. Tecker

A Dissertation

Presented in Partial Fulfillment of
Requirements for the
Degree of
Doctor of Education
in
Educational Leadership
Date of Dissertation Oral Defense

School of Education
Concordia University Irvine

ABSTRACT

This research addresses the problem of low math achievement of middle school students through the use of a Growth Mindset intervention and related strategies. While the research on Growth Mindset interventions and strategies show positive results in controlled settings, there is a need to better understand Growth Mindset implementation from the perspectives of teachers and students in classroom settings. This study looked at Growth Mindset implementation with 449 students and seven teachers in sixth-grade math classrooms from two middle schools in one suburban school district. This study examines teacher and student perspectives of the effectiveness of four Growth Mindset instructional strategies and achievement results after a Growth Mindset intervention conducted by the classroom teachers. Teachers learned to implement four Growth Mindset strategies through an online professional development series provided by the district and shared their perspectives in an online discussion group and subsequent survey. All the sixth-grade students completed a survey and the researcher conducted two focus groups to identify students' perspectives of the classroom goal orientation and the Growth Mindset strategies. The impact of the Growth Mindset intervention was measured using benchmark test scores and trimester grades, which assisted the district's goal to improve mathematics achievement in middle school. The results demonstrate that teachers and students perceive both mastery and performance classroom goal orientations and find two Growth Mindset strategies, celebrating mistakes and providing challenging math tasks, to be well received by both groups. Findings also indicate that after the Growth Mindset intervention student achievement on the benchmark test did not improve, however, students' grade point average did improve compared to students from the previous school year in the same district.

Keywords: Growth Mindset, middle school, mathematics, goal orientation

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACKNOWLEDGMENTS

My two sons and their experiences learning math inspired this dissertation. Everything I learned in the writing of this dissertation helped me both as an educator and as a mother watching her sons have two vastly different journeys in mathematics.

This dissertation was written to support the education community that is applying Growth Mindset research with teachers and students. This study would not be possible without the support of the sixth-grade teachers and mathematics academic coaches in this study. I thank them for their willingness to try Growth Mindset strategies and share that experience.

I am forever thankful for my husband who supported my aspirations to earn a doctorate in education and who did more than his share of laundry and dishes while I read, studied, and wrote. I also want to thank my dissertation chairperson, Dr. Quiroz, my committee members, Dr. Webb and Dr. Carlos, and my amazing cohort (32.5!) for their friendship and encouragement.

CHAPTER 1: INTRODUCTION

When a person has a Growth Mindset, they believe in their potential to learn. Individuals with a Growth Mindset are resilient in the face of difficulty and failure and look forward to challenges that help them learn, while individuals with a Fixed Mindset believe their intelligence is set and avoid challenges (Dweck, 2006). There is a commonly held Fixed Mindset belief that some people can "do math" and others cannot (Boaler, 2016).

Educators working with struggling math students might wonder how to practically apply the increasingly well-known Growth Mindset research to increase student motivation and academic achievement. Typical research in Growth Mindsets has primarily focused on intervention studies implemented by researchers in small, controlled settings (Blackwell, Trzesniewski, & Dweck, 2007; Fitzakerley, Michlin, Paton, & Dubinsky, 2013; Good, Aronson, & Inzlicht, 2003). A broader evidence base from interventions conducted by classroom teachers would strengthen the claims from these studies (Farrington et al., 2012). While Growth Mindset interventions have been successfully scaled to impact large groups of students using computer programs (Paunesku et al., 2015), it is not clear that its positive impact could be duplicated in natural settings using classroom teachers and freely available resources.

A well-substantiated body of research suggests that mindsets derive not just from the individual but the interaction between the student and their school and classroom context (Deci, 1992; Stipek, 1986; Yeager, Walton, & Cohen, 2013). While the connection between classroom contexts, instructional strategies, and student mindsets is clear, knowing how to change classroom practice to support the development of Growth Mindsets is less clear (Farrington et al., 2012). Recent research studies on how teachers implement Growth Mindset strategies in math classrooms have begun to identify the challenges in taking research to practice (Schmidt,

Shumow, & Kackar-Cam, 2015; Sun, 2015). Sharing Growth Mindset research with teachers and encouraging them to engage in a reflective inquiry regarding Growth Mindset instructional strategies is where this study begins. Farrington et al. (2012) argue that "while numerous studies have identified specific aspects of classroom context that contribute to strong academic mindsets, a gap persists between research findings and teachers' intentional use of strategies to promote positive student mindsets…figuring out how to bridge this research/practice gap seems to be a prudent avenue for future work" (p. 38). This study investigates the challenges and successes teachers encounter while implementing Growth Mindset strategies, and also investigates how students perceive those same strategies. Making the experience of teachers and students visible and listening to their voices will help practitioners improve implementation of Growth Mindset strategies and take a step towards closing the gap between research and practice.

The first chapter describes the background of the Growth Mindset topic and credentials of the researcher. Next is an explanation of the problem, the purpose of the study and the significance of the research to both education practitioners and the field of Growth Mindsets. Key terms are defined, as well as an overview of the theoretical framework, limitations, delimitations, and assumptions of the study. Two research questions are introduced, along with an overview of the organization of the study.

Background of the Study

The topic of student motivation has interested educators and psychologists for decades. In 2005, there was an emphasis on competence motivation with the publication of the *Handbook of Competence and Motivation* (Elliot & Dweck, 2007). While the desire to be competent is universal (Elliot & Dweck, 2007), some students have a Fixed Mindset regarding their intelligence and potential. Some students give up on mathematics in particular due to the belief

that they are just not a "math person" (Boaler, 2016). Other students have a Growth Mindset, and when faced with challenges and failures, they try new strategies and persevere. How teachers implement Growth Mindset instructional strategies, and how their students perceive those same strategies, will be investigated as well as any potential impact on students' test scores and grades.

The researcher is a district administrator who provides professional development and oversees the administration of student assessment. Low test scores, particularly in math during the challenging transition year to middle school, are a particular concern in her district and the state in general. Throughout her 18 years in the district, she has been an assistant principal at one middle school, a principal at two elementary schools, the Director of Programs and Assessment and is currently the Assistant Superintendent of Educational Services.

Statement of the Problem

Low math achievement is a widespread concern across the United States. We are well aware that mathematical achievement in the United States is behind other comparable countries. In the Trends in International Math and Science Study (TIMSS) 2015, students in fourth grade were ranked 14th and students in eighth grade were ranked 10th internationally (Mullis, Martin, Foy, & Hooper, 2016). There is also a significant difference between groups within the United States. On the 2015 Nations Report Card, 40% of fourth-grade students and only 26% of Hispanic fourth-grade students were proficient or above on the math portion of the National Assessment of Educational Progress. Similarly, 33% of eighth-grade students and only 19% of Hispanic eighth-grade students were proficient or above. For students participating in the National School Lunch Program (NSLP) only 24% of fourth-grade students and 18% of eighth-grade students are proficient or above (The Nation's Report Card, 2015). Standardized test

results from the first three administrations of the Smarter Balanced Assessment (SBAC) in California (CA) also show that only approximately one-third of sixth graders met the grade level standards for College and Career Readiness in math. Students included in this school district (SSD) where this sample was drawn from study scored even lower than the California state average, with only 19% demonstrating College and Career Readiness in math in 2017.

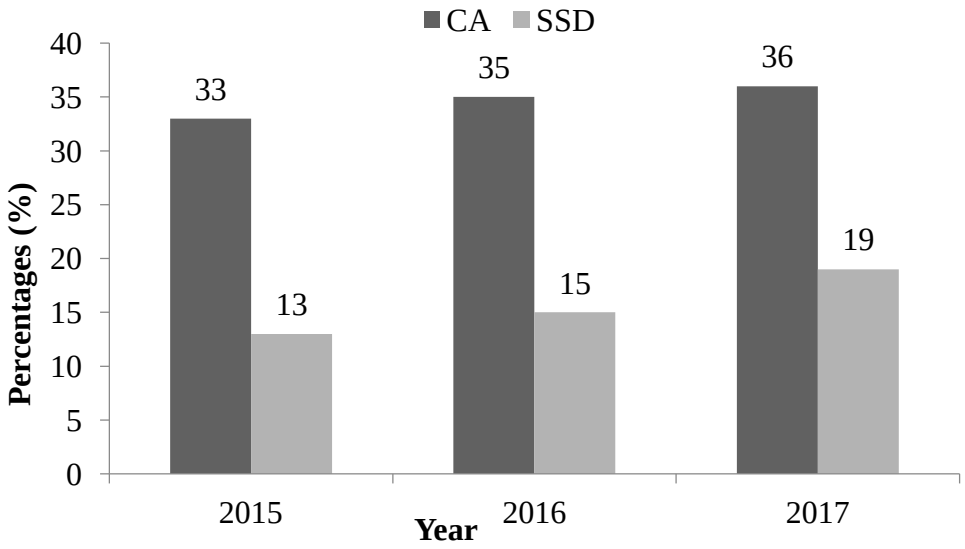


Figure 1. Percent of sixth-grade students who met or exceeded math standards on 2015-2017 SBAC in California (CA) and Sample School District (SSD).

Middle school is a pivotal time for developing concepts of competence when students typically begin to have larger classes, less personal teacher interactions, and more grouping by ability often referred to as tracking or homogeneous grouping. The transition to middle school can impact students' competence beliefs and have a negative impact on motivation and achievement (Wigfield & Wagner, 2007). Trends of declining math achievement data in this district demonstrate that students' achievement, as they transition to middle school, is similar to the general trends of declining mathematics grades as students transition to middle or junior high school across the nation (Gutman & Midgley, 2000).

Due to the challenges faced by students as they transition to middle school as evidenced by low test scores and declining grades, the district encouraged teachers to implement Growth Mindset strategies. While the teachers in this district are supportive of Growth Mindsets in general, their level of implementation of Growth Mindset interventions and strategies varied. The math teachers in this sample had only a basic understanding of Growth Mindset theory before this study and had not implemented a Growth Mindset intervention or attempted to use Growth Mindset strategies consistently. Implementation of new programs with limited training is common practice in school districts, and the most valuable exploration of this study is perhaps its potential to learn about the teachers' experience and students' perception of their teacher's efforts to use Growth Mindset strategies in their natural settings.

Purpose of the Study

The purpose of this mixed method study is to examine how teachers implement a Growth Mindset intervention and related strategies and the perceptions of their students' about the classroom goal-orientation and Growth Mindset strategies. A secondary goal is to examine what impact, if any, their efforts might have on their sixth-grade students' academic achievement in mathematics as measured by standardized tests and trimester grades. After a brief Growth Mindset intervention administered by teachers at the beginning of the transition to middle school, teachers began to implement four Growth Mindset strategies. Teachers wrote about their experiences and completed a survey. A survey was also given to all sixth graders in the district to explore students' perception of the classroom goal orientation. The survey was analyzed as both a dichotomous construct of performance versus mastery goals and as separate constructs. A strategic subsample of students was selected to participate in the qualitative portion of this study to further explore students' perceptions of classroom goal orientations and Growth Mindset

strategies through a semistructured focus group interview. The quantitative analysis was used to investigate students' growth in mathematics on a computer adaptive and norm-referenced assessment and trimester math grades comparing scores from students during the first year of Growth Mindset implementation in the 2016–2017 school year and students' from the previous year in the same schools.

Significance of the Study

Competence motivation is a multidimensional construct involving student and teacher beliefs, the home environment, as well as the classroom and school culture. While acknowledging this complexity, this research took a practical approach and focused on two factors that classroom teachers can influence; students' implicit theory of intelligence (through the impact of the Growth Mindset intervention at the beginning of middle school) and students' perceived classroom goal orientation (through implementing classroom practices that support mastery goals and Growth Mindsets versus performance goals and Fixed Mindsets).

This study makes two significant innovations to research in this field, the practical design of the study and contrasting the perceptions of the teachers and students about the implementation of Growth Mindset strategies. First, previous research in this area was done in a research setting by external researchers or using external program materials that are currently not readily available to teachers in schools. This study was done by teachers using free materials, making this a more sustainable and practical model, with high face validity. Another benefit of this naturalistic design is that participating sixth-grade teachers deepened their understanding of Growth Mindset practices through online professional development and discussion, thus increasing the teachers' knowledge of non-cognitive factors that develop students' motivation as learners. The second significant contribution of this study is that teachers' and students' voices

regarding their perceptions of classroom goals and instructional practices were explored to provide feedback on the Growth Mindset strategies that were more or less effective from both points of views. Previous studies have examined teacher behaviors related to Growth Mindset strategies, but not teachers' and students' perspectives. Urdan and Turner (2007) propose that "assumptions about the transmission process from teachers' practices to students' motivational orientations may not be supported in the classroom and need to be validated through discussions with students" (p. 313).

While there is a broad research base connecting Growth Mindsets to higher learning gains and eagerness by practitioners to utilize Growth Mindset theory, teachers need actionable and practical steps for how to incorporate Growth Mindset strategies into their daily instruction and eliminate strategies that encourage Fixed Mindsets. This study will help bridge the divide between Growth Mindset research in controlled research settings, and the practitioners who want to utilize Growth Mindset theory and practices in the natural setting of their classrooms and schools.

Definition of Terms

The following definitions clarify the meaning of terms used in this research study:

Attribution Theory: The explanation or beliefs individuals have for events determine their reaction to those same events and about their expectations for future events (Urdan & Turner, 2007).

Competence motivation: The condition or quality of effectiveness, ability, sufficiency, or success (Elliot & Dweck, 2007).

Entity Theory of Intelligence: Belief that intelligence is fixed and uncontrollable, also referred to as the Fixed Mindset (Dweck, 2006).

Goal-orientation: Describes a person's purpose for engaging (or not) in learning activities.

Incremental Theory of Intelligence: Belief that intelligence is malleable, increasable**,** and controllable, also referred to as the Growth Mindset (Dweck, 2006).

Measures of Academic Progress: An online, computer-adaptive and norm-referenced assessment created by the Northwest Evaluation Association and used by over 28 million students in the nation (Northwest Evaluation Association, 2011).

Mastery Goal Structure: Holding learning or task goals, with a purpose of developing competence or task mastery (Elliot, 2007).

Performance Goal Structure: Holding ability or ego goals, with a purpose of demonstrating competence or avoiding demonstrating one's incompetence (Elliot, 2007).

Smarter Balanced: Annual state assessment administered to third–eighth and eleventh-grade students as a measure of progress towards college and career readiness (California Department of Education, 2016).

Stereotypes: Culturally shared beliefs, both positive and negative, about characteristics and behaviors of certain groups (Graham & Hudley, 2007).

Stereotype Threat: The awareness and fear among members of a group of reinforcing negative stereotypes about the intellectual ability of the group (Aronson, Cohen, & McCloskey, 2009).

Theoretical Framework

The field of Growth Mindsets is rooted in Social Cognitive Theory. Initially called Social Learning Theory in 1977, Albert Bandura proposed that much of human learning occurs in a social environment, rather than by observation and imitation as the behavioral theory

suggested (Bandura, 1977). Bandura changed the name to Social Cognitive Theory in 1986 to better describe how humans learn from social experiences (McLeod, 2016). In Social Cognitive Theory, people are viewed as self-organizing, self-reflecting, and self-regulating, rather than being merely reactive or driven by inner impulses. Individuals do not only respond to their environment, but they actively seek and interpret information. In Social Cognitive Theory, people are active information processors who use cognitive and social factors to mediate the learning process (Bandura, 1990).

From the perspective of Social Cognitive Theory, human functioning is the product of the interplay of behavioral, personal, and environmental influences (Schunk & Pajares, 2007). Bandura (1990) refers to this as "triadic reciprocal causation" in which (a) action or behavior, (b) inner personal factors in the form of cognitive, affective, and biological events, and (c) environmental influences all interact with each other (p. 101). Social Cognitive Theory views people as proactively engaged in their development. A person's sense of agency is due to self-beliefs that enable them to have some control over their thoughts, feelings, and actions. This self-system includes the ability to symbolize, learn from others, strategize, regulate one's behavior and self-reflect (Pajares, 1995). Through self-reflection, people make sense of their experiences and explore self-beliefs. It is the capability for self-reflection that "allows people to evaluate and alter their own thinking and behavior" (Pajares, 1995, p. 3).

Self-evaluations include perceptions of self-efficacy, or "personal judgments of capability to accomplish specific tasks and deal with different realities" (Pajares, 1995, p. 3). Although self-efficacy is only one of many determinants of motivation in Social Cognitive Theory, it is the one most closely related to the field of Growth Mindsets. People's perceptions of self-efficacy influence their choice of behavior and effort (Pajares, 1995). For example, people choose to

engage in tasks in which they feel competent and confident. People with high self-efficacy will expend greater effort and perseverance. Self-efficacy beliefs also influence people's thoughts and emotions (Pajares, 1995). People with high self-efficacy feel positive and serene, rather than stressed or anxious when faced with a challenging task, which is an optimal state for learning. Self-efficacy affects whether people think and behave in self-enhancing or self-debilitating ways (Bandura & Locke, 2003). Thus, self-efficacy affects individuals' choice of activities, motivation and ultimately their achievement outcomes.

There are four primary sources for self-efficacy; mastery experience, vicarious experience, social persuasions and somatic and emotional states (Schunk & Pajares, 2007). People develop self-efficacy from mastery experience when they engage in tasks and use their interpretation of the results to develop perceptions of their capabilities. If the outcome is interpreted as successful, self-efficacy will increase, and if not, self-efficacy will decline. Vicarious experiences influence self-efficacy when people observe others perform a task, especially when the other person is similar to the observer, and see their performance as diagnostic of their capability. Social persuasions and verbal judgments from others also create and impact self-efficacy in positive and negative ways. For example, when a respected and credible supervisor tells their employee: "You can do it. I have confidence in you" [versus] "This is unacceptable! I thought you could handle this project", the employee will feel either encouraged or discouraged (Redmond, 2016). Finally, positive or negative somatic and emotional states provide information about self-efficacy. For example, a strong adverse emotional reaction such as stress or anxiety can lower self-efficacy. Of the four sources of self-efficacy, mastery experiences are the most influential source of self-efficacy beliefs because they provide authentic evidence that directly impacts people's perceptions of their capabilities

(Bandura, 1977; McLeod, 2016; Schunk & Pajares, 2007). Relating mastery experiences to the field of Growth Mindsets, students with high self-efficacy attribute their success to effort, while low self-efficacy students attribute their success to luck. Alternatively, students with high self-efficacy attribute failure to lack of effort, while low self-efficacy students attribute failure to lack of ability and general intelligence (Pajares, 1995).

In "A Social-Cognitive Approach to Motivation and Personality," Dweck and Leggett (1988) explored the maladaptive "helpless" response and more adaptive "mastery-oriented" response as related to individuals implicit theories of intelligence (p. 256). Students with the helpless response avoid challenges while students with a mastery-oriented response seek out challenging tasks. However, Dweck and Leggett (1988) found that even students with high abilities sometimes exhibit the maladaptive helpless response. To explain this, Dweck and Leggett (1988) hypothesized that different theories or self-conceptions about oneself would orient individuals towards either performance or learning goals. In other words, individual differences in beliefs and values generate differences in behaviors. Dweck and Leggett (1988) explained that their model represents "a social-cognitive approach to motivation and personality in that it (a) seeks to illuminate specific, moment-to-moment psychological mediators of behavior and, (b) assigns a central role to interpretive processes in the generation of affect and the mediation of behavior" (p. 257).

Path analyses show that students with an incremental theory of intelligence have mastery or learning oriented goals, and positive effort beliefs and effort attributions that lead to mastery strategies (Dweck & Leggett, 1988). Utilizing a psychological intervention to change a student's implicit theory of intelligence from an entity (fixed) to incremental (growth) can have a "snowball" effect that positively impacts students' achievement. Also, students' perception of

their classroom environment, as either emphasizing mastery or performance goal orientation, may mediate the impact of their belief systems. Students who believe in an incremental theory and hold mastery goals, yet learn every day in a classroom with experiences and procedures that emphasize performance goals, may not grow to their full potential. To understand the variance in the effectiveness of psychological interventions, we need to look at the classroom context and Growth Mindset strategies that might mediate the impact of the intervention (Yeager, Walton, & Cohen, 2013).

Research Questions

1. How do students and teachers perceive the classroom goal orientation and the effectiveness of four Growth Mindset strategies?
2. How will a Growth Mindset intervention conducted by sixth-grade classroom teachers change student growth on a norm-referenced, computer adaptive mathematics assessment and their trimester math grades?

Limitations

This study has the following limitations:

1. Due to the annual state testing administered in the spring each year, students in the sample only take the MAP assessment twice a year, in fall and winter.
2. The researcher only sought student participants who take the MAP assessment and teachers who administer the MAP from one district. Although the sample size is large (N = 449) caution should be taken when generalizing results to the entire population.
3. There is a one-year time frame between the control group of 2015–2016 and the implementation group of 2016–2017. This time gap creates the possibility for many

confounding factors unrelated to this study to impact the results. In the future, it would be better to compare the two groups concurrently.

Delimitations

Hispanic students make up the majority (87.7%) of the students in the school district for this sample. Similar to all students in California, there is an achievement gap in this sample between the White and Hispanic students, even when controlling for low socioeconomic disadvantaged (SED) status (see Table 1). Thus, there is a need to consider the impact of ethnic identity and stereotype threat on students' academic achievement.

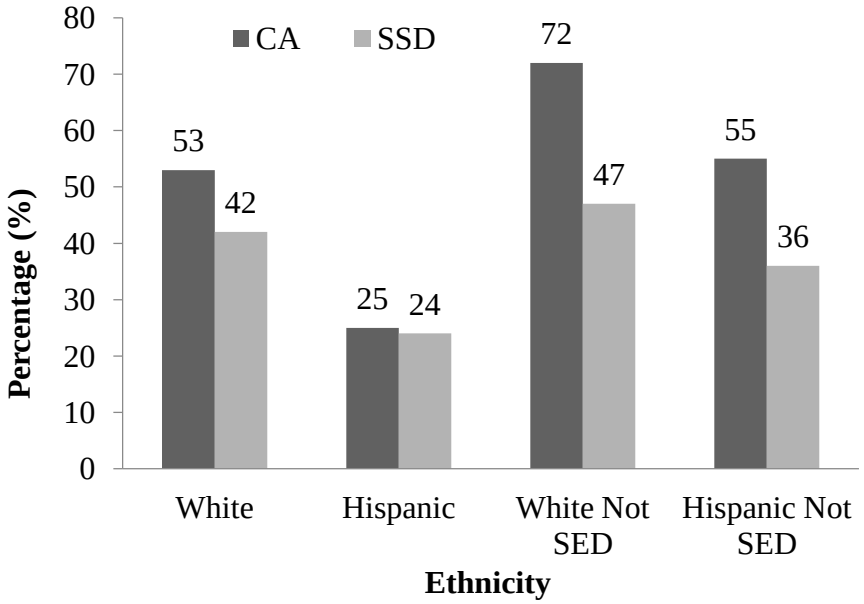


Figure 2. Percent of students by subgroup who met or exceeded math standards on 2017 SBAC. SED = Socioeconomically Disadvantaged; CA = California; SSD = Sample School District

Researchers and educators are coming to understand that intellectual competence is not an innate quality inside a person's brain, but rather a product comprised of interactions with others. Researchers Joshua Aronson and Claude Steele (2007) coined the term "stereotype threat" to describe how people cope with negative stereotypes about their group, specifically those related to intelligence. Aronson and Steele (2007) argue that the achievement gap is partly

caused by the "psychology of stereotyping and stigma, namely, the way people are influenced by stereotypes of intellectual inferiority" (p. 438). For example, people affected by stereotype threat may wonder about the validity of the stereotype, worry about how their performance may confirm the stereotype and may begin to believe that the stereotype correctly points to an innate lack of ability in members of their group. Even if the person does not believe the stereotype, simple awareness can affect academic achievement. Aronson and Steele's (2007) research show that "a student need never encounter actual prejudice or differential treatment . . . to be meaningfully affected by stereotypes. Just the mere knowledge of a stereotype can influence [their] thinking and behavior" (p. 440).

Children can be significantly affected by negative stereotypes about their group's intellectual abilities around the age of 11 or 12 (Good et al., 2003). For example, by middle childhood, "most American children have learned that blacks and Latinos are less intelligent than whites, that Asians are good at math, while girls are not, that blacks are better athletes than whites, and so on" (Aronson & Steele, 2007, p. 438). Students affected by stereotype threat experience self-doubt and anxiety that undermine their achievement. Stereotypes about low ability can cause students to attribute poor performance or difficulty with a task to an internal, fixed characteristic rather than to a surmountable challenge that can be addressed with increased effort and strategy. During challenging tasks, stereotyped-threatened students' attention splits between accomplishing the task itself and wondering about what their performance says about them (Graham & Hudley, 2007). The stereotype threat creates an extra cognitive burden and consumes valuable cognitive resources and energy needed for self-control, memory, and organization (Aronson & Steele, 2007).

Coping with ability-related stereotypes can also lead students to develop maladaptive learning strategies that negatively impact their motivation, learning, and achievement. Students may adopt performance-avoidance goals where they avoid situations that could make them look incompetent (Elliot, 2007). For example, when students were allowed to choose an easier or more challenging task, Latinos on a reading test and females on a math test chose the easier task to avoid looking incompetent (Aronson & Steele, 2007). Significantly, one of the most dangerous effects of stereotype threat is that "it creates an atmosphere in which *looking* smart is more important than *getting* smart" (Aronson, 2004, p. 17).

Interventions that counter the adverse effects of stereotype threat are similar to Growth Mindset interventions. Since stereotypes imply stable or fixed characteristics, interventions to reduce stereotype threat teach students to perceive intelligence as malleable and failure or difficulties as surmountable. Good, Aronson, and Inzlicht (2003) developed an intervention to help students perceive their intelligence as malleable and difficulties as surmountable. In their analysis of the results, Good et al. (2003) concluded that encouraging students to view intelligence as malleable does not only change their beliefs about intelligence; it also changes the attributions they make for the causes of their difficulties.

Teachers can reduce the adverse effect of stereotype threat through promoting mastery goal orientations and a sense of belonging in their classrooms. Stevens, Hamman, and Olivarez (2007) studied school belonging with Hispanic students and White teachers and found that students' sense of belonging was positively influenced by teachers who were perceived to promote a mastery goal orientation in the classroom rather than performance goals. Stevens et al. (2007) also found that teachers could influence school belonging by challenging their students and encouraging in-depth thinking. This type of academic press "likely conveys to students that

their teachers are interested in them and see them as capable and valuable" (Stevens et al., 2007, p. 65). Farrington et al. (2012) also found that the "critical challenges facing racial and ethnic minority students in the formation of strong, positive mindsets for academic achievement can be alleviated through the careful work of creating supportive contexts that provide consistent and unambiguous messages about minority students' belonging, capability, and value in classrooms and schools" (p. 34).

In this sample, nearly 87% are Hispanic students who are potentially impacted by stereotype threat. While acknowledging this, the researcher chose not to address stereotype threat as a separate issue due to the similarity between the Growth Mindset and stereotype threat interventions and instructional strategies. In the Growth Mindset professional development series, teachers were taught to reinforce strategic messages such as intelligence is malleable and difficulties are surmountable. These strategies help students focus on mastery goals which in turn increase students' feelings of school belonging. Thus, while stereotype threat is likely a contributing factor to the low math achievement of students in this study, that issue will not be addressed separately due to the similarity of the interventions and strategies.

Assumptions

There are three assumptions of this research study not tested as a part of the research. First, the assumption that the MAP assessment accurately measures growth will not be analyzed in this research study. The metrics used by Northwest Evaluation Association (NWEA) to determine growth are summarized in Chapter 3 on methodology. The second assumption is that the sixth-grade teachers participating in the study want to develop Growth Mindset strategies. This supposition will also not be scrutinized. Finally, the existence and impact of stereotype threat in the Hispanic minority majority sample in this research are assumed. Stereotype threat

impacts ethnic minorities regardless of their numbers in schools, communities, and the country because people exist in a broader socio-political context that profoundly impacts their experience (Suzuki & Aronson, 2005).

Organization of the Study

This research study is presented in five chapters. Chapter 1 provided the introduction to the study, background information, statement of the problem, purpose, and significance of the study, definition of terms, theoretical framework, research questions and hypothesis, limitations, delimitations, and assumptions. In Chapter 2, a thorough examination of the literature is presented beginning with an overview of competence motivation, and including a discussion of the achievement, goal construct and goal orientation theory, intrinsic motivation, attribution theory and implicit theories of intelligence, psychological interventions and Growth Mindset strategies for mathematics. Chapter 3 discusses the methods and measurements that are used to collect data, including MAP results, trimester grades, the teacher and student surveys and the focus group interviews. Chapter 4 is an analysis of the findings and results of the quantitative and qualitative study. Finally, Chapter 5 discusses the research findings, implications for practice, recommendations for future research and conclusions.

Summary

The first chapter introduced the topic of Growth Mindsets and the background of the study. The problem of low mathematics achievement for students in sixth grade was described, as well as the purpose of the study to examine how teachers and students perceive Growth Mindset strategies and how a Growth Mindset intervention implemented by the teachers might improve academic outcomes. The significance of focusing on how practitioners apply the Growth Mindset research was discussed. After grounding the research in the theoretical

framework of Social Cognitive Theory, two research questions were presented. Finally, the limitation, delimitations, and assumptions were discussed.

CHAPTER 2: REVIEW OF THE LITERATURE

Dweck and Elliot (2005) presented to the field *The Handbook of Motivation and Competence* and asked contributors to share their thoughts on achievement motivation through the lens of competence. Their purpose was to establish competence as the conceptual core of the achievement motivation literature. Competence motivation relates to both goal orientation theory and attribution theory. Goal theories include performance and mastery orientations. Attribution theories include incremental (growth) and entity (fixed) theories of intelligence. Six themes pertinent to this research study and discussed in this section include: (a) competence motivation, (b) achievement goal construct, and goal orientation theory, (c) intrinsic motivation (d) attribution theory and implicit theories of intelligence, (e) psychological interventions, and (f) mathematics—a unique challenge to Growth Mindsets.

Competence Motivation

Why are students more or less motivated to learn and do well in school? Elliot and Dweck (2007) refocused the long history of achievement motivation literature around the concept of competence. Achievement motivation explains that people are drawn to tasks that are neither too hard nor too easy, and that help them improve (Sternberg, 2007). According to Elliot and Dweck (2007), the achievement motivation literature was weak because the precise nature and definition of achievement was unclear and lacked a clear set of structural parameters. Competence motivation "refers to a persons' belief in their own ability to solve the problem at hand" (Sternberg, 2007, p. 19). Specifically, competence is the "condition or quality of effectiveness, ability, sufficiency, or success" (Elliot & Dweck, 2007, p. 5). In addition to being more precise than achievement, competence is a strong psychological concept that has a

substantial impact on humans' emotion and well-being. Thus the focus on competence both strengthens and clarifies the concept of achievement motivation.

Elliot and Dweck (2007) believe that competence is an "inherent psychological need of the human being" (p. 6). This need for competence motivates people to set goals and develop strategies. Competence-related behaviors can be positive or negative. In other words, people may strive for competence or actively avoid being incompetent. From a motivational standpoint, educators look at both the positive (appetitive) and negative (aversive) behaviors. Students may develop goals and strategies to increase their competence or to avoid incompetence. Competence motivation is present in all aspects of daily life and across the lifespan. People's emotions and sense of well-being are impacted by attaining competence and avoiding incompetence. Babies and young children begin with an appetitive desire and curiosity to explore and understand their environment. As children develop abstract thinking, they evaluate competence and begin to develop strategies to attain competence and avoid incompetence. Adults continue to be motivated by competence attainment or incompetence avoidance, and as they age, declining abilities lead to diminishing competence motivation. Thus "competence can be seen as a basic psychological need that has a pervasive impact on daily affect, cognition, and behavior across age and culture" (Elliot & Dweck, 2007, p. 8).

Strong competence beliefs and motivation are particularly crucial to healthy development during adolescence (Wigfield & Wagner, 2007). Identities take shape during adolescence and impact the development of competence and motivation. Cognitive changes during adolescence increase their ability to think abstractly, control their behavior and manage daily routines independently, making these years pivotal for developing concepts of competence. Adolescents go through school transitions from elementary to middle and middle to high school. These

transitions include larger classes, less personal teacher interactions as class sizes increase, more tracking and ability grouping and disruptions to social networks. These changes can impact students' competence beliefs and motivation (Wigfield & Wagner, 2007). As children become adolescents, they receive more evaluative feedback from teachers, and this can decrease motivation and cause students to focus more on performance goals rather than mastery goals. Thus, adolescents' "competence related beliefs, intrinsic motivation, and goal orientations for achievement change, often in negative ways" (Wigfield & Wagner, 2007, p. 228). The observed decline in productive competence-related beliefs and motivation during adolescence underscores the importance of continued research and case studies conducted during the transition to middle school.

According to Urdan and Turner (2007), competence motivation is a complex and multidimensional construct. The social cognitive conceptions of competence motivation include achievement goals, interest and intrinsic motivation, self-efficacy, expectancy-value theory, self-determination theory, and attribution theory. Understanding competence motivation in the classroom context is even more complex due to the highly social nature of classroom interactions. For example, Urdan and Turner (2007) stress that in many classrooms "there are greater incentives for students to *be* competent or to *appear* competent than there are for *becoming* competent" (p. 307). Also, the motivational climate in the classroom is not unidirectional from teacher to student, but rather a reciprocal exchange between students and teachers and among the students. Thus research on competence motivation in the classroom requires thoughtful analysis of the voices and perspectives of the teachers and students.

Goal orientation theory, interest and intrinsic motivation, attribution theory, and implicit theories of intelligence all emphasize students' perception of control over learning and are

central to this research on Growth Mindsets during adolescence. Goal orientation theory pertains to the purpose of students' engaging in academic activities. Interest and intrinsic motivation both play a role in satisfying students' need for competence. Attribution theory states that when students believe that academic achievement depends on controllable factors, they will be more motivated and achieve at higher levels (Urdan & Turner, 2007). Implicit theories of intelligence compare the difference between entity and incremental belief systems. Next is a summary of the literature on these three theories, followed by an overview of the role of intrinsic and extrinsic rewards on developing Growth Mindsets. The chapter concludes with a review of significant psychological interventions that address Growth Mindsets and a discussion of the implications for mathematics classrooms specifically.

Achievement Goal Construct/Goal Orientation Theory

Individuals have different purposes for engaging (or not) in learning activities, and these purposes are called goal orientations (Urdan & Turner, 2007). The achievement goal construct has two goal orientations, performance and mastery. According to Elliot (2007), the purpose of a person's behavior with a performance goal orientation is to demonstrate competence or avoid demonstrating one's incompetence. In contrast, the purpose of a person's behavior with a mastery goal orientation is to develop competence and task mastery. Performance goals are also referred to as ego or ability goals, and mastery goals are also referred to as task or learning goals. (Ames & Archer, 1988). The primary concern of those pursuing performance goals is to appear able while the main concern of those pursuing mastery goals is to develop competence (Urdan & Turner, 2007). Dweck (2000) explains that when students pursue performance goals, they want to look smart and avoid appearing dumb, whereas when students pursue mastery goals, they want

to understand new things and learn new skills. Simply put, performance goals are about measuring ability, and mastery goals are about learning.

Research on achievement goals consistently finds that an emphasis on mastery goals correlates to higher achievement, greater feelings of competence, and less engagement in avoidance behaviors, whereas the emphasis on performance goals correlates with self-handicapping and avoidance behaviors (Urdan & Turner, 2007). For example, a study of fifth-grade students by Elliott and Dweck (1988) showed that performance and mastery goals directly correlated with helpless and mastery-oriented responses, respectively. Elliott and Dweck (1988) gave some fifth-grade students a performance goal by sharing that their ability would be evaluated on the task, and others were given a mastery goal by telling them that the task would allow them to learn some valuable things. All students received the same tasks that progressed from easy to more difficult tasks. As the tasks became more challenging, students with the performance goal showed a pattern of helplessness, and their problem-solving behaviors deteriorated, while the students with the mastery goal stayed on task, increased their effort and continued problem-solving. The students were not surveyed to discover their previous personal goal orientation. Significantly, the goals given to the students produced the helpless or mastery-oriented behavior. Elliott and Dweck (1988) also told some students that they could do well on the task while others were told that their level of ability on the task was not so high. For students who had the performance goal, those who were told they had high ability continued to persevere on the task, while those who were told that their ability was lower showed helpless behavior. For students who were given the mastery goal, there was no difference between students who were told they had the high or low ability; all continued to try hard on the increasingly difficult tasks. Thus, students do not have to feel competent at something to persevere on a challenging

task because the goal is to learn, not to prove their ability. In another study by Farrell and Dweck (1985), junior high school students were surveyed to categorize them as having predominately performance or mastery goal orientations. All students were given new science material to learn and were then tested on applying that knowledge to novel tasks. The students with the mastery goal structures scored significantly higher and produced 50% more written work when attempting to solve the problem and tried to apply their new learning to the task. Thus in normative models of goal orientation,

> mastery goals orient students to focus on learning and mastery of the content or task and have been related to a number of adaptive outcomes including higher levels of efficacy, task value, interest, positive affect, effort and persistence, the use of more cognitive and metacognitive strategies, as well as better performance. In contrast, performance goals orient students to a concern for their ability and performance relative to others and seem to focus the students on goals of doing better than others or avoiding looking incompetent or less able in comparison to others (Pintrich, 2000, p. 544).

Researchers have further explored performance and mastery orientations and divided them into approach and avoidance goals. Andrew Elliot and Holly McGregor (2001) explain that the performance-mastery goal dichotomy needs to include the distinction between avoidance and approach goals. Using competence as the conceptual core of the achievement goal construct, Elliot and McGregor (2001) argue that both the definition and valence (desirable or undesirable possibility) be included in the achievement goal construct. Thus, achievement goals can be further defined as mastery-approach, mastery-avoidance, performance-approach or performance-avoidance (Elliot & McGregor, 2001). In the revised goal theory perspective, an important

distinction is made between performance-approach goals (trying to outperform others) and performance-avoidance goals (trying to avoid appearing less able than others).

Performance-approach goals can coexist and even supplement the positive effect of mastery goals. Researchers have explored the possibility that students can endorse different levels of mastery and performance goals at the same time as they are orthogonal, or statistically independent (Pintrich, 2000). Pintrich's (2000) research findings on the most adaptive combination of goal orientations, high-mastery/high-performance or high-mastery/low-performance, conclude that the two groups did not differ significantly from each other. Pintrich (2000) explains that "students who were concerned about their performance and wanted to do better than others and, at the same time, wanted to learn and understand the material had an equally adaptive pattern of motivation, affect, cognition, and achievement as those just focused on mastery goals" (p. 552). Thus, when students with mastery goal orientation also adopt a performance-approach orientation, there is no negative effect on motivation or achievement. Midgley, Kaplan, and Middleton (2001) propose that "performance goals may be adaptive for certain students in certain circumstances as long as mastery goals are also high" (p. 83). The concern for maladaptive behaviors is when only performance-avoidance goals are present. Dweck (2000) agrees that there is a place for both goal orientations and that problems only arise when "proving ability becomes so important to students that it drives out mastery goals" (p. 152). Understanding this, educators will want to enhance students' mastery goal orientations, rather than decrease performance goal orientations, in the classroom and school environment.

The degree to which the mastery-goal orientation characterizes the learning environment in the classroom is a critical factor in predicting students' use of effective learning strategies. Turner et al. (2002) explain that students may perceive a high or low emphasis on both goals or

greater emphasis on one or the other. While multiple goal orientations can be present, which goal orientation is perceived by students as more prevalent? Ames and Archer (1988) conducted a study of junior high and high school advanced students to determine their perceptions of the classroom goal orientation and use of effective learning strategies. They found that mastery and performance goals provide a meaningful way to differentiate students' perceptions of the learning environment in the classroom. Students who perceived performance goals to be most important tended to focus on their ability and attributing failure to lack of ability. Students who perceived mastery goals to be most important reported a preference for challenging tasks, increased use of effective learning strategies and belief that effort will lead to success (Ames & Archer, 1988). Research findings by Turner et al. (2002) of sixth-grade students who recently made the transition from elementary to middle school confirm that a perceived emphasis on mastery goals is positively related to lower reports of avoidance behaviors.

Ames and Archer (1988) believe that classroom goal orientations are impacted by what happens in the class and by how students interpret and give meaning to those actions or events. In 2001, Patrick, Anderman, Ryan, Edelin, and Midgley attempted to "unpack" the teacher behaviors that impact students' perceptions of classroom goal orientation. Their research study in four fifth-grade classrooms was organized around nine classroom observations; task, authority, recognition, grouping, evaluation, time, social, help-seeking and messages from the teacher. Patrick et al. (2001) found that it was not the presence or absence of rewards or social comparisons that were important in communicating goal orientation, but rather the meaning given to those events by the teacher. Teachers' comments about how students learn as well as their implicit theories of how students learn are critical. Teachers perceived as high mastery spoke about learning as an active process requiring understanding, rather than memorization,

encouraged group work and verbally recognized effort and improvement. Teachers perceived as low mastery made comments regarding learning being about the transmission and memorization of knowledge discouraged students from helping one another and focused on students getting answers correct rather than ensuring understanding. Similarly, Turner et al. (2002) found that "students reported lower incidences of avoidance strategies in classrooms in which teachers provided instructional and motivational support for learning" (p. 90). Thus understanding how teachers encourage students' internal motivation is a central component of competence motivation.

Intrinsic Motivation

Intrinsic motivation is related to humans' three innate psychological needs of competence, autonomy, and relatedness. Self-determination theory argues that the satisfaction of these needs, particularly competence and autonomy, leads to intrinsic motivation (Deci & Moller, 2007; Urdan & Turner, 2007). Attribution theory suggests that people are more intrinsically motivated when they perceive the locus of control to be within themselves. When they perceive the locus of control to be external, they tend to be more extrinsically motivated (Deci & Moller, 2007). Thus, when extrinsic, tangible rewards and motivators are present, students tend to attribute the cause of their behavior to an external factor rather than an internal factor, which leads to diminished intrinsic motivation. External rewards tend to diminish students' feelings of autonomy. However, studies of positive feedback, such as verbal recognition, tend to satisfy students' needs for competence (Elliot et al., 2000). Thus, teachers must carefully select their reward systems and be thoughtful in their language and praise to ensure that students are recognized for competence, but in a way that does not undermine autonomy. For example, if a teacher says "Good job, you did exactly what I told you to do"

students'need for competence will be fed, yet their need for autonomy will be diminished. In addition to verbal rewards, providing appropriately challenging tasks and choice increase students' interest and internal motivation, by satisfying students' needs for competence and autonomy.

When students are not interested in the subject and lack internal motivation, teachers will turn to external motivation to engage learners. Extrinsic motivation is defined as "doing an activity for some operationally separable consequence" (Deci & Moller, 2007, p. 588). According to Deci and Moller (2007), extrinsically motivated students can move towards intrinsic motivation by progressing through stages of external regulation, introjection, identification, and, finally, integration, which is the most mature form of extrinsic motivation. When students have integrated extrinsic motivation, they identify with the importance of the behavior and integrate that identification with other aspects of one's self. Thus, what began as something externally regulated will gradually transform into autonomous self-regulation. For the process of integration of extrinsic motivation to take place, the psychological need for relatedness plays a central role alongside competence and autonomy (Baumeister & Leary, 1995). When students are not intrinsically motivated by a task, it is their desire to maintain and enhance relationships that will lead them to internalize behaviors and attitudes that are important in the classroom.

Thus, intrinsic motivation and integrated extrinsic motivation are based on all three psychological needs of competence, autonomy, and relatedness. Optimal challenge and positive feedback tend to enhance intrinsic motivation by satisfying the need for competence. While tangible rewards tend to decrease intrinsic motivation as students lose a sense of autonomy, choice and appropriately challenging tasks enhance internal motivation as students gain a sense

of autonomy. For integrated extrinsic motivation to occur, students' needs for relatedness is critical alongside the need for competence and autonomy. Deci and Moller (2007) contend that "people are inclined to internalize the behaviors and values in their social environment in order to feel both a sense of belonging within that environment and a sense of competence and autonomy" (p. 594). Understanding how students' psychological needs are met or thwarted by praise and reward systems is essential for increasing student motivation.

Unfortunately, motivational messages are often mixed in classrooms. For example, "students may be encouraged to focus on their own improvement but may be evaluated in either normative or absolute grading systems that disregard improvement" (Urdan & Turner, 2007, p. 297). Turner et al. (2002) agree and warn against simple interpretations of goal orientation theory as their study demonstrated the complexity of instructional interactions and students' psychological interpretations. Ames and Archer (1988) found that informational cues about performance or mastery goals are mixed and inconsistent over time in the classroom and that students will interpret those cues differently. In addition to students' experience in the classroom, students' perceptions are also impacted by home influences, prior experiences and differential treatment by teachers. Ames and Archer (1988) write that "how students approach tasks, engage in the process of learning and respond to the situation may be related to their perceived ability as well as to the perceived goals of the environment" (p. 261). Encouraging teachers to change their classroom goal structure and reward structures to be more mastery focused may not help some students who lack skills and as a result of accumulated academic experiences, have adopted a belief that they are not able. Thus, to understand why students orient more toward performance or mastery goals, it is essential to examine the relative contribution of students' beliefs about intelligence to the study of competence motivation.

Attribution Theory/Implicit Theories of Intelligence

Jean Piaget, known for defining four stages of cognitive development that children move through based on age and maturity, conceded that the "worldviews" children develop might influence their behavior in ways that are just as important as their logical thinking (Dweck & London, 2004). Blackwell et al. (2007) described children's beliefs as "mental baggage" that they bring to school. Bernard Weiner (2007) considered competence a perception or inference about the self and others that influence behavior. These are all examples of the attribution approach that suggests that the individuals' attributions for events determine their reaction to those same events and about their expectations for future events. Thus, if a person perceives competence as ability or aptitude, it is uncontrollable, whereas if a person perceives competence as related to effort, the attainment of competence is controllable (Weiner, 2007). Accordingly, "a failure that is attributed to lack of ability will give rise to different reactions and future expectations than will a failure attributed to lack of effort" (Dweck & Leggett, 1988, p. 268).

Building on the attribution work, Dweck and Leggett (1988) identified a related class of beliefs or self-theories that generate attributions for achievement. Dweck and Leggett (1988) defined children's theories of intelligence, or their implicit conception about the nature of ability, as either incremental or entity. Children who believe in the incremental theory of intelligence believe that intelligence is malleable, increasable and controllable. Children who believe in the entity theory of intelligence believe that intelligence is a fixed or uncontrollable trait. Dweck and Molden (2007) write that both theories are equally prevalent in children and adults with 40% endorsing entity theory, 40% endorsing incremental theory and 20% undecided. These self-theories can help educators understand why some children pursue competence acquisition

(learning) while others pursue competence validation (performance) and how an overemphasis on competence validation can drive out learning.

Self-theories affect students' goals, effort, response to failure, and achievement outcomes. Dweck and Molden (2007) found that the incremental theory of intelligence correlates with learning goals. Incremental theorists pursue learning goals to develop their intelligence. Entity theorists pursue performance goals to validate their intelligence. In a study by Hong, Chiu, Dweck, Lin, and Wan (1999), college students with an incremental theory of intelligence opted to take remedial English to shore up their skills and help them learn, whereas entity theorists elected not to take the remedial class and preferred to hide their deficiency in English. In Dweck and Leggett's 1988 study with eighth graders, over 80% of students with an entity theory chose a performance-goal task, with 50% choosing a very easy task to ensure perfection. In contrast, over 60% of the eighth–graders with an incremental theory chose the learning-goal task and all but a few of the remaining, 40% selected a challenging performance task. Students who chose the performance goal were concerned with measuring their ability and finding out if their ability was adequate, whereas students who chose the learning goal were concerned with increasing their ability and achieving mastery.

In addition to goals, students' theories of intelligence strongly predict their beliefs about effort. In the Dweck and Leggett 1988 study, those students with an entity theory and performance-goal preference used effort to predict low or high ability. Effort and ability were inversely related for these students. High effort implied low ability, and low effort implied high ability. Conversely, those with an incremental theory of intelligence and learning goal orientation viewed effort as a means or a strategy. For these students, effort and ability were positively related. Dweck (2000) explains that "in the entity theory framework effort measures

intelligence, and it signifies low intelligence. In the incremental theory framework, effort is what turns on people's intelligence and allows them to use it to full advantage" (p. 39). Thus for an entity theorist, competence is something people have innately, and if competence does not emerge quickly, they will lose interest or become distressed. Conversely, for incremental theorists, competence is something that grows over time with effort. Incremental theorists feel confidence, pride, and interest in the continued effort (Dweck & Molden, 2007).

Failure, like effort, has different meanings to the entity and incremental theorists. In the entity framework, failure means low intelligence, while, in the incremental theory, failure means it is time to try a new strategy. In response to failure, students with an incremental theory in three longitudinal studies (Blackwell et al., 2003; Robins & Pals, 2002; Tresniewski & Robins, 2003) agreed with the following statements more often than entity theorists. After a failure on a test "I would work harder in this class from now on" and "I would spend more time studying for the test." Conversely, students with an entity theory agreed with the following statements more often than incremental theorists. After a failure on a test "I would spend less time on this subject from now on," "I would try not to take this subject ever again," and "I would try to cheat on the next test" (Dweck & Molden, 2007, p. 125). Failure for the entity theorist means you lack ability, which leaves no strategy for overcoming it.

Given the effect on goals, effort, and response to failure, it should not be surprising that implicit theories of intelligence predict achievement outcomes. In the Blackwell et al. (2007) study, seventh-grade students with an incremental theory of intelligence outperformed those who held more of an entity theory in mathematics, controlling for prior achievement. Their grade trajectory in mathematics rose every semester over a two-year period while the grades of entity theorist began to decline after just one term. Path analyses show that students with an

incremental theory have mastery or learning oriented goals, and positive effort beliefs and effort attributions that lead to mastery strategies. These strategies predicted increasing scores in mathematics across the junior high years. Significantly, only the motivational variables (not entering achievement scores) predicted students' increasing or decreasing grades (Dweck & Molden, 2007). Trzeniewski and Robins (2003) conducted a similar study of students crossing from fifth to sixth grade and found that the students who started middle school with an incremental theory of intelligence and learning goal orientation increased their math grade over the year and a half long study. In another study by Stipek and Gralinski (1996) of over 300 children in third to sixth grades, students' beliefs in an entity versus the incremental theory of intelligence predicted their academic achievement on mathematics grades over and above the effects of goal orientation. Schunk and Pajares (2007) conclude that "researchers and school practitioners should continue to look at students' beliefs about their academic capabilities as important predictors and determinants of academic achievement, for they are critical components of motivation and behavior" (p. 100).

Changing someone's meaning system can lead to changes in learning and achievement. Dweck and London (2004) write, "if beliefs control important aspects of children's functioning, it follows that changing the beliefs should result in changes in functioning. This is good news since beliefs can be changed" (p. 437). Changing students' self-theories can, in fact, lead to a cascade of changes in motivation, behavior, and outcomes. Dweck, Tenney, and Dinces (1982) showed how an experimental manipulation of children's theory of intelligence impacted their goal choice on an upcoming task. By reading three passages, the students were oriented towards either an incremental or entity theory. Then they were asked to select different problems to solve, each embodying a different goal choice. Students who read the incremental passage were

more likely to adopt a learning goal for the task than those who had read the entity passage. "This study, then, by (temporarily) orienting children toward a particular theory of intelligence, provided support for a causal relationship between implicit theories and goal choice" (Dweck & Leggett, 1988). Self-theories can be induced experimentally and through targeted interventions.

Powerful situations and strategic interventions targeted during adolescence and school transitions can change self-theories. Adolescence is a crucial window of opportunity and risk when students are cognitively ready to develop learning strategies and are challenged by a new school environment. As children enter adolescence, their prefrontal cortex develops allowing them to think more abstractly and use the information to shape behavior. With the increased ability for abstract thought and self-assessment, adolescents begin to make decisions about motivation, effort, and engagement based on feelings of competence (Farrington et al., 2012). Their increased capacity to distinguish ability from effort impacts their beliefs about learning and creates a heightened sense of vulnerability when faced with challenging tasks and a less personalized and supportive environment. The transition to middle school or high school can be a threat to entity theorists who prefer safe tasks and guaranteed success, whereas incremental theorists enjoy the challenge and give themselves time to master difficult tasks (Dweck, 2000). Thus, it is essential to understand how Growth Mindset interventions can be effectively implemented during the pivotal adolescent years.

Psychological Mindset Interventions

The following four research studies highlight the efficacy of mindset interventions between 2003 and 2015 (Blackwell, Trzesniewski, & Dweck, 2007; Good, Aronson, & Inzlicht, 2003; Fitzakerley, Michlin, Paton, & Dubinsky, 2013; and Paunesku et al., 2015). While the four research studies verify the positive impact of having an incremental theory of intelligence

on achievement outcomes, the methodologies used vary from more extended interventions with the support of outside research assistants to shorter online interventions. For psychological mindset interventions to be practical for large-scale use in schools and districts, time, cost and ease of implementation need to be considered.

Good, Aronson, and Inzlicht (2003) tested methods to help females, minority, and low-income students overcome anxiety, stereotype threat and improve performance on standardized tests. The intervention was purposefully timed to coincide with adolescents' transition to junior high school because it is the time when many students decline in academic performance, with the decline being particularly steep for females and minorities (Good, Aronson, & Inzlicht, 2003). They predicted that stereotyped students who received an intervention focused on changing attributions from pejorative (lack of intelligence) to non-pejorative (understanding the difficulty of the transition to junior high school) would outperform students who did not receive the intervention. Stereotype threat elicits characteristics of the entity theory of intelligence, such as attributing academic difficulties to internal shortcomings and lack of ability. Thus, they hypothesized that exposing students to an intervention teaching the incremental theory of intelligence might reduce students' vulnerability to stereotype threat and improve their performance on math and reading standardized tests.

Good, Aronson and Inzlicht's (2003) study was conducted in a rural Texas school district with 138 seventh-grade students. The participants were 67% Hispanic, 13% Black, 20% White, with approximately 70% receiving free or reduced-priced meals. Each student was assigned a college mentor who met with them twice for 90 minutes and maintained regular email correspondence for the entire school year. Students were assigned to one of four intervention groups to learn an incremental, attribution, combination or antidrug message. At the end of the

school year, students took the Texas Assessment of Academic Skills (TAAS). The college mentor explicitly taught the educational message, provided advice regarding study skills and assisted students as they designed and created website pages for future students who were having difficulty in school. Students in the incremental condition learned about neurons and dendrites and how the brain is capable of forming new neural connections throughout life; students in the attribution condition learned that difficulties they experience are likely due to the transition and novelty of junior high school rather than their shortcomings; students in the combined condition learned both the incremental and attribution message; and students in the antidrug condition learned about the dangers of drug use (Good et al., 2003).

The results of the Good, Aronson and Inzlicht (2003) study showed that boys outperformed girls on the TAAS math test if they were in the control (anti-drug) condition group, but the gender gap disappeared for students in the incremental, attribution or combined groups. Similarly, students performed better on the TAAS reading test if they were mentored in the malleability of intelligence and attribution of difficulties to the novelty of junior high, rather than the dangers of drug use. Both the incremental and attribution message raised students' test scores and combining the two messages did not have an additive effect. The findings support their hypothesis that when students view intelligence as expandable, they change their beliefs about intelligence and the attributions they make for the causes of their difficulties (Good et al., 2003). Thus, this study showed a clear connection between achievement and implicit theories of intelligence and attributions during the adolescent years.

Blackwell, Trzesniewski, and Dweck (2007) examined what makes some students resilient during the adolescent transition to junior high school while other students decline. While the Good, Aronson, and Inzlicht (2003) research study showed that implicit theories of

intelligence could be manipulated with positive results on one-time academic outcomes, this research study aimed to answer if students' theories were related to their achievement trajectory across junior high school and could reverse a downward achievement trajectory. This research study also strove to answer; why is the theory of intelligence related to grades, does teaching an incremental theory provide added benefit over similar academic interventions, and would changing implicit theories impact classroom behavior?

The first part of the Blackwell et al. (2007) study took place over five years and included 373 entering junior high school students in four successive entering seventh-grade classes. The participants were 55% African American, 27% South Asian, 15% Hispanic and 3% East Asian and European American with 53% eligible for free and reduced-priced meals. In the fall, participants filled out a questionnaire assessing their theory of intelligence, goals, beliefs about effort and helpless versus mastery-oriented responses to failure on a six-point Likert-type scale (Blackwell et al., 2007a). Researchers collected participants' sixth-grade math achievement scores on the Citywide Achievement Test (CAT) and their fall and spring semester math grades for the seventh and eighth grade. In this study, an incremental theory of intelligence, learning goals, positive beliefs about effort, non-helpless attributions, and strategies in response to failure were all positively correlated with one another (Blackwell et al., 2007a). Also, the motivational variables were not significantly correlated with students' prior sixth-grade CAT scores. Having an incremental theory of intelligence did, however, predict higher mathematics grades earned at the end of eighth grade. Math achievement growth patterns showed that students with an incremental view of intelligence and related motivational beliefs began to pull apart and achieve higher grades than their entity theorist peers.

In the second part of the study, 91 lower-achieving students participated in an incremental theory intervention, and then researchers assessed the effects on classroom motivation and achievement. The participants were 52% African-American, 45% Latino and 3% White and Asian with 79% eligible for free and reduced-priced meals (Blackwell et al., 2007a). Sixth-grade math grades were used to measure prior student achievement and seventh-grade fall and spring semester grades were used to measure changes in achievement outcomes. Blackwell et al. (2007) utilized the same questionnaire to assess students' initial motivational profiles including the theory of intelligence, goals, beliefs about effort and helpless versus mastery-oriented responses to failure. The intervention occurred over eight 25-minute advisory period classes with 12 to 14 students in each. Both groups received instruction in the physiology of the brain, study skills, and anti-stereotypic thinking. Students in the experimental group also had lessons that taught them the brain is malleable and can be developed while the control group had a lesson on memory techniques. Undergraduate college students were trained to provide the lessons. Students were reassessed on their theory of intelligence and teachers took notes on changes in students' motivation and behavior. Students in the experimental group showed a greater change in their theory of intelligence and were significantly higher in the incremental theory than the control group after the intervention. Also, teachers noted positive changes in 27% of the students in the experimental group compared to only 9% in the control group (Blackwell et al., 2007a). Regarding achievement outcomes, students in the experimental group halted their downward trajectory after the intervention while students in the control group who endorsed the entity theory continued to decline. Significantly, this study proved that an incremental theory intervention could have long-lasting effects beyond a one-time academic

outcome. The Blackwell et al. (2007) study confirms the importance of how students' belief systems impact their behavior and achievement.

Fitzakerley, Michlin, Paton, and Dubinsky (2013) evaluated the effects of a Brain Awareness (BA) classroom visit program to determine whether short interactive BA scientists-in-the-classroom sessions could change students' implicit theories of intelligence. The BA visits were 45 to 60 minutes in length, resulting in a shorter intervention than the eight-week intervention by Blackwell et al. (2007). Three questions (Fitzakerley et al., 2013) guided this research study:

1. Do the BA classroom visits present neuroscience concepts that are valued by teachers and remembered by upper elementary students?
2. Does the one-hour lesson regarding Growth Mindsets diminish students' identification with a fixed mindset?
3. Do neuroscientists classroom visits alter students' attitudes and interest towards science?

Scientists and students from the University of Minnesota visited fourth- through sixth-grade classrooms conducting 168 presentations and conducting pre-surveys in 52 classrooms and post-surveys in 54 classrooms. Personal information was not collected on students or teachers, and only aggregate data were reported. All presenters received a minimum of one hour of training, and first-time presenters were paired with experienced presenters. Presenters were not professional teachers and had varied content and ability to manage students. Some of the classroom teachers prepared their students for the visit and followed up with activities while others did not. The amount of time for the presentation and time of day varied considerably.

The results of the Fitzakerley et al. (2013) study showed that 90% of the teachers found the BA presentations to be valuable. Analysis of the student surveys showed favorable shifts on 16 of the 18 survey items, ten of which represented statistically significant improvements towards a Growth Mindset. The impact of the BA program was greatest where presenters were well trained and experienced and in schools with more student diversity or high poverty (Fitzakerley et al., 2013). This study is significant because the positive shift towards a Growth Mindset was achieved in a one-hour lesson, rather than the more extended interventions utilized in previous studies.

Paunesku, Walton, Romero, Smith, Yeager, and Dweck (2015) tested whether psychological interventions could be practically scaled to impact academic achievement with minimal researcher involvement. Previous interventions have been tested in one context at a time with more researcher involvement and control than is practical in most schools. Paunesku et al. (2015) argue "if interventions are not tested in realistic ways with broad samples and minimal researcher input, they remain only exemplar test cases whose practical impact on educational outcomes is unclear" (p. 2). To address scalability and practicality, Paunesku et al. transformed existing in-person interventions into brief computerized interventions that could be delivered to students without researcher involvement or training. Mindset interventions can be brief because they target a single belief, theory of intelligence. Furthermore, mindset interventions can be standardized with common narratives and objective information to change core beliefs about school for any underperforming student (Paunesku et al., 2015).

The researchers tested two mindset interventions, one for Growth Mindsets and one for a sense of purpose, with 1,594 students in 13 high schools. Teachers created accounts on http://www.perts.net and scheduled two 45-minute sessions about two weeks apart in the second

semester. Teachers described the activity to students as an ongoing Stanford University study about why and how students learn. Students were assigned to either a control condition or one of three intervention conditions; a Growth Mindset intervention, a sense-of purpose-intervention, or a combination of the two interventions. The first 45-minute session was about the Growth Mindset or control condition and the second 45-minute session was about the sense-of-purpose or control condition. In the Growth Mindset intervention, students read articles about the ability of the brain to grow with effort and strategies and stressed that setbacks in school do not indicate low potential, but are rather opportunities to learn. Students then wrote a summary of the articles in their words and advised a hypothetical student who was struggling. In the sense-of-purpose intervention, students wrote about how they wished the world could be a better place; then they were told to think about their goals and write about how learning and working hard in school could help them achieve their goals. Students were also given brief psychological measures about the malleability of intelligence and purpose of schoolwork before session one and after session two. Intervention effects were measured against grade point average.

The research study found GPA to be positively associated with baseline values for Growth Mindset and a sense of purpose. The Growth Mindset interventions led to a more malleable view of intelligence while the sense-of-purpose and combined interventions did not. About GPA, Paunesku et al. (2015) found that the intervention effect was significant amongst at-risk students but not among other students. Also, students who received both interventions did not show greater benefits. Finally, at-risk students were significantly more likely to earn satisfactory grades (A, B, C, P or CR) in core classes after the intervention than students in the control group and showed a significant increase in their GPA over the course of one semester.

This study showed that a brief intervention, in this case, an hour and a half online intervention, can change students' mindsets and improve GPA.

All of the above four research studies use psychological interventions to impact students' implicit theories of intelligence, develop Growth Mindsets and improve achievement outcomes. The interventions varied in format, length, and involvement of research assistants. In replicating or designing future research studies that are brief and practical for classroom teachers, it is essential to understand why psychological interventions work.

Psychological interventions do not teach students about academic content, but instead, target students' beliefs. The goal of psychological interventions is to "alter a specific way in which people think or feel in the normal course of their lives to help them flourish" (Walton, 2014, p. 73). Walton refers to these psychological interventions as "wise" because they focus on "specific underlying psychological processes that contribute to social problems or prevent people from flourishing" (p. 73). According to Yeager, Paunesku, Walton, and Dweck (2013), psychological interventions have three essential qualities. First, they target students' beliefs about themselves and their educational environments. Second, they are delivered in a precise and potent way. Third, they tap into recursive processes that sustain the effects of the initial intervention.

Psychological interventions target students' beliefs about themselves and school from the student's perspective. For psychological interventions to be effective, they must change how students think or feel about school or themselves in school. Yeager, Walton, and Cohen (2013) argue that "understanding what school feels like to different students can lead to non-obvious but powerful interventions" (p. 62). Students have beliefs and worries that prevent them from learning, such as believing that they are not a math person. In the Blackwell et al. (2007) study,

researchers found that when students believe that they can become smarter over time, they are more likely to believe in and use powerful learning strategies that help them succeed. Psychological interventions begin with a well-founded psychological theory that allows researchers to create a precise tool, such as a Growth Mindset lesson, to change students' psychological processes and behavior.

Psychological interventions are precise and potent in their delivery. Psychological interventions are "stealthy" in that students do not know that they are the targets of the message. Students who are told to have a Growth Mindset may resist or feel stigmatized as someone who needs help (Yeager & Walton, 2011). Psychological interventions take an indirect approach by sharing information that students then personalize for themselves. For example, in the Paunesku et al. (2015) study, students read about Growth Mindsets, then summarized the information and wrote a letter to a struggling student. Significantly, psychological interventions require students to be active participants in generating and then advocating the message to others. Research on the "saying-is-believing" effect shows that encouraging students to write to others is a powerful means of self-persuasion (Yeager et al., 2013). Finally, psychological interventions are by design, brief. Excessive repetition of the same message may send the message that students are seen as in need of help. Overstating the intervention message may undo the effects, and shorter interventions are recommended. Thus, psychological interventions that are stealthy, require active participation, and are brief can have significant effects on students' achievement.

Psychological interventions also work because they are recursive. Schools are an ideal setting for psychological interventions because typically, positive experiences facilitate positive

outcomes, reinforcing the changed belief system. For example, Yeager and Walton (2011) explain that

> when students achieve success beyond what they thought possible, their beliefs about their potential may change, leading them to invest themselves more in school, further improving performance and reinforcing their belief in their potential for growth. As students do well, they are placed in higher level classes – gateways that raise expectations, expose them to high-achieving peers, and improve subsequent academic opportunities. (p.286)

Kenthirarajah & Walton, (2015) compare psychological interventions to movies because people's core beliefs are changed causing people's behavior to change over time, and this, in turn, can lead to a "snowball" effect (p. 1).

Long-term effects of psychological interventions can be magnified or lessened depending on the context (Schmidt et al., 2015). Yeager, Walton, and Cohen (2013) write that "psychological interventions work only because they catalyze the students' potential and the classroom resources for growth" (p. 64). For example, the long-term effects of a Growth Mindset intervention will vary if a student belongs to a class or school setting where effort is recognized, and challenging material is presented, versus a class or school setting where lessons are less engaging, and performance is rewarded. Growth Mindset research studies are social-psychological and represent an intersection between psychological interventions and everyday interactions and practices between teachers and students. Further research examining the relationship between psychological interventions and classroom practices is needed. For example, Yeager et al. (2013) in a white paper prepared for the White House meeting on Excellence in Education, put forth a research and development agenda to effectively scale

mindset research in education and address priorities for both researchers and practitioners. Among others, Yeager et al. recommend finding ways for practitioners to learn about the effectiveness of their classroom practices in developing Growth Mindsets.

Mathematics – a Unique Challenge to Growth Mindsets

Fixed mindsets flourish in mathematics due to beliefs about mathematical ability, and beliefs about the nature of mathematics. More than any other subject, math is viewed as a gift that some people have, and others do not (Boaler, 2016). Boaler argues that no one is born knowing math, nor is anyone born lacking the ability to learn math, rather that math giftedness is nothing more than a pervasive cultural idea that "math people" are those who effortlessly achieve in math. In addition to the damaging belief that mathematics ability is innate, math is seen as a performance subject with right and wrong answers which further encourages fixed-mindsets.

> One way that mathematics is different is that it is often thought of as a performance subject – if you ask most students what they think their role is in math classrooms, they will tell you it is to get questions right. Students rarely think that they are in math classrooms to appreciate the beauty of mathematics, to ask deep questions, to explore the rich set of connections that make up the subject, or even to learn about the applicability of the subject; they think they are in math classrooms to perform. (Boaler, 2016, p. 21)

Many teachers also believe that math is primarily a set of procedural steps that must be mastered rather than an open, multi-dimensional subject. Fortunately, brain research proves that everyone, with access to Growth Mindset math instruction, can be very successful and achieve at the highest levels of math (Boaler, 2016).

Understanding the kind of mathematics instruction that promotes Growth Mindsets for students is important. Research by Sun (2015) sought to deepen the understanding of classroom

practices that support students' development of Growth Mindsets in math. Sun found a disconnect between teacher's mindset beliefs and practices. That is, teachers could believe in Growth Mindsets personally and communicate Growth Mindset messages to their students, yet still hold instructional practices inconsistent with Growth Mindsets. In her case study of eight middle school math teachers, Sun (2015) found that (a) teacher mindset does not predict student mindset, (b) multi-dimensional math is essential for Growth Mindset math teaching, and (c) teacher mindset does not always align with practice. The implications of Sun's research include providing professional development related to teaching mathematics in a way that aligns with Growth Mindset teaching, making visible the disconnect between mindset beliefs and practices, and emphasizing the importance of enacting mindset norms throughout the school year.

Jo Boaler (2013) recommends several instructional strategies to help students develop Growth Mindsets in mathematics including (a) celebrating mistakes and failures, (b) providing process praise, (c) giving mastery feedback and assessments for learning, and (d) utilizing challenging math tasks that promote struggle and growth. Regarding mistakes, Boaler (2013) recommends celebrating the mistake and as an opportunity for brain growth. Students commonly regard mistakes as indicators of low ability rather than opportunities to increase learning. To combat this, teachers can share their favorite mistake with the class to clear up conceptual misunderstandings while giving a positive message about the value of mistakes and break the myth of "effortless achievement" (Boaler, 2016, p. 178). Praising students for their effort and use of effective strategies supports Growth Mindsets while praising students for their intelligence or innate ability undermines Growth Mindsets (Mueller & Dweck, 1998). When providing positive praise, Boaler (2013) recommends not using the word *smart* and instead praising students for their thinking, hard work or persistence. Based on many studies showing

that grading reduces achievement and communicates Fixed Mindset messages to students, Boaler recommends eliminating grades and instead, giving feedback and encouraging self and peer assessments. When students get an incorrect answer, Boaler recommends looking for patterns and giving feedback on their thinking that helps students understand their mistake. Finally, Boaler recommends giving challenging math tasks that help students view math as an open and creative subject rather than a closed subject with right and wrong answers. When math tasks have more than one answer, students receive the message that high achievement is possible with effort (Boaler, 2013). Boaler contends that mathematics is more than calculating and that students need to learn to "make connections, think logically, and use space, data, and numbers creatively" (Boaler, 2016, p. 31).

Summary

In chapter two, the review of the literature was presented. Competence is the core of motivational achievement. Students develop goals and strategies to increase their competence and to avoid appearing incompetent. Competence motivation is especially susceptible to change during adolescence and school transitions. The increase in evaluative feedback as students' progress through school tends to increase adolescents' focus on performance goals, leading to maladaptive and avoidance behaviors. For students with a performance goal orientation, their purpose in engaging in a task is to demonstrate competence or avoid looking incompetent. For students with mastery goal orientations, their purpose is to learn and develop competence. It is a concern when students are only focused on performance avoidance, and thus teachers need to emphasize mastery classroom goal structures. Also, to increase intrinsic motivation, teachers' use of recognition and rewards need to support students' psychological needs for competence, autonomy, and sense of belonging.

In addition to goal orientation, students' beliefs about their intelligence impact competence motivation. Some students attribute competence to a fixed ability or aptitude while others perceive competence as dependent on effort. In the first, entity theory of intelligence, students believe intelligence is not controllable, while in the latter, incremental theory of intelligence, students think intelligence is controllable through effort. These self-theories lead to different goals, effort, and response to failure that ultimately impact achievement. Fortunately, beliefs about intelligence can be changed. Strategic interventions during adolescence and school transitions provide a critical window of opportunity for students to develop an incremental theory of intelligence.

The psychological mindset interventions targeting adolescents reviewed involved teaching students about how their brain works and studying the impact of the intervention on achievement and or motivation. Three of the studies presented were highly dependent on trained researchers conducting the intervention while the last study by Paunesku et al. (2015) explored if scaling mindset interventions is possible by using online resources rather than direct researcher involvement. Psychological interventions are effective because they target students' beliefs about themselves and their learning environment, are precise and stealthy, and are recursive.

It is crucial to target Growth Mindsets in mathematics due to the pervasive belief that math is an innate ability. Also, traditional mathematics instruction that emphasizes memorizing procedures and one correct answer encourage performance goals and Fixed Mindsets. Teachers must purposefully use multi-dimensional mathematics instruction along with Growth Mindset instructional practices such as celebrating mistakes and failures, praising the process rather than the person, and providing feedback rather than grades to support students' development of

mastery goals and adaptive behaviors that will ultimately improve student motivation, learning, and achievement.

CHAPTER 3: METHODOLOGY

This research examined the practical applications of implementing a Growth Mindset intervention and related strategies in a typical middle school setting by regular classroom teachers. As discussed before, the unique contribution of this study is that teachers implemented the Growth Mindset strategies in their natural school and classroom setting as opposed to utilizing trained researchers, outside presenters, or software programs which may not be a sustainable model for schools. Yeager, Walton, and Cohen (2013) recognized that psychological interventions, such as Growth Mindset interventions, work best in classroom settings that encourage students' effort and emphasize learning over performance. Thus, in addition to measuring the effect of the intervention, this study examined teacher and student perspectives on Growth Mindset strategies following a professional development series.

Much of the qualitative research in the area of Growth Mindsets uses clinical experiments to measure construct validity, such as examining the effects of teachers' language, such as praise, on students' task choice (Cimpian, Arce, Markman, & Dweck, 2007; Kamins & Dweck, 1999; Mueller & Dweck, 1998). Understanding what works in a clinical setting is very different from understanding what works in classrooms. This research utilized formative measures and took a user-centered approach to study teacher and student voices regarding their perspectives on what is effective in applying Growth Mindset strategies in complex and dynamic classrooms. Building on the goal-orientation work of Patrick et al. (2001), the researcher sought to understand what classroom strategies and practices supported students' perceptions of a mastery goal structure. Thus, this research study surveyed students' perceptions of the classroom goal orientation (mastery versus performance) to understand better how students perceived their learning environment and contrasted their perceptions with the teacher's perspectives on the way

they implemented the strategies. Using the results from the student survey on classroom goal orientation, the researcher conducted two focus groups of students from each middle school to learn from those who perceived a predominate mastery classroom goal structure. The researcher also surveyed the seven participating sixth-grade math teachers to understand their perspectives on the ease and effectiveness of four Growth Mindset strategies they learned and attempted to implement.

The quantitative part of this research study focused on a quasi-experimental design analyzing students' mathematics test scores and grades as the outcome during the critical transition to middle school. The researcher sought to understand how a brief Growth Mindset intervention implemented by classroom teachers might impact student growth in mathematics on a norm-referenced standardized assessment and math grade trajectory. Other studies were conducted under more controlled conditions like the Blackwell et al. (2007) study which was an eight-week intervention by trained researchers with an experiment and control group and included 91 participants. This study's sample is much larger than most previous studies. It included nearly all sixth-grade students (n = 449) in two middle schools from one district for a brief Growth Mindset lesson. Finally, this study looked at the association between a Growth Mindset intervention and both GPA and a standardized benchmark assessment, the Measures of Academic Progress (MAP).

MAP measures student growth and aligns with the Smarter Balanced assessment used by many states, including California. As a standardized assessment, MAP scores are built to measure performance and growth on specific math content standards. All MAP questions are in a multiple-choice or multiple-selection format, with no open-response items. Grades measure the performance of an individual course and include a component of subjectivity. MAP scores

and GPA have different strengths. MAP scores allow growth to be measured among higher achievers, whereas GPA suffers from a range restriction at the top (Yeager et al., 2016). Higher achievers simply do not have room to show growth on GPA. Grades incorporate scores from classroom assessments, portfolios, projects, participation, attendance and teachers' judgment regarding quality, improvement, and the student's organization. In addition to measuring content mastery, grades measures motivation, perseverance, good study habits and time management skills. In a study by Dickinson and Adelson (2015), GPA was found to reflect elements of the achievement construct not captured in large-scale assessment scores (p. 15). Thus both the fall to winter MAP growth results and fall, winter and spring math grades were analyzed. Change on MAP scores and three grade points were compared between the sixth-grade students attending these schools during the 2016–2017 school year after the Growth Mindset intervention was implemented in the fall of 2016, and sixth-grade students attending the same schools during the 2015–2016 school year, who did not receive the Growth Mindset implementation.

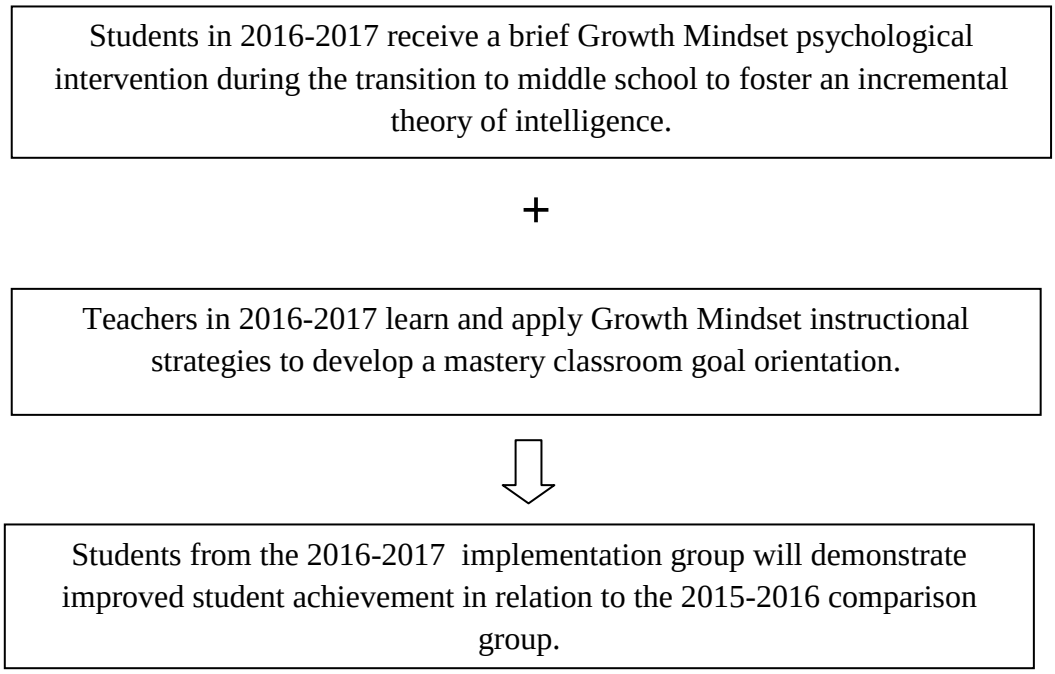


Figure 3. Growth Mindset model developed by the researcher.

Chapter 3 is organized into five sections (a) participants, (b) sampling procedures, (c) instrumentation, (d) data collection, and (e) data analysis. The methodology used to test the two research questions is presented throughout this chapter.

Participants

This research study took place in a small, suburban district in North Orange County, California with nearly 5,000 students. In the Sample School District (SSD), the students are predominately Hispanic (87.8%), and 74.4% of all students qualify for free and reduced-priced meals. English Language Learners make up 32.6% of the student population, and the predominant language is Spanish (California Department of Education, 2017). The participants in the research study were sixth-grade students (*n* = 449) and sixth-grade math teachers (*n* = 7) from two middle schools (see Tables 1 & 2).

Table 1

Demographic Information for Sixth-Grade Middle School Students in Sample School District

	Franklin Middle School (FMS)	Bertrand Middle School (BMS)
Student Population	261	239
Ethnicity	%	%
Hispanic	88	81
White	8	11
Black	1	1
Filipino	1	2
Asian	1	3
Other	1	2
Economically disadvantaged	74	73
English learners	24	25
Students with disabilities	10	8

Note. Bertrand Middle School and Franklin Middle School are pseudonyms.

Table 2

Years of Experience and Type of Credential for Sample School District Sixth-Grade Math Teachers

Experience/Credentials	Teachers
0 - 3 years	3
10+ years	4
Clear Multiple Subject	4
Clear Multiple Subject with Mathematics authorization	1
Preliminary Single Subject with Foundational Level Math	2

Sampling Procedures

The student sample population for the study was a convenience sample and selected based on the access the researcher had to student data as the Director of Programs and Assessment for the sample district. Generalizing the results of this study to student populations that do not resemble the students in this sample should be done with caution. Sixth-grade students were selected both because of low math test scores in this grade and because students transition to middle school for their sixth-grade year in this district. Good, Aronson and Inzlicht (2003) and Blackwell, Trzesniewski, and Dweck, (2007) support timing Growth Mindset interventions to coincide with a transitional year in school when students are adjusting to new routines and expectations.

The sample size is large (n = 449) and exceeds the requirement (N = 217) for a population of 500 (Krejcie & Morgan, 1970). Those in the sample represent all of the sixth-grade students who were in attendance for the Growth Mindset intervention lesson in the fall of 2016, completed the student survey and took both the fall and winter MAP Math assessment. Sixth-grade math teachers were allowed to decide if their students would participate in the perception of Classroom Goal Orientation Survey. The decision was made to respect the comfort level of each teacher in having their students surveyed regarding their classroom goal

structure. Of the seven sixth-grade math teachers in the sample district, all decided to survey their students. A notification letter to parent/guardians about the student survey was sent home in March of 2017 in English and Spanish. This letter gave parents the option to opt out and contact information should they have concerns or questions. Students were provided information on the study and given the option to opt out. Two students opted out of taking the survey, and the rest were surveyed in April 2017.

The selection criteria for students participating in the two focus groups included several variables. Students were selected based on their responses to the student survey and MAP assessment results. The researcher specifically sought students who perceived a mastery classroom goal orientation and who demonstrated academic growth in both regular and honors level math classes. The researcher wanted to learn from these students what happens in their class that influences their perception of a mastery classroom goal orientation. Consequently, students were considered for participation if their survey responses indicated a relatively stronger perception of mastery goal structure (3.6 or higher) and who demonstrated growth on the Math MAP assessment between fall and winter (see Table 3). Once those 84 students were identified, 52 students were randomly selected who represented all seven of the sixth-grade math teachers. The Focus Group Parental Consent Forms (see Appendix E) were sent to 26 families from each middle school with the goal of eight to 12 families from each middle school returning and affirming permission to participate. The consent forms granted students permission to miss class and be recorded. Many consent forms were not returned, and of those that were returned, most came from students in the honors level classes. To address this, the researcher had the community liaison at each school remind students from the regular math classes to return their form. In the end, consent forms were returned from 13 students at Franklin Middle School and

15 students at Bertrand Middle School. The researcher eliminated five honors-level students who returned their consent form to create focus groups that proportionally represented students from both the regular and honors-level classroom teachers. Eleven students at one middle school and 12 students at the other school were ultimately selected. One student was absent the day of the focus group, and thus a total of 22 students participated, 11 from each school.

Table 3

Selection Criteria for Focus Groups

Middle School	Total students taking the survey	Total students who scored 3.6 or higher on survey	Total students who met MAP goal
FMS	234	122	49
BMS	217	126	35

Note. BMS = Bertrand Middle School; FMS = Franklin Middle School

Teachers were asked to participate in this study because they teach sixth-grade mathematics in SSD. All seven teachers agreed to deliver the Growth Mindset intervention lesson in the fall as a part of a larger district-wide initiative. All seven teachers also agreed to participate in the online professional development on Growth Mindset strategies and subsequent teacher survey (see Appendix F).

District Growth Mindset Intervention Description

Based on research demonstrating the efficacy of brief psychological interventions (Kenthirarajah & Walton, 2015; Paunesku et al., 2015), all sixth-grade teachers in SSD delivered a Growth Mindset lesson on brain development at the beginning of the 2016 school year to their students. The intervention lesson utilized strategies and ideas from the Project for Education Research that Scales (PERTS) at www.perts.net. The researcher met with the sixth-grade teachers at the beginning of the school year to review the lesson, provide the materials and

answer questions. The intervention lesson was created to be taught by a classroom teacher and followed standard lesson plan design (see Appendix A). The direct instruction, discussion, and independent project were designed to be completed in approximately 90 minutes, or two classroom periods. During the lesson, students watched two short videos and read an article on how their brain develops and grows like a muscle. The teacher led the students in a classroom discussion and shared a personal experience of learning something new. Students then wrote a letter, created a poster, PowerPoint presentation or i-movie to a potential "new" student to their class to teach them about how their brain grows with challenges and mistakes. When students tell another why the content is important, it feels less controlling, and the "saying-is-believing" strategy makes the information self-relevant and easier to recall (Yeager et al., 2016). Optional homework and activities were suggested but not required. Students completed their letter or project on how the brain grows with effort on the second or subsequent days depending on the complexity of their project. Only students who were present for the lesson and completed a letter or project were included in this study. The researcher visited the classrooms after the intervention was completed to discuss the experience with the teachers and examine student work. The student work samples indicate that some of the teachers allowed students to work in groups rather than complete the project or letter independently. The work samples also demonstrate that some of the students focused more on labeling the parts of the brain rather than the retelling the core message that your brain grows with effort. Appendix B shows samples of student work.

District Growth Mindset Professional Development Description

As a part of the district's emphasis on Growth Mindsets, sixth-grade math teachers were encouraged to participate in a Growth Mindset professional development online series. Using a

Haiku Learning Management system commonly used by teachers at both middle schools, teachers logged in to the Growth Mindset class and from there were directed to one of four lessons found on the PERTS website. Teachers listened to videos and read articles about each of the four strategies (a) celebrate mistakes; (b) praise the process, not the person; (c) feedback and assessments for learning; and (d) challenging math tasks. After learning about the Growth Mindset strategy, teachers wrote a "Commit to Try" on the Haiku Learning Management System. The Director of Programs and Assessment responded and gave feedback on their commit to try. After a week focused on implementing that strategy, the teacher reflected on the successes and challenges they had with that strategy.

Instrumentation

Patterns of Adaptive Learning Scales (PALS) Student Survey

The purpose of PALS is to examine the relationship between the learning environment and students' motivation (Midgley et al., 2000). The student scales assess several dimensions, one of which is students' perception of classroom goal structure. The various PALS scales can be used together or individually. For this research study, only the perception of classroom goal structure scale was used to learn about students' perceptions of the purposes for engaging in academic work that is emphasized in the classroom. The perceptions of classroom goal structure scale use a five-point Likert scale anchored at 1 = *Not at all true*, 2 = *A little bit true*, 3 = *Somewhat true*, 4 = *Mostly true*, 5 = *Very true* (Midgley et al., 2000).

To establish reliability on the PALS student survey, a district administrator followed the suggestions for survey administration (Midgley et al., 2000). The district administrator, rather than the classroom teacher, administered the survey. Classroom teachers left the room for the duration of the survey. Students were told that the survey was not a test and that there were no

right or wrong answers. The students were also told that the information in the survey would be confidential and that no one at home and no one at school other than the district administrator would ever see their responses. The instructions were read aloud to the students, and the district administrator walked about the room to answer student questions.

To validate the classroom goal structure scales, Midgley et al. (2000) conducted confirmatory factor analysis on the mastery goal structure, performance-approach goal structure, and performance-avoidance goal structure items. LISREL VII (Joreskog & Sorbom, 1993, p. 4) confirmed that the items loaded on different factors (*GFI* = .96, *AGFI* = .94). PALS have been used in nine public school districts in three Midwestern states at elementary, middle and high school levels. The students in these districts were low to middle socioeconomic status and up to 55% ethnic minorities (primarily African-American.). PALS has been used in over 30 publications examining various aspects of student motivation (Midgley et al., 2000).

For this research study, the perception of classroom goal structure scale was reduced from 14 to 12 items. Two performance-avoidance statements were eliminated after feedback from colleagues and students indicated the wording was not clear. In the revised survey, students responded to six mastery classroom goal structure statements and six performance classroom goal structure statements. Three of the performance classroom goal structure statements were performance-approach, and three were performance-avoidance. The three performance-avoidance proved to be difficult for students to answer and many were left blank. Please see Table 4 and note the italicized performance-avoidance questions. Information on how the skipped questions were handled can be found in the Data Analysis section. Students also answered two open-ended questions developed by the researcher. The scale for the modified

PALS Student Survey included 1 = *Not at all true*, 2 = *A little bit true*, 3 = *Somewhat true*, 4 = *Mostly true*, and 5 = *Very true*

Table 4

Modified PALS Student Survey

Survey items
1. In our class, getting good grades is the main goal.
2. In our class, trying hard is very important.
3. In our class, getting right answers is very important.
4. In our class, how much you improve is really important.
5. In our class, it is important to get high scores on tests.
6. In our class, really understanding the problem or math content is the main goal.
7. *In our class, it is very important to not look dumb.*
8. In our class, it is important to understand the work, not just memorize it.
9. *In our class, it is important not to make mistakes in front of everyone.*
10. In our class, learning new ideas and concepts is very important.
11. *In our class, it is important not to do worse than other students.*
12. In our class, it is OK to make mistakes as long as you are learning.
Open-ended questions
1. What do you think is most important in your mathematics classroom?
2. Do you have a personal or classroom goal related to math? If so, what is it?

Measures of Academic Progress (MAP)

The MAP Survey with Goals Mathematics Test used in this research was designed to measure student achievement as they progress through Grades 2 to 12. The test provides an overall score and sub-scores in algebra and functions, mathematical reasoning, measurement and geometry, number sense and statistics and probability. The test measures students' current status and growth using the Rasch Unit or RIT score. RIT scores are based on item response theory

(IRT) that provides a scale based on a student's achievement level and item characteristics (Northwest Evaluation Association [NWEA], 2011). Students answer approximately 40 questions from a bank of 5,600 items that adapts as they respond correctly or incorrectly until a student's instructional level is determined.

The adaptive nature of MAP requires non-traditional methods to determine reliability. NWEA uses "correlations between two tests administered from two different but related item pools and those administered twice but from different item pools" (Northwest Evaluation Association, 2011, p. 55). NWEA gathered strong validity evidence in 2008 - 2009 "expressed in the form of a Pearson correlation coefficient between the total domain area RIT score and the total scale score of another established test designed to assess the same domain area" (Northwest Evaluation Association, 2011, p. 164). The reliability and validity data specific to sixth grade MAP math test scores in California is presented in Table 5. These reliability and validity studies were completed before California's transition from the California Standards Test to the Smarter Balanced Assessment in 2015. While new validity studies have not yet been completed, in 2015 NWEA completed a concordance study and published "Linking the Smarter Balanced Assessments to NWEA MAP Assessments" using data gathered from the first administration of the Smarter Balanced assessments in 2015. NWEA also studied classification accuracy or the extent to which MAP scores accurately predicted whether students achieved a level 3 or 4 on the Smarter Balanced assessments. The classification accuracy for sixth grade in mathematics is .88 (Northwest Evaluation Association, 2015, p. 8). Until NWEA conducts further reliability and validity studies in California using the Smarter Balanced test, the concordance study and classification accuracy provide some level of assurance that MAP tests accurately measure what it purports to measure.

Table 5

Reliability and Validity Measures for MAP

Instrument Name	Concept Measured	Standardized Measure	Scores Used	Sample	Reliability/ Validity
MAP	Instructional level and growth in algebra and functions, mathematical reasoning, measurement and geometry, number sense and statistics and probability	Marginal Reliabilities for California state content aligned test in the Spring and Fall of 2008 and Spring of 2009	Rasch Unit (RIT)	*n* = 23,475	*r* =.962
		Validity of concurrent performance on California state accountability tests	Rasch Unit (RIT)	*n* = 2,525	*r* = .862

Note. Adapted from "Technical Manual for Measures of Academic Progress (MAP) and Measures of Academic Progress for Primary Grades (MPG)" by Northwest Evaluation Association, 2011, Tables 22 and 33.

Data Collection

Research Question 1

How do students and teachers perceive the classroom goal orientation and the effectiveness of four Growth Mindset strategies? To answer this question, the researcher utilized a student survey, student focus groups, and a teacher survey.

Student survey. The modified PALS survey was administered to all students in the spring. Teachers who agreed to survey their students invited the researcher to administer the survey while they left the classroom. The researcher explained the format of the survey and how students would answer using a Google form on their iPads. After completing the survey, two students requested to have their survey results deleted. Students took the 12-question survey

modified from the Patterns of Adaptive Learning Survey (PALS) along with two additional open-ended questions that provided participants an opportunity to share opinions and evidence that supported their perception of the classroom goal orientation.

Student focus groups. Two student focus groups were conducted at each middle school. Students were selected at the classroom level and invited to participate. After revising the questions to increase clarity, the final version of the focus group questions (see Table 6) asked students two questions regarding the goal structure in the classroom and one question for each of the four Growth Mindset strategies (a) celebrating mistakes; (b) praise the process, not the person; (c) feedback and assessment for learning; and (d) challenging math tasks. Students were asked the questions in a classroom free from distractions and were recorded. Students at one of the middle schools may have recognized the researcher as their former elementary school principal. To help students feel comfortable answering honestly, the researcher sat away from the focus group table and took notes while the academic coaches led the focus group. One academic coach asked the primary question, and the other academic coach asked follow-up questions. The follow-up probing questions were pre-written to ensure consistency across the two focus groups. Students were told to avoid naming their teachers and not to repeat any responses outside of the focus group. Students were encouraged to give honest feedback and told that there were no right or wrong responses, just their opinion. Students were also told that their teacher, principal, and families would not see or hear their responses. Students' responses were audio-recorded and later coded by the two math academic coaches to establish reliability.

Table 6

Student Focus Group Questions

Focus Group Questions		Probing Questions
1 Goals	What do you think is most important to your teacher in your math class? Why?	What makes you think ___ is most important?
2 Goals	In your classroom, is there a shared or common goal – something that everyone is working toward? If so, what is it?	How do you know ___ is a goal? How do you keep track of your progress on the goal?
3 Celebrating Mistakes	What happens in your class when someone makes a mistake? Tell me more.	Are students embarrassed when they make mistakes? Why or why not?
4 Praise	Does your teacher praise you or other students in the class? If so, please give an example of something he/she might say or write to you or a classmate.	When are you likely to hear praise? How often? What is the praise for?
5 Feedback	Please describe the feedback, if any, that you get on your homework, projects or tests.	What feedback is most helpful to you? Why?
6 Challenging Tasks	Describe the math tasks you receive on a typical day. Do you prefer to work on problems that are easy for you or challenging? Why?	What do you think is your teacher's favorite math task? Why? How often do you get challenging math tasks?

Teacher survey. The researcher also surveyed the teachers after participating in the online professional development series to understand their perspectives on what works to help students develop a Growth Mindset. The survey questions mirrored the four topics presented in the online professional development series (a) celebrating mistakes; (b) praise the process, not the person; (c) feedback and assessments for learning; and (d) challenging tasks and were parallel in nature to the questions asked of students in the focus groups (see Table 7). For example, teachers were asked, "Did you find praise the process, not the person, a relatively easy or difficult strategy to implement?" To establish validity, teachers were told that their responses

would be anonymous, aggregated with the other participants, and not shared with their site supervisor. Teachers were assured that actual school names would not be used in the study results. Teachers were also told that they could skip any question or discontinue the survey at any time. The scale used in the teacher survey for even numbered statements was *Once, Occasionally, Frequently, Daily & DNA/Did not try*. The scale used in the teacher survey for odd numbered statements was *Strongly disagree, Disagree, Agree, Strongly agree & DNA/Did not try*.

Table 7

Teacher Survey Questions

Questions
1. Celebrating mistakes and failures helped my students develop a Growth Mindset.
2. Celebrating mistakes and failures is a strategy I tried…
3. Praising students for process/effort rather than their ability helped my students develop a Growth Mindset.
4. Praising students for process/effort rather than their ability was a strategy I tried…
5. Providing written or oral feedback about specific math skills, rather than a letter or numeric grade, helped my students develop a Growth Mindset.
6. Providing written or oral feedback about specific math skills, rather than a letter or numeric grade was a strategy I tried…
7. Providing students with challenging math tasks helped my students develop a Growth Mindset.
8. Providing students with challenging math tasks was a strategy I tried…
Short Answer Questions
1. Which topic(s) in the professional development series do you feel has the most impact on developing a classroom culture supportive of Growth Mindsets? Please explain.
2. Did you find Celebrating Mistakes and Failures, a relatively easy or difficult strategy to implement? Please explain
3. Did you find Praise the Process, Not the Person, a relatively easy or difficult strategy to implement? Please explain.
4. Did you find Providing Feedback and Assessments for Learning a relatively easy or difficult strategy to implement? Please explain.
5. Did you find Providing Challenging Math Tasks a relatively easy or difficult strategy to implement? Please explain.
6. When discussing goals, do you emphasize performance goals (such as a letter grade), mastery goals (such as a specific skill) or both with your students? Please explain.
7. If you implemented Growth Mindset practices with more than one group of students, did you find any differences in how the strategies were received or embraced by the students? If so, please explain.

Research Question 2

How will a Growth Mindset intervention conducted by sixth-grade classroom teachers change student growth on a norm-referenced, computer adaptive mathematics assessment and their trimester math grades? To answer this question, the researcher utilized MAP math growth scores and trimester grades.

MAP. Teachers delivered a lesson on brain development to all sixth-graders in SSD in the fall of 2016 as a part of a district-wide initiative to implement Growth Mindsets. The students took the regularly scheduled Fall 2016 and Winter 2017 MAP math assessment to measure the impact of the Growth Mindset lesson. The MAP math assessment is approximately 40 questions in length, adapts in difficulty based on students' responses and takes about 50 minutes to complete. Students took the MAP assessment with their math teacher in their classroom using an iPad. The researcher then accessed students' RIT score and growth score between fall and winter.

Grades. Trimester grades for 2016–2017 were recorded by the classroom teachers in Aeries, a student data system, following an established district calendar for data entry and later retrieved by the researcher.

The MAP assessment growth scores from Fall 2015 and Winter 2016, and trimester math grades from sixth-grade students in 2015–2016 were used for comparison. The number of students in the comparison group of sixth-grade students from 2015–2016 is larger (n = 587) than the implementation group of 2016–2017 (n = 449) yet both student groups have similar demographics.

Data Analysis

Three measurements (the student survey, two student focus groups, and a teacher survey) informed the first question: how do students' and teachers' perceive the classroom goal orientation and the effectiveness of four Growth Mindset strategies? Statements on the student survey were written to represent a mastery classroom goal structure (even numbers) or performance-approach/performance-avoidance classroom goal structure (odd numbers). The researcher analyzed the goal orientation data in two ways. First, the researcher inversed the data

for the odd numbered questions to attain a single classroom goal orientation score. This combined score indicated where students' perceptions of goal orientation fell on the continuum from performance (score of one) to mastery (score of five). Second, the researcher analyzed the data as three separate constructs, mastery, performance-approach and performance-avoidance. The researcher analyzed the data to determine any variances in the survey and noticed that many students skipped one or more of the three performance-avoidance statements. Students may have been confused by the double negative sentence structure and therefore elected not to answer. For the three performance-avoidance questions that many of the students skipped, the researcher inserted the average of the remaining performance orientation questions for each student.

Students' responses to the open-ended questions in the focus groups were analyzed to generate themes around students' perceptions of classroom goals and the classroom strategies used by teachers. Student responses were initially coded a priori as (a) Growth Mindset/Mastery Goal Orientation, (b) Fixed Mindset/Performance Goal Orientation or (c) Both by two trained academic coaches. The researcher and academic coaches analyzed written notes and coded the student responses independently. Using Cohen's kappa, the initial inter-coder reliability ranged from .817 to .966 for the two focus groups. The team then listened to the audio recording and discussed variances until intercoder reliability was attained.

When a student's response indicated that a Growth Mindset practice might be occurring in the classroom, the research team wanted to find out what gave the student that impression. Thus, student responses coded as "Growth Mindset" were further coded as a "Verbal Feedback," "Written Feedback," "Peer Comments" or "Classroom Walls/Environment." Other codes that emerged during the analysis included "Classroom Culture/Feeling Tone" and "Reward System/Grades."

The researcher also analyzed the teacher survey results regarding their perceptions of both the classroom goal orientation and the four Growth Mindset strategies that were presented in the professional development series. Teachers' responses from both the survey and their reflections after trying out the four Growth Mindset strategies were analyzed and compared to the students' responses.

A quasi-experimental study was conducted to answer the second question; how will a Growth Mindset intervention conducted by sixth-grade classroom teachers impact student growth on a norm-referenced, computer adaptive mathematics assessment and their trimester math grades? A two-tail *t*-test analysis with a significance level of $p \leq .05$ was used to compare the change in MAP growth scores between the fall and winter in SSD. The amount of growth between the sixth-grade students in the 2016–2017 school year, who received the Growth Mindset intervention, and sixth-grade students from 2015–2016, who did not receive the Growth Mindset intervention will be compared to answer research question one. An ANOVA analysis with a significance level of $p \leq .05$ was used to compare the trimester trajectory of students' GPA in 2015–2016 compared to 2016–2017.

Summary

This chapter summarized the similarities and differences between previous research studies and this research study and restated the two research questions. The participants were chosen as a convenience sample of the sixth-grade students in the district where the researcher works. The district's Growth Mindset intervention and professional development series were explained. The validity and reliability of the PALS survey and MAP assessment were presented. The data collection process for the two research questions was shared. Finally, the data analysis

procedures and statistical tests were discussed. Results of the data analysis are presented next, in Chapter 4.

CHAPTER 4: RESULTS

This study intended to explore teachers' and students' perceptions of classroom goal orientations and Growth Mindset strategies, and the impact of a Growth Mindset intervention conducted by sixth-grade middle school math teachers. The purpose of the study was to uncover challenges and successes in the implementation of Growth Mindset theory in the classroom to bridge the gap between researchers and practitioners. The purpose of the study was achieved by giving a voice to both teachers and students regarding the classroom goal orientation and the effectiveness of four Growth Mindset strategies, and by utilizing classroom teachers to conduct the Growth Mindset intervention. This chapter presents the descriptive statistics for the sample, including demographics, baseline achievement and students' perceptions of classroom goal orientation. The quantitative and qualitative results for the two stated research questions are also presented.

Descriptive Statistics

Demographic information on the students in the sample is presented below for readers wanting to understand the context in which this study took place. Table 8 displays the percentage of total students by ethnicity, gender, language proficiency and economic status. Most students in this sample are Hispanic (86.9%) and socioeconomically disadvantaged (79.3%) and nearly 19% are in the process of learning English.

Table 8

Demographic Variables for Students in Sample

Demographic variables	Frequency	%
Hispanic	390	86.9
White	30	6.7
Asian	15	3.3
Black or African American	5	1.1
Two or more races	7	1.6
American Indian or Alaskan Native	2	.4
Subtotals	449	99.6
English Only	187	41.6
English Learner	84	18.7
Redesignated	170	37.9
Initially English proficient	8	1.8
Subtotals	449	100
Socioeconomically disadvantaged	356	79.3
Not socioeconomically disadvantaged	93	20.7
Subtotals	449	100

The fall math MAP scores for this sample were used to gather baseline student achievement information before the Growth Mindset intervention was implemented (see Table 9). Students took this test in the first few weeks of school. The researcher compared the Fall RIT score to national norms and categorized students as performing below (0 - 216), at (217 - 222) or above (223 - 300) sixth-grade norms when they entered their sixth-grade year. Most students in this sample are performing below sixth-grade norms for mathematics (71.7%).

Table 9

Percent of Students Below, At and Above Sixth-Grade Norms on MAP

Level of Grade Norms	Frequency	%
Below sixth-grade norms	323	71.7
At sixth-grade norms	57	12.7
Above sixth-grade norms	69	15.4

Research Question 1

How do students and teachers perceive the classroom goal orientation and the effectiveness of four Growth Mindset strategies?

To answer the first question, a student survey with 12 multiple-choice questions and two open-ended questions regarding perceptions of classroom goal orientation was given to 449 students. Also, 22 students and the seven participating teachers were asked parallel questions regarding classroom goal orientation and four Growth Mindset strategies (a) celebrating mistakes; (b) praise the process, not the person; (c) feedback and assessment for learning; and (d) challenging math tasks. The 22 students participated in one of two focus groups, and the teachers completed a survey. Teachers' and students' responses were analyzed separately and then compared to find similarities and differences in how the two groups perceived the classroom goal orientation and four Growth Mindset strategies. All seven teachers had a positive attitude towards implementing the Growth Mindset intervention and strategies, and the 22 students selected for the Focus Groups held a relatively stronger perception of mastery classroom goal orientation. However, the results from both the teacher and student groups indicate a varying degree of implementation and effectiveness for the four Growth Mindset strategies studied.

Classroom Goal Orientation

The classroom goal orientation describes the purpose of the students to engage in learning activities based on what is deemed important in the classroom. Perceptions of a performance classroom goal orientation indicate that what is most important is the outcome or grade on assignments and assessments. Perceptions of a mastery classroom goal orientation indicate that what is most important is learning and mastery of skills.

Analysis of teachers' responses. When teachers were asked, "When discussing goals, do

you emphasize performance goals (such as letter grades), mastery goals (such as a specific math skill), or both with your students?," all who responded (6 out of 7) believe they emphasize both (see Table 10). Two of the teachers' responses indicated a need to emphasize letter grades (performance goal) due to the larger context in which they work. For example, one teacher wrote, "Because our grading system is based on letter grades, it is hard to get away from that, and the students are so ingrained in letter grades and what is associated with them." The four other teachers' responses indicated a belief that both mastery and performance goals are important. For example, one teacher wrote, "I want them to be motivated by performance goals while understanding that mastery goals are important in the marathon that is education."

Table 10

Teacher Question on Classroom goal orientation

Response	Total
Mastery	0
Performance	0
Both	6
No Response	1

Analysis of student responses. A modified PALS student survey was administered to 449 students to gather information on their perceptions of the classroom goal orientation. Table 11 reports the mean score and standard deviation for the six performance and six mastery questions as well as the overall average. The researcher inversed the performance goal orientation scores. Students responded to a five-point Likert scale with lower scores indicating perception of a performance classroom goal orientation and a higher score indicating a perception of a mastery classroom goal orientation. The average mean (3.62) and negative skewness of the total average (-.08) indicate that students in this sample lean towards perceiving a mastery goal orientation in their classroom. It is important to note that of the six performance

statements three of them (P1, P2, P3) were performance-approach statements and three of them (P4, P5, P6) were performance-avoidance statements. The three performance-approach statements had the lowest mean (*M* = 1.68, *M* = 2.65, *M* = 2.01, respectively) indicating that students found these statements to be mostly true and reflected a performance classroom goal orientation. These statements captured the importance given to good grades, correct answers and earning high scores on tests. The three performance-avoidance statements (P4, P5, P6) all had significant missing data. Seventy students did not respond to P4, 34 did not respond to P5 and 59 did not respond to P6. These statements utilized a negative sentence structure (see Table 4), and students may have skipped these statements due to a lack of clarity in how to respond. To address missing data, the researcher utilized an average of all six performance statements at the student level.

Table 11

Students' Perceptions of Classroom goal orientation

Question Code	*n*	*M*	*SD*	Skewness
P1	437	1.68	.97	1.49
M1	444	4.56	.76	-1.82
P2	430	2.65	1.17	.34
M2	440	4.33	.89	-1.28
P3	482	2.01	1.03	.89
M3	437	4.03	1.1	-.94
P4	448	3.38	1.4	-.32
M4	441	4.10	1.09	-1.04
P5	448	4.04	1.26	-1.01
M5	437	4.29	.89	-1.15
P6	448	3.52	1.42	-.4
M6	444	4.69	.79	-2.9
Average	449	3.62	.45	-.08

Note. P = Performance goal-orientation question; M = Mastery goal-orientation question

The researcher also analyzed the results from the PALS survey as three separate constructs (Performance-Approach (P1 - P3), Performance-Avoidance (P4 - P6) and Mastery

(M1 - M6) using totals rather than average of all statements. To address any missing data, the researcher inserted the average from the remaining statements in that construct for each student. If the student did not respond to any of the items in any of the three constructs, they were eliminated from the analysis. The number indicates the level of agreement with the statement (1 = *Not at all true*, 2 = *A little bit true*, 3 = *Somewhat true*, 4 = *Mostly true*, 5 = *Very true*). Students in this sample find the mastery goal orientation statements to be mostly true to very true for their math classroom. Students find the performance-approach goal orientation statements to be somewhat true to mostly true, and the performance-avoidance goal orientation statements to be a little bit true to somewhat true for their math classroom.

Table 12

Student Totals on Performance-Approach, Performance-Avoidance and Mastery Constructs

Goal Construct	*n*	*M*
P1	445	4.31
P2	445	3.35
P3	445	3.96
Performance-approach average	445	3.87
P4	445	2.93
P5	445	1.86
P6	445	2.32
Performance-avoidance average total	445	2.18
M1	445	4.56
M2	445	4.30
M3	445	4.03
M4	445	4.09
M5	445	4.28
M6	445	4.68
Mastery average total	445	4.33

Two open-ended questions on the survey gave students an opportunity to write a short response (see Table 13). These open-ended responses were coded as indicating a performance classroom goal-orientation, mastery classroom goal-orientation, both performance and mastery

classroom goal-orientation, a “no-type” answer such as “nothing,” “no,” or “none” and either it was left blank, or the answer was off-topic or irrelevant. When students were asked, what do you think is most important in your math classroom, nearly 60% gave a response coded as mastery goal orientation. However, when students were asked, do you have a personal or classroom goal related to math, and if so, what is it, only 16% gave a response coded as a mastery goal orientation. While students hear that learning, growth, perseverance, and effort is important, when asked to articulate a personal or classroom goal, 37.5% of the students wrote a performance-approach goal and nearly 43% wrote that they had no math related goal at all or did not answer the question.

Table 13

Open-Ended Questions on Classroom goal orientation

What do you think is most important to in your math class?				
Response	BMS (n = 221)	FMS (n = 235)	Total (n = 456)	%
Mastery	126	147	273	59.86
Performance	28	12	40	8.77
Both	17	18	35	7.67
“Nothing”	1	0	1	.21
Left Blank/Off topic	47	52	99	21.70
Do you have a personal or classroom goal related to math? If so, what is it?				
Response	BMS (n = 221)	FMS (n = 235)	Total (n = 456)	%
Mastery	39	35	74	16.22
Performance	75	96	171	37.5
Both	11	9	20	4.38
“Nothing”	45	44	89	19.51
Left Blank/Off topic	54	51	105	23.02

Note. BMS = Bertrand Middle School; FMS = Franklin Middle School

In order to learn more about students’ perceptions of classroom goal orientation, the 22 students in the focus groups were asked two similar questions. On the first question (What do you think is most important to your teacher in your math class?), most student responses

indicated a presence of mastery goal orientations at BMS, while at FMS the student responses were split fairly evenly (see Table 14). Typical responses coded as mastery-oriented included statements about trying their best and never giving up. For example, one student responded that what is most important to the teacher is "to never give up and try our best, and when we are in teams [the teacher] says to work together to figure out the answers." Another student said, "to make sure that everyone learns new things and understands." The student responses coded as performance-oriented focused on being respectful to the teacher and following rules and completing work. For example, students responded that what was most important was "respect," and "the page is done and went smoothly." These responses suggest that students receive performance messages regarding their behavior, work completion, and grades, as well as mastery messages regarding the importance of effort and learning the math concept.

Table 14

Student Focus Group Question One on Classroom goal orientation

Response	BMS	FMS	Total
Mastery	10	5	15
Performance	0	6	6
Both	1	0	1
No Response	0	0	0

Note. BMS = Bertrand Middle School; FMS = Franklin Middle School

On the second question regarding classroom goal orientation, (In your math classroom, is there a shared goal, something that everyone is working towards?) 12 of the student responses were coded as a performance-oriented goal (see Table 15). For example, students' responses about the shared classroom goal included: "to get to 100 points and if not you get detention"; "we try to get good grades on our tests"; "when we're playing Kahoot, those who get the most points get candy—the questions are about math, and you get points the faster you answer"; and

"my classroom goal is to get the highest percentage on the tests and the test with the highest percentage gets stapled to the wall-that is the class goal; to get the highest percentage."

In the examples above, points, grades and external rewards seem to focus the student on the result or reward rather than learning the math concept. For the student responses coded as mastery-oriented or both, the results indicate that classroom points (such as when teachers use Class Dojo) can reinforce a mastery goal orientation when the points explicitly connect to student effort, perseverance or problem-solving. For example, students said: "my teacher puts points on the Class Dojo, like how much you answer and try"; "our class goal is to know how to work the answer to the question"; "my teacher is not forcing us to get it correct; our goal is just to work the answer"; "the goal changes daily; every day at the beginning of class the teacher puts up the Class Dojo, and when we get to a specific number, it means that we made our goal. We earn our points by answering the question correctly or explaining well"; and "the goal is to understand the math, not just get the answer right. Our last goal was about geometry. Usually, our teacher will tell us when we meet the goal, and our teacher has Class Dojo, and it gives us points." Strategic use of class reward systems such as Class Dojo has the potential to raise students' awareness of effort, teamwork and problem-solving, and to elevate mastery and learning goals to match the importance already given to traditional performance goals.

Table 15

Student Focus Group Question Two on Classroom goal orientation

Response	BMS	FMS	Total
Mastery	2	1	3
Performance	4	8	12
Both	3	2	5
No Response	2	0	2

Note. BMS = Bertrand Middle School; FMS = Franklin Middle School

Synthesis of students' and teachers' responses. Teachers at BMS and FMS report having both performance and mastery goals in their classroom. Student responses also indicate that both mastery and performance goals are present. Students believe it is important to their teacher for students to have mastery goals, yet when asked to articulate their personal or classroom goals, they are predominately performance-approach related. The notable differences found in Tables 14 and 15 between the number of student responses coded as performance and mastery at BMS and FMS may be due to differences in how each school levels students into honors level classes. However, the school system and culture regarding leveling students into general and honors level math classes is not a focus of this study.

The researcher completed secondary coding on responses that were initially coded as mastery, or both mastery and performance, to understand how educators might increase students' perceptions of mastery-oriented goals (see Table 16). The words teachers use in verbal feedback, and the classroom culture and feeling tone created by everyday interactions between students and teacher, are mainly responsible for the perceptions students hold about the importance of mastery goals at both schools. Reward structures, when utilized purposefully to focus students on effort and perseverance, also help students perceive that mastery/learning goals are important. A few students at BMS gave responses that referenced specific motivational or Growth Mindset posters or bulletin boards indicating that some students do read the walls and may be influenced by their classroom environment.

Table 16

Secondary Codes for Mastery and Mastery/Performance Responses on Goal Orientation Questions

Secondary codes	BMS	FMS	Total
Verbal Feedback	10	3	13
Written Feedback	0	0	0
Peer Interaction/Assistance	0	0	0
Classroom Walls/Environment	3	0	3
Classroom Culture/Feeling Tone	9	5	14
Reward System/Grades/Scores	4	2	6

Note. BMS = Bertrand Middle School; FMS = Franklin Middle School

Celebrating Mistakes

The celebrating mistakes strategy emphasizes that mistakes are a normal part of the learning process and helps learners become more precise in their understanding of a concept. Teachers can celebrate mistakes by telling students how much they love mistakes and assigning challenging work that will result in mistakes rather than easy work that will result in all correct answers. Examples of activities teachers might use from the Mindset Kit website include sharing a favorite mistake with the entire class that shows a common error, and returning a test with mistakes highlighted rather than a grade at the top (The Project for Education Research that Scales, 2017).

Analysis of teachers' responses. All seven teachers implemented the strategy of celebrating mistakes occasionally, frequently or daily, and all agreed or strongly agreed that this strategy helped their students develop a Growth Mindset (see Table 17). For half of the teachers, celebrating mistakes has become a part of their daily instructional routine, while the other half purposefully plan to celebrate mistakes for a particular lesson. While all teachers embraced implementing this strategy, one teacher wrote "I found it difficult to implement because of the time constraints. When planning a lesson, celebrating mistakes and failures can take out

considerable time. This can affect the pacing of my math lessons daily if done frequently. I need to be strategic about how and when I implement this strategy." This same teacher reflected that after spending five minutes to discuss and celebrate a mistake with his students that

> some of the students were a bit puzzled because this was different from what we normally do in class. I believe most of them simply feel that the correct answer is correct and they needed to confirm this answer. Moreover, this took some time off my original lesson plan, and we did not finish what I wanted to cover for the day. As the state test inches closer, I feel a bit pressured to change the routine of the class and celebrate mistakes.

This teacher's reflections demonstrate the change process some teachers and students experience as they shift their focus from the product to the process. The other teachers did not express the same concerns about the amount of class time spent on mistakes and instead reflected on its value and how they might deepen their use of this strategy. For example, one teacher commented about shifting from normalizing mistakes to fully celebrating mistakes.

> Although I have been talking about mistakes being ok and creating a safe learning environment in our class from the beginning of the year…this time…however we did not just talk about it being ok, but how we celebrate mistakes because it gives us an opportunity to learn. I shared with them how I am excited when I see that my classes are making similar mistakes at the beginning of a lesson because that means that I can have a big impact in my teaching by addressing that specific mistake. We also talked about how we love to find somebody that made a mistake because they are probably not alone. They are comfortable with the idea that mistakes are not only ok but opportunities to learn, so we will now celebrate them.

Overall, the teachers in this sample view celebrating mistakes as an effective Growth Mindset strategy and they are at various stages of implementation, from finding time to fit it in occasionally, to consistent use, and from normalizing mistakes to celebrating mistakes.

Table 17

Teachers' Responses to Celebrating Mistakes

Teacher questions	Response/Code	Frequency
Did you find Celebrating mistakes and failures a relatively easy or difficult strategy to implement? Please explain.	Difficult	2
	Easy	4
	Both	0
	No Response	1
Celebrating mistakes and failures helped my students develop a Growth Mindset.	Strongly Disagree	0
	Disagree	0
	Agree	2
	Strongly Agree	5
Celebrating mistakes and failures is a strategy I tried...	Once	0
	Occasionally	3
	Frequently	1
	Daily	3
	Not applicable/Did not try	0

Analysis of students' responses. At both middle schools, students' responses reveal that most (16 of 22) view mistakes as an opportunity to learn or fix their error (see Table 18). When asked what happens when someone makes a mistake, student responses included: "My teacher tells them not to worry because you learn from your mistakes and to keep trying your best"; "My teacher will ask, what did you think was the answer and what do you think you did wrong or what did you do to get this answer?"; "My teacher does not tell us the answer but what we did wrong, then leaves us to figure it out, and if we still don't figure it out, we raise our hand, and the teacher explains but doesn't give us the answer"; "My teacher helps us and guides us but doesn't give us the answer. He does not want us just to give the answer"; and "My teacher tries to lead

us to the right answer. My teacher will not get mad or anything, just helps us along and pushes us in the direction of the answer and will ask if we need help."

The student responses confirm that the classroom culture has been set up to normalize mistakes and allow time for productive struggle. Most students frame the purpose of learning from mistakes as a way to get the correct answer, rather than deepening their understanding of the concept. A few of the responses also indicate that students know the behavior expectations related to mistakes. Most students said that classmates do not usually laugh when someone makes a mistake or get embarrassed if they make a mistake, but if someone does laugh, it is handled by the teacher. For example, students said "if someone giggles, they get sent outside by the teacher because they know it is not ok to laugh," and "if students make fun of someone, the teacher gives them a three-minute talk about school or will take off Class Dojo points." Overall, students' responses at times left the coders unclear as to students' perceptions of the teacher's purpose (learning the concept or getting the answer correct) in celebrating mistakes. Students' responses were coded as supporting a Growth Mindset if the way the teacher handled mistakes seemed to normalize or celebrate mistakes as a part of the learning process.

Table 18

Students' Responses to Celebrating Mistakes

Student question	Response/Code	BMS	FMS	Total
What happens in your class when someone makes a mistake?	Growth/Mastery	6	10	16
	Fixed/Performance	2	1	3
	Both	2	0	2
	No Response	1	0	1

Note. BMS = Bertrand Middle School; FMS = Franklin Middle School

Synthesis of students' and teachers' responses. Students notice teachers' efforts to normalize mistakes as a part of the learning process. Of those giving responses indicating a Growth Mindset, secondary coding revealed that most responses (17) reflected classroom culture

and feeling tone, seven responses reflected peer interactions and assistance, two responses reflected reward systems, and two responses reflected verbal feedback (see Table 19). Students' responses indicated their teachers have made it ok to make mistakes as they complete classwork and work towards understanding the concept and obtaining the correct answer. Thus, there is alignment between teachers' efforts to normalize and celebrate mistakes, and students' perceptions that mistakes are a normal part of the learning process.

Table 19

Secondary Codes for Mastery and Mastery/Performance Responses on Celebrating Mistakes and Failures

Secondary codes	BMS	FMS	Total
Verbal Feedback	2	0	2
Written Feedback	0	0	0
Peer Interaction/Assistance	4	3	7
Classroom Walls/Environment	0	0	0
Classroom Culture/Feeling Tone	7	10	17
Reward System/Grades/Scores	2	0	2

Note. BMS = Bertrand Middle School; FMS = Franklin Middle School

Praise the Process, Not the Person

With this Growth Mindset strategy, teachers modify their verbal praise to focus on the learning process rather than the student. Praise is given when students work hard on difficult tasks, rather than completing easy tasks without effort. For example, rather than saying "You are really smart" after a student gets 100% correct on a task below their ability level, teachers assign challenging tasks and say "I see you used several problem-solving strategies on your classwork, please tell me which one you found most helpful." Other examples of this strategy can be found on the Mindset Kit website (The Project for Education Research that Scales, 2017).

Analysis of teachers' responses. The teachers in this study view the praise strategy differently, with some finding it easy to implement and others acknowledging the difficulty in

breaking old habits (see Table 20). One teacher remarked "praising the process rather than the person was the biggest stretch for me as a teacher." Three of the teachers wrote that they created a script or list of statements to help them feel prepared to offer process related praise. All seven teachers reported trying this strategy occasionally, frequently or daily, and all agreed or strongly agreed that praising the process, not the person, helped their students develop a Growth Mindset. For example, one teacher reflected when a student was praised for a specific process strategy; it made a noticeable impact on the student. That teacher wrote,

> I looked at one student's written answer, and I was able to tell her exactly how I could see that what she had written directly related to the prompt. I noticed how the student was able to internalize what I said and took it to heart. I could see that it was more powerful than how we traditionally praise students.

Another teacher wrote,

> as students were praised specifically for something they did, they were often more interested in what was being said and sometimes questioned something else they had done on the paper. It has more meaning for them and enables them to tackle specific tasks, instead of being left confused about what to do next or how to improve.

Table 20

Teachers' Responses to Praise the Process, Not the Person

Teacher Questions	Response/Code	Frequency
Did you find praise the process, not the person, a relatively easy or difficult strategy to implement? Please explain.	Easy	3
	Difficult	1
	Both	2
	No Response	1
Praise the process, not the person helped my students develop a Growth Mindset.	Strongly Disagree	0
	Disagree	0
	Agree	3
	Strongly Agree	4
Praise the process, not the person is a strategy I tried...	Once	0
	Occasionally	2
	Frequently	3
	Daily	2
	Not applicable/Did not try	0

Analysis of students' responses. When students were asked to give examples of praise in the focus groups, none shared a response that was consistent with praise focused on the learning process or developing a Growth Mindset. The most predominant praise students recall hearing from their teacher is about their behavior, performance and getting something right. For example, students responded: "My teacher would say 'good job' and reward us with candy when we get a good score on a test or get a good sub report"; "If we do a good job when we have a sub, we will get free play the next day"; "The teacher will write problems on the board, and if we get it right, we get a point"; "If you were listening, you would get a class point, and if you were not, you lose a point"; "When you do a project, like when we presented our board game, we will get claps for presenting it"; "When you are kind to someone you get a point, and you can trade it in for candy. You also can get points for doing homework correctly"; and "When you get a question right, you get a point, and the teacher says 'keep it up!'"

These responses indicate that students equate praise with concrete rewards such as points, candy, free time and applause. Furthermore, five students responded that they do not get individual praise at all. One of these students said,

> My teacher does not praise individual students. Our teacher does say "Good job"if we get it right, or our teacher will praise us if the sub writes down the names of the really good kids, but we do not get candy. Sometimes if we excel as a class, we will do something like Kahoot or get time on our I PADS.

The closest response indicating praise for the process was from a student who said "the teacher says 'good job' on what we did right on a problem and gives us a point on Class Dojo. You also get points if you help someone with a problem or figure something out." Interestingly, seven students declined to answer this question at all (see Table 21).

Table 21

Students' Responses to Praise the Process, Not the Person

Student question	Response/Code	BMS	FMS	Total
Does your teacher praise you or other students in the class? If so, please give an example of something he/she might say to you or a classmate.	Growth/Mastery	0	0	0
	Fixed/Performance	4	9	13
	Both	2	0	2
	No Response	5	2	7

Note. BMS = Bertrand Middle School; FMS = Franklin Middle School

Synthesis of students' and teachers' responses. While all teachers report that they tried the strategy of praising the process, not the person, the students in the focus groups did not remember or were not able to identify examples of when their teacher gave them specific process related praise (see Table 22). The reason students did not recognize process praise may relate to the difficulty that half of the teachers acknowledged in breaking old habits and shifting to process related praise. Another explanation might be that the concept of praise to these students seemed connected to points and rewards rather than words and verbal feedback. Perhaps for

students, verbal praise is seen as the teacher simply "teaching" rather than "praising." The bottom line is that students in this sample do not yet express feeling recognized for demonstrating growth or effort in the learning process, but rather for their academic performance or compliance with classroom and school behavior expectations. There were only two students whose responses were coded as both Growth Mindset and Fixed Mindset and thus received secondary coding found in Table 22.

Table 22

Secondary Codes for Mastery and Mastery/Performance Responses on Praising the Process, not the Person

Secondary Codes	BMS	FMS	Total
Verbal Feedback	2	0	2
Written Feedback	0	0	0
Peer Interaction/Assistance	0	0	0
Classroom Walls/Environment	0	0	0
Classroom Culture/Feeling Tone	1	0	1
Reward System/Grades/Scores	1	0	1

Note. BMS = Bertrand Middle School; FMS = Franklin Middle School

Feedback and Assessments for Learning

Feedback and assessments for learning support the development of a Growth Mindset by helping students reflect on their learning and understanding, rather than just the final grade. The feedback is specific, strategic, and helps students focus on what they know, what they do not yet know, and their next steps. An example from the Mindset Kit website of assessment for learning is peer and self-assessment. Rather than using grades, teachers provide a specific learning target that describes the important idea for students to master, and students self-evaluate their work or the work of a classmate (The Project for Education Research that Scales, 2017).

Analysis of teachers' responses. Of the four Growth Mindset instructional strategies included in this study, this is the only strategy that had two teachers decline even to try (see

Table 23). Of the five teachers who indicated that they tried this strategy once or occasionally, only three specifically wrote a commit-to-try response in the online professional development discussion board. One teacher who did not write a commit-to-try expressed skepticism on how this strategy would impact student motivation.

> I find it interesting that students who received only feedback without grades learned more than those with grades. I have never tried giving feedback only and would like to see how this does with student motivation and learning towards a unit test. Ideally, I hope that all students are able to continue to give their best effort in their learning without worrying about their grades. However, I think this will be difficult for students to grasp because I know that many of my students check their grades daily online through Aeries. They want to know what grade they have on a particular test/assessment. This will be new, and I think it will take a lot of time for me to get used to doing and for the students to actually get used to doing.

This strategy, more so than the others, seemed challenging to implement because of the pressure teachers feel to give grades or because it was perceived as time-consuming. For the three teachers who explicitly shared what they would commit-to-try regarding assessments for learning, they selected either providing descriptive feedback on class work or having their students evaluate their progress on a learning objective. The experiences the three teachers had were all very different from each other. One teacher wrote, “I could not go cold turkey and just ask students how they felt they understood [the lesson on] statistics and displaying data. I had to ask them to show the data on their own also. I hope to get more comfortable with it as I practice it.” This teacher’s response demonstrates the change process teachers experience as they shift from being the holder of the knowledge who confirms the “right answer” to students taking

control and ownership for their learning. The second teacher expressed relief that trying out this strategy "came at a good time for me because we are doing a review and test prep at the moment, so I was able to not worry about grades and give students feedback on their effort, participation and creatively looking at the math problems." This response indicates that teachers may struggle with providing feedback only due to expectations for grading. The third teacher shared a successful experience. The students were asked to self-reflect and rated themselves on how well they understood a learning statement. After trying out this strategy, the teacher felt "that the students were very honest" and confirmed the teacher's observations. Furthermore, the teacher realized that without explicitly reviewing the learning goal, "the students do not always know what the objective of the lesson might be. If I address it specifically and discuss what the desired goal is, I think the students can have a better assessment about themselves and where their learning is." Although only three teachers specifically shared their experience, five teachers responded that this strategy helped their students develop a Growth Mindset.

Table 23

Teachers' Responses to Feedback and Assessment for Learning

Teacher questions	Response/Code	Frequency
Did you find feedback and assessments for learning, a relatively easy or difficult strategy to implement? Please explain.	Easy	3
	Difficult	3
	Both	0
	No Response	1
Feedback and assessments for learning helped my students develop a Growth Mindset.	Strongly Disagree	0
	Disagree	0
	Agree	3
	Strongly Agree	2
	Not Applicable/Did not try	2
Feedback and assessments for learning is a strategy I tried...	Once	1
	Occasionally	4
	Frequently	0
	Daily	0
	Not applicable/Did not try	2

Analysis of students' responses. Students in both focus groups seemed perplexed when asked about feedback. The researcher and academic coaches attempted to clarify the word "feedback" by describing it as something a person says or writes as you work on something, or after you complete it. Four students shared that their teacher rarely gave feedback and seven students declined to answer. When students did share, their responses indicated that teacher feedback occurred either after a mistake or to help students get to the right answer. Examples students gave of teacher feedback that students found helpful include: "The teacher walks around and sees the work that we do, and if a student makes a mistake, the teacher will explain it to everyone, so we don't make the same mistake. I find this helpful"; "My teacher gives feedback out loud and on the board or projector. The teacher says 'good job,' 'look a little closer,' 'that wasn't right, but you are close,' it helps us stay awake and motivates us to keep going."

Other examples of student responses about helpfulness of teacher feedback include: “My teacher gives us ClassDojo points or tells us that it is right or not quite right, but that we are on the right path to getting the answer. It is helpful because you know you’re on the right track or can do it differently. The teacher will usually give us a hint and help us with a little part of the problem so we can do the rest on our own”; “If we get the answer right, the teacher will ask, ‘how did you get it?’ and if it is not right, the teacher will give us a little hint. It is helpful because when the teacher gives us a little hint with the problem, it helps us try to find the answer”; and “My teacher gives us feedback about overall progress, like a progress report. It is like a piece of paper, and it helps me because I can see how I am doing. If I got a bad grade on something, the teacher just gives me feedback like ‘good job,’ or ‘try again’”. Other student responses indicated that feedback, like praise, was general in nature. For example: “My teacher does not give much feedback unless we are doing a problem and the teacher notices an error. We do not get a lot of feedback unless we get it right and get a ‘good job’”; “My teacher does not criticize the work or say you are bad, just that you got this wrong and ‘let me help you’”; and “If we have an assignment, or projects, or homework, the teacher will write a smiley face and say ‘good job’ and tell us what we are doing right and give Class Dojo points. Sometimes the score or comment will let you know you are doing a good job.”

Overall, the responses students gave regarding teacher feedback seem to be general and centered around helping students correct a procedural error and get to the correct answer. The researcher did not find clear evidence of mastery-oriented feedback that was specific, built conceptual understanding or helped students close the gap between what their current knowledge, and the learning target. However, without more information regarding the learning objective, student assignment or assessment, coding for mastery-oriented feedback could not be

ruled out. For this reason, most student responses were coded as encouraging both a Fixed Mindset/performance goal-orientation and a Growth Mindset/mastery goal-orientation (see Table 24).

Table 24

Students' Responses to Feedback and Assessment for Learning

Student question	Response/Code	BMS	FMS	Total
Please describe the feedback, if any, that you get during math class as you work on or complete something.	Growth/Mastery	0	0	0
	Fixed/Performance	1	1	2
	Both	8	5	13
	No Response	2	5	7

Note. BMS = Bertrand Middle School; FMS = Franklin Middle School

Synthesis of teachers' and students' responses. For teachers, feedback and assessment for learning strategies are challenging due to concerns about time and expectations for grading. From the students' perspectives, feedback is general and centered on how to correct mistakes and get the answer correct. For those students who shared their opinion on teacher feedback, most of it was the result of teachers' verbal feedback (12), followed by a classroom reward system, then teachers' written feedback (see Table 25).

Table 25

Secondary Codes for Mastery and Mastery/Performance Responses on Feedback for Assessment and Learning

Secondary Codes	BMS	FMS	Total
Verbal Feedback	7	5	12
Written Feedback	2	0	2
Peer Interaction/Assistance	0	0	0
Classroom Walls/Environment	0	0	0
Classroom Culture/Feeling Tone	0	0	0
Reward System/Grades/Scores	4	0	4

Note. BMS = Bertrand Middle School; FMS = Franklin Middle School

Challenging Math Tasks

In the final Growth Mindset strategy, teachers learn that short, closed math tasks with one right answer lead students to believe that math is a performance subject, whereas open-ended, challenging math tasks lead students to believe that math is a growth and learning subject. Challenging math tasks provide opportunities for students to struggle, understand the content deeply, and thereby increase engagement and motivation. An example of a multi-dimensional and challenging math task from the Mindset Kit website is to create "low floor/high ceiling" tasks that have different entry points and ways of seeing the task (The Project for Education Research that Scales, 2017).

Analysis of teachers' responses. All teachers agreed or strongly agreed that challenging math tasks support students' development of a Growth Mindset and all tried it occasionally, frequently or daily (see Table 26). Despite the fact that the district has not yet adopted a math curriculum aligned to the new California State Standards, teachers responded that they had access to open-ended tasks and challenging material through their use of "Open Up" curriculum and their use of the "Number Strings" strategy. Most teachers, four of the six, who responded found this strategy to be both easy and difficult. After watching the online video resources on giving tasks that support struggle and growth, one teacher remarked that "they recommended tasks, not answers, and attention to how the problems and questions are presented. We need to give the students space to learn. We need to keep these ideas in mind as we look into new math curriculum."

All of the teachers committed to allocating time in their lessons for open-ended tasks and math discussions to share and push students' thinking. When reflecting on how students responded to the challenging tasks, teachers saw the value of assigning tasks with higher Depth

of Knowledge (DOK) levels and allowing students to struggle. For example, one teacher wrote: "The higher level DOK's were a struggle for many. The difficulty is holding back to explain them through the struggle for the sake of time. They are learning more through the struggle. It's been a learning curve for me too …to see the value of the struggle and to explain it to parents." Another teacher indicated:

> I made a point to give tasks that support struggle and growth. They were tasks that allowed for all students to be able to be successful but ramped up so that, at the same time, all were challenged. We had fruitful discussions that pushed the students to struggle. As always, my biggest challenge is to not teach but to let the students struggle and find ways to solve the problems.

Another teacher wrote: "When we originally began the activities, many students struggled, but through self and partner discovery, many of the students were able to understand the objective and utilize the ratio language." The teachers support the concept of providing challenging math tasks, yet at the same time are learning both how to play the role of coach and how to pace their lessons to allow more time for struggle, discovery, and discussion.

Table 26

Teachers' Responses on Challenging Math Tasks

Teacher questions	Response/Code	Frequency
Did you find providing challenging math tasks, a relatively easy or difficult strategy to implement? Please explain.	Easy	2
	Difficult	0
	Both	4
	No Response	1
Providing challenging math tasks helped my students develop a Growth Mindset.	Strongly Disagree	0
	Disagree	0
	Agree	3
	Strongly Agree	4
Providing challenging math tasks is a strategy I tried...	Once	0
	Occasionally	1
	Frequently	3
	Daily	3
	Not applicable/Did not try	0

Analysis of students' responses. Students at both schools overwhelmingly responded (16 of 21) that they preferred tasks that were challenging (see Table 27). Also, several students' responses indicated they had internalized the message from the Growth Mindset intervention administered at the beginning of the year. For example, a student stated that "I like to work on the challenging problems because on easy problems you don't learn anything from them. You answer them quickly because they are too easy. When you work on a challenging math problem, you know that you are learning". Other examples of student responses include, "When the teacher gives us problems I prefer challenging because I will develop more and faster in my brain"; "I prefer challenging because that is how you learn. You're not learning anything when it is easy. On the hard ones, you have to really figure it out, and it helps you learn better"; and, "I prefer working on problems that are challenging because it gets your brain working, and then I learn from my struggles."

Table 27

Students' Responses on Challenging Math Tasks

Student question	Response/Code	BMS	FMS	Total
Do you prefer to work on problems that are easy for you or challenging? Why? How often do you get challenging math tasks?	Growth/Mastery	8	8	16
	Fixed/Performance	2	1	3
	Both	1	1	2
	No Response	0	1	1

Note. BMS = Bertrand Middle School; FMS = Franklin Middle School

Synthesis of teachers' and students' responses. Both the teachers and students in this sample see the value in engaging in open-ended, challenging math tasks. The researcher elected to not use secondary coding for the students' responses because the question asked for their preference, not what was happening in the classroom. Instead, the researcher asked students to give their input on the frequency of challenging math tasks. In some classrooms the students reported that challenging math tasks are assigned to a specific day and are given a catchy name such as "Task it Tuesdays" or "Which One Wednesdays." Fourteen students gave an estimate for how many days they thought they received challenging math tasks and eight students said it depended, did not know or did not answer the question. Receiving challenging math tasks twice a week was the most common response, and only one student thought they received challenging math tasks daily (see Figure 4). These results indicate that providing open-ended, challenging math tasks have yet to become a daily classroom routine.

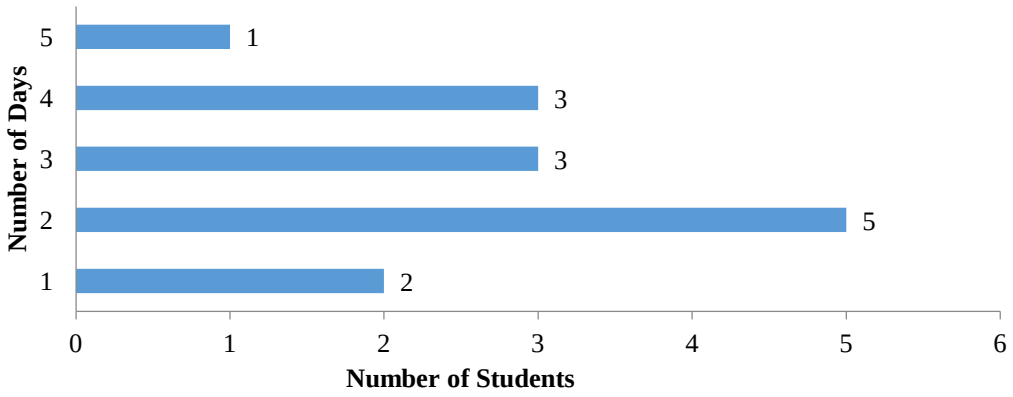


Figure 4. Number of days student report receiving challenging math tasks per week.

Research Question 2

How will a Growth Mindset intervention conducted by sixth-grade classroom teachers change students' growth on a norm-referenced, computer adaptive mathematics assessment and their trimester grades?

Group descriptive statistics (see Table 28) for the two sixth-grade classes show that the average growth on the MAP Math assessment for the intervention group was slightly lower (M = 1.20) than the non-intervention comparison group (M = 1.52). An independent-samples t-Test (see Table 29) was conducted to compare the MAP Math growth scores for the sixth-grade classes of 2015–2016 (no-intervention) and 2016–2017 (intervention). There was no significant difference in growth scores; t (985) = .697, p = .486, two-tailed. Thus the difference between the intervention group and the comparison was not statistically significant.

Table 28

Comparison of MAP Growth for Sixth-Grade Class of 2015–2016 and 2016–2017

Year	*N*	*M*	*SD*	*SEM*
2015–2016 No-Intervention	523	1.52	7.150	.313
2016–2017 Intervention	464	1.20	7.149	.332

Table 29

Independent Samples t-Test for Growth on MAP – Equal Variances Assumed

Levene's Test for Equality of Variances		*t*-test for Equality of Means					95% Confidence Interval of the Difference	
F	*Sig.*	*t*	*df*	*Sig.* (2 tailed)	*M* Difference	*SE* Difference	Lower	Upper
.075	.784	.697	985	.486	.318	.456	-.577	1.213

Several factors unrelated to this study may have impacted the lack of significance found in MAP results after the Growth Mindset intervention and are discussed in Chapter 5. Since MAP growth scores focus on students' acquisition of content rather than being a more wholistic measure of effort, students' grades were also analyzed.

Trimester math grades were used to monitor growth after the intervention and compare to the previous class of sixth graders who did not receive the Growth Mindset intervention. Although there was no growth in GPA for the class of 2016–2017 after the Growth Mindset intervention, there were some notable differences. Table 30 displays the average GPA for each trimester on a four-point scale for the class of 2015–2016 and 2016–2017. The first trimester grades are collected in November, second trimester in February, and third trimester in June. The sixth-grade class of 2016–2017 that had the Growth Mindset intervention in September had a

higher first trimester GPA than the class of 2015–2016. Table 31 displays the frequency of students with passing grades (A, B, or C) in both groups. Sixth-grade students in 2016–2017 who had the Growth Mindset intervention began the year with 10% more students earning a satisfactory grade and concluded the year with 17.2% more students earning a satisfactory grade compared with the sixth-grade students in 2015–2016 who did not have the Growth Mindset intervention.

Table 30

Average Trimester GPA for Sixth-Grade Students

Year	*N*	*M*	*SE*	*SD*	Skewness		Kurtosis	
					Statistic	*SE*	Statistic	*SE*
2015–2016								
1st Tri	520	2.86	.05	1.10	-.94	.11	.10	.214
2nd Tri	523	2.59	.05	1.19	-.48	.11	-.77	.213
3rd Tri	521	2.44	.05	1.20	-.27	.11	-.91	.213
2016 -2017								
1st Tri	455	3.07	.04	.94	-.97	.11	.39	.23
2nd Tri	457	2.99	.05	1.01	-.87	.11	.06	.23
3rd Tri	458	2.94	.05	1.13	-.96	.11	.02	.23

Note. Tri = Trimester

Table 31

Percent of Students with Satisfactory (A, B, C) Grades

Year	Frequency	Percent
2015–2016		
1st Trimester	415	77.9
2nd Trimester	382	71.7
3rd Trimester	353	66.2
2016–2017		
1st Trimester	400	87.9
2nd Trimester	384	84.0
3rd Trimester	382	83.4

The expected decline as students transition to middle school was less in 2016–2017 than in 2015–2016 (see Table 32). To explore whether there was a significant decline in average GPA over

the three trimesters, a one-way between-groups analysis of variance was conducted in the comparison group (sixth-grade students in 2015–2016) and the implementation group (sixth-grade students in 2016–2017). There was a statistically significant difference for the 2015–2016 sixth-graders at the $p < .05$ in GPA for the three trimesters: F (2, 1,562) = 17.523, p = .000. The effect size, calculated using eta squared, .02, was small. Post-hoc comparisons using the Tukey HSD test indicated that the mean score for the first trimester (M = 2.86, SD = 1.10) was significantly different from both the second trimester (M = 2.56, SD = 1.19) and third trimester (M = 2.44, SD = 1.19). There was not a significant difference between second and third trimester. Conversely, there was not any statistically significant difference for the sixth-graders in 2016–2017 at the $p < .05$ in GPA for the three trimesters: F (2, 1,367) = 1.862, p = .156. Post-hoc comparisons using the Tukey HSD test again indicated that the mean scores for first (M = 3.07, SD = .94), second (M = 2.99, SD = 1.02), and third (M = 2.94, SD = 1.13) trimester were not significantly different from each other. Thus, the sixth-grade class of 2015–2016 who did not experience the Growth Mindset intervention began with a lower average GPA and demonstrated the expected decline in GPA as students transition to middle school. The sixth-grade class of 2016–2017 who had the Growth Mindset intervention began with a higher GPA and did not demonstrate the expected decline in GPA.

Table 32

Comparison of Average GPA over Three Trimesters

Year		*SS*	*df*	*MS*	*F*	*Sig.*
2015–2016	Between Groups	47.593	2	23.797	17.523	.000
	Within Groups	2121.227	1562	1.358		
2016–2017	Between Groups	3.998	2	1.999	1.862	.156
	Within Groups	1467.139	1367	1.073		

Summary

In this chapter, the results for qualitative research question were presented for teachers' and students' perspectives on classroom goal orientation and four instructional strategies; (a) celebrating mistakes; (b) praise the process, not the person; (c) feedback and assessment for learning; and (d) challenging math tasks. Next, the quantitative results for the second research question were presented. The results included an independent samples *t*-test results on MAP growth that showed no significant change between the sixth-grade class of 2015–2016 that did not receive a Growth Mindset intervention and the sixth-grade class of 2016–2017 that did receive a Growth Mindset intervention. Descriptive statistics for trimester grades in both years showed that students who had the Growth Mindset intervention in 2016–2017 earned higher grades on average and had a higher percentage of passing grades. Also, results of a one-way between-groups analysis of variance test demonstrated a significant decline in trimester grades in 2015–2016 that was not observed in 2016–2017.

CHAPTER 5: DISCUSSION

In Chapter 4, the data results were presented. In Chapter 5, presents a summary of the study's findings, a discussion of the findings, implications for practitioners, recommendations for further research and conclusions. In this final chapter, the purpose is to inform both researchers and practitioners of the successes and challenges of implementing Growth Mindset research in sixth-grade math classrooms.

Summary of the Study

The purpose of the study was to help bridge the gap between researchers and practitioners on applying Growth Mindset theory in the classroom. Classroom teachers using readily available resources implemented a Growth Mindset intervention at the beginning of students' sixth-grade year and transition to middle school. Teachers continued their year-long journey into Growth Mindsets by participating in an online professional development series and discussion that focused on four strategies (a) celebrate mistakes; (b) praise the process, not the person; (c) feedback and assessments for learning; and (d) challenging math tasks. Teachers were also surveyed to learn their perspective on the ease and effectiveness of the four Growth Mindset instructional strategies. Students' voices were explored via a district-wide sixth-grade survey regarding their perceptions of the classroom goal orientation. Follow-up student focus groups allowed a deeper investigation into students' perspectives on the instructional practices intended to develop Growth Mindsets. Data from a district administered mathematics test and students' trimester grades were gathered to gauge the effectiveness of the intervention.

The study included 449 sixth-grade students from two middle schools and seven sixth-grade math teachers. Secondary source achievement data from sixth-grade students in 2015–2016 was also utilized for comparison purposes. Two questions guided the study:

1. How do students and teachers perceive the classroom goal orientation and the effectiveness of four Growth Mindset strategies?
2. How will a Growth Mindset intervention conducted by sixth-grade classroom teachers change student growth on a norm-referenced, computer adaptive mathematics assessment and their trimester math grades?

Question 1 was answered both quantitatively and qualitatively from both the students' and teachers' perspectives. A district-wide student survey and student focus groups at both middle schools revealed how the Growth Mindset strategies were perceived by students. A teacher survey and online discussion board provided insight into the struggles and successes teachers encountered while attempting to implement four Growth Mindset strategies.

Question 2 was answered quantitatively from the MAP math data gathered in the fall and winter and from students' three-trimester grades over the course of a school year in math. Students' growth on MAP was compared to the previous sixth grade class from 2015–2016 using a *t*-test for independent means. Students' average GPA over three trimesters was also compared to the previous sixth grade class from 2015–2016 using descriptive statistics and a one-way between-groups analysis of variance.

Discussion of the Findings

This study supported the concept that psychological interventions do not stand alone, but rather are context-dependent tools embedded in a complex educational environment (Yeager & Walton, 2011). The voices of the participating teachers and students helped deepen the understanding of how practitioners can improve implementation of Growth Mindset strategies in classrooms.

Findings from Research Question 1

How do students and teachers perceive the classroom goal orientation and the effectiveness of four Growth Mindset strategies?

Classroom goal orientation. Students perceive both mastery and performance goals in the classroom. Data collected from the students indicate that they do hear and internalize that mastery goals, such as learning from mistakes, are important. However, when asked to share an example of a personal or classroom goal, most students on both the student survey and in the focus groups shared performance-approach goals (e.g., getting good grades or correct answers) or did not have a goal. Thus, students are aware of classroom mastery goals, yet tend to express performance goals such as good grades and high test scores, or do not answer when asked. The student results align with teachers' perception that they emphasize both mastery and performance goals. Students' awareness of mastery and performance goals supports research (Ames & Archer, 1988; Deci & Moller, 2007; Pintrich, 2000) about the mixed messages students often hear regarding academic goals. Research also supports the benefits of having both performance-approach goals and mastery goals (Dweck, 2000; Midgley et al., 2000; Pintrich, 2000).

Celebrating mistakes. Teachers frame mistakes as a tool for growth, and as a result, students are comfortable making and then learning from their mistakes. Students gave examples of the classroom culture, verbal feedback, peer interactions and reward systems that create a classroom environment where mistakes are a normal part of the learning process. This finding supports research (Boaler, 2013; Sun, 2015) that teachers' messages about mistakes in math can be positive and linked to the brain's ability to grow. Because students tend to internalize the behaviors and values of their classroom environment to develop a sense of belonging (Deci & Moller, 2007), celebrating learning from mistakes and failures with verbal praise and classroom

reward systems can have a profound impact on the class culture and orient students towards mastery goals.

Praise the process, not the person. Teachers may be inadvertently promoting Fixed Mindsets due to overuse of generic praise focused on performance outcomes. Despite teachers' attempts to offer process-related praise, students do not report hearing praise that is process-related. Although teachers report that they are attempting to praise the process rather than the student and finding positive student reactions when they do, the only examples students gave regarding praise indicated being recognized for an outcome such as correct answers, high test scores or good behavior. Fixed Mindsets are supported when students only hear praise for outcomes such as correctness or compliance (Mueller & Dweck, 1998; Sun, 2015). The examples students gave for praise were usually generic, such as hearing "good job" after getting a problem correct, and attached to a reward such as free time or a point on Class Dojo. Also, generic praise may lead students to think that whatever is being praised is a stable trait and undermine motivation (Cimpian et al., 2007). Furthermore, when the praise is attached to an extrinsic reward, such as free time or candy, it tends to undermine intrinsic motivation by shifting the perceived control from internal to external and thereby reduce feelings of autonomy (Deci & Moller, 2007).

Feedback and assessments for learning. Students report hearing more general rather than specific feedback, and teachers reported more difficulty with this Growth Mindset strategy than the others. Teachers struggled with the time it took to give specific feedback and two in this study declined to try this strategy. About a third of the students were not able (or selected not to) give an example of teacher feedback. Those students that did respond gave examples of teacher feedback that encouraged them and was general rather than specific. Teacher feedback that is

not specific, or clear, and is occasional and perfunctory, does not increase student motivation or understanding (Lucariello et al., 2016).

Challenging math tasks. Students and teachers see the value of challenging math tasks. Students report that challenging math tasks help them learn more and develop their brains, showing that they internalized the Growth Mindset messaging. Teachers, however, tend to provide challenging math tasks as a special activity rather than a daily routine. Providing time for students to struggle and learning to coach students rather than directly teach students were issues noted by the teachers. It is important for teachers to create the time for challenging math tasks because it is the multi-dimensional tasks that focus on connections, reasoning and alternative strategies that support Growth Mindsets, while those that are one-dimensional and have only one solution promote Fixed Mindsets (Boaler, 2016; Sun, 2015). Providing optimal challenge, rather than too easy or too difficult tasks, also increases intrinsic motivation by satisfying students' psychological need for competence (Deci & Moller, 2007).

In this study, two Growth Mindset strategies stand out as being well received and effective from both the teachers' and students' perspectives, Celebrating Mistakes and Challenging Math Tasks. With these two strategies, teachers were willing to implement them regularly and recognized their value in helping students develop Growth Mindsets. Students likewise confirmed that these strategies were occurring in their classroom and were helpful. The other two strategies, Praise the Process, Not the Person and Feedback and Assessments for Learning were both more difficult for teachers to implement and less likely to be recognized by the students. Although teachers saw the potential value in all of the Growth Mindset strategies, these two strategies proved to be challenging to implement. Teachers noted the difficulty in breaking old habits with praise and students either reported receiving no praise, or praise for

performance rather than process. While some teachers found success with providing assessments for learning, others noted the difficulty in providing specific feedback or assessments for learning due to time and expectation for grades. These results may assist education practitioners to select entry points for Growth Mindset professional development that are more likely to have a simpler implementation and immediate impact on students, as well as recognize the Growth Mindset strategies that may require more intensive support and time to implement.

Findings from Research Question 2

How will a Growth Mindset intervention conducted by sixth-grade classroom teachers change student growth on a norm-referenced, computer adaptive mathematics assessment and their trimester math grades?

The findings were similar to the results found in previous research studies (Blackwell et al., 2007; Paunesku et al., 2015) that used Growth Mindset interventions and measured the impact on students' grades. In the Blackwell et al. (2007) study, students in the implementation group receiving the Growth Mindset intervention halted the downward trajectory in grades often seen as students' transition to middle or junior high school (Eccles, Lord, & Midgley, 1991; Gutman & Midgley, 2000). In the Paunesku et al., (2015) study, at-risk students were more likely to earn passing grades and increase their GPA over one semester after a Growth Mindset intervention. Similarly, in this study, students on average earned higher grades overall, had a higher percentage of passing grades, and slowed the downward trajectory of GPA over the course of the year. The general effects on GPA from Growth Mindset interventions tend to be moderate, about 0.2 to 0.3-grade points in size (Farrington et al., 2012). This study had similar results. The difference in the decline in GPA between the comparison group (0.42 for the sixth-

grade class of 2015–2016) and the intervention group (0.13 for the sixth-grade class of 2016–2017) was 0.29-grade points.

Students' growth results on the MAP assessment showed that the intervention group of 2016–2017 did not grow more than the comparison group in 2015–2016. Thus, the MAP results did not turn out as expected. One reason for this may be the instrumentation itself. MAP measures content acquisition over time on a multiple-choice and multiple-selection test. Student grades, on the other hand, measure performance on traditional tests as well as open-response items, projects, homework, class work, participation, attendance and improvement and thus better capture student motivation and effort, the central constructs of Growth Mindsets. Another possible reason the results on MAP did not turn out as expected is that the MAP test was not consistently implemented as intended. MAP is intended to be used as a growth measurement with students and teachers setting mastery goals between the fall and winter administration. However, goal setting did not take place in most of the classrooms in the study. Students' effort and growth on this test may have been impacted by a perceived lack of purpose and importance due to goals not being set. Also, teachers in this study varied from each other regarding years of experience and curriculum used. While all teachers in this sample have been trained on utilizing the California State Common Core Standards, the district has not yet adopted a math textbook and thus students experience a variety of curriculum that is teacher-created or modified from many sources. Thus the instrument itself, as well as how it was utilized by the teachers and students, and variation in teacher experience and curriculum used, may account for the lack of growth found in the results.

Despite the lack of growth seen on the MAP Math assessment, the higher overall average GPA, higher percentage of passing grades, and lack of significant decline in the GPA of this

sample indicate that the Growth Mindset intervention may have had a positive impact on students' effort and learning. This study adds evidence from education practitioners to the growing body of research on the positive potential of psychological interventions. It also provides education practitioners some evidence that interventions implemented without support from researchers or paid programs may be effective.

Implications for Practice

Teachers need to engage in continuous cycles of inquiry to refine their daily instruction and classroom practices to align with Growth Mindset strategies. In this study, teachers implemented a Growth Mindset intervention and tried out four instructional strategies. Other practitioners can learn from both their successes and challenges.

1. Increase student awareness of mastery goals by incorporating learning goals into daily and summative reward and grade systems.
2. Shift from normalizing mistakes to celebrating mistakes to emphasize conceptual understanding rather than correctness.
3. Analyze mistakes as a form of formative assessment for a student-centered, rather than curriculum-driven approach, to guide instruction and lesson design.
4. Plan specific process-related praise to avoid falling back into generic statements such as "good job."
5. Incorporate recognition of process strategies (such as effort, creative problem-solving, perseverance, and creativity) into existing reward systems or grades to raise students' awareness of their importance.

6. Create feedback protocols and systems that clarify learning targets and conceptual understanding, rely on student ownership of their learning and are practical for the teacher to implement.
7. Develop coaching skills to support students as they engage in productive struggle with open-ended, challenging math tasks.

Recommendations for Further Research

Education practitioners are likely to use practical Growth Mindset strategies that work within the complexity of their daily classroom environment, increase student engagement and motivation and produce measurable results on classroom assessments. Researchers can support educators with Growth Mindset implementation by observing the day-to-day work in classrooms and how teachers solve practical problems through a Growth Mindset lens. Michael Fullan, a noted expert on how to impact change in education, said at a recent conference that "eighty percent of the best ideas come from practitioners" (2017). Taking his lead, Growth Mindset researchers might design studies to learn from practitioners how they connect Growth Mindset strategies to common classroom practices such as establishing classroom norms and reward systems, reviewing homework, introducing a new topic, providing feedback on class work, or assessing learning. Instructional practices that support Growth Mindset theory could be evaluated to determine the impact on student motivation, engagement or achievement and provide iterative feedback to refine promising practices. For example,

1. How does the use of classroom point systems that recognize student behaviors aligned to Growth Mindsets such as effort, perseverance, and use of multiple strategies impact students' achievement on an end of unit assessment?

2. How does reviewing homework to discover patterns of mistakes, rather than correct answers, impact homework completion rates and student achievement on unit tests?
3. How does explicitly setting mastery goals for student-led conferences impact growth over a trimester or school year?

Conclusion

Research has shown that Growth Mindset interventions and strategies have great potential to improve student achievement and reduce achievement gaps. The work ahead is to align Growth Mindset strategies with common instructional practices and routines. This study has shown that classroom teachers can implement a Growth Mindset intervention successfully without the assistance of trained researchers or paid programs. This study also underscores the importance of having teachers and researchers work collaboratively to engage in cycles of inquiry around the implementation of practical Growth Mindset strategies.

REFERENCES

Ames, C., & Archer, J. (1988). Achievement goals in the classroom: Students' learning strategies and motivation processes. *Journal of Educational Psychology*, *80*(3), 260–267. doi: 10.1037/0022-0663.80.3.260

Aronson, J. (2004). The threat of stereotype. *Educational Leadership*, *62*(3), 14–19.

Aronson, J., Cohen, G., L., & McCloskey, W. (2009). *Reducing stereotype threat in classrooms: A review of social-psychological intervention studies on improving the achievement of black students* (Report No. 076). Retrieved from the Institute of Education Services website: http://ies.ed.gov/ncee/edlabs

Aronson, J., & Steele, C. (2007). Stereotypes and the fragility of academic competence, motivation and self-concept. In A. J. Elliot and C. S. Dweck (Eds.), *Handbook of competence and motivation.* (pp. 436–456). New York City, NY: The Guilford Press.

Bandura, A. (1977). *Social learning theory*. Englewood Cliffs, NJ: Prentice-Hall.

Bandura, A. (1990). Some reflections on reflections. *Psychological Inquiry*, *1*(1), 101–105.

Bandura, A., & Locke, E. A. (2003). Negative self-efficacy and goal effects revisited. *Journal of Applied Psychology*, *88*(1), 87–99. doi: 10.1037/0021-9010.88.1.87

Baumeister, R., & Leary, M. R. (1995). The need to belong: Desire for interpersonal attachments as a fundamental human motivation. *Psychological Bulletin*, *117*(3), 497–529.

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

Boaler, J. (2013). Ability and mathematics: The mindset revolution that is reshaping education. *Forum*, *55*(1), 143–152.

Boaler, J. (2016). *Mathematical mindsets. Unleashing students' potential through creative math, inspiring messages and innovative teaching.* San Francisco, CA: Jossey-Bass.

California Department of Education. (2016). California Assessment of Student Performance and Progress. Retrieved from http://caaspp.cde.ca.gov/sb2016/

California Department of Education. (2017). DataQuest. Retrieved from http://dq.cde.ca.gov/dataquest/

Cimpian, A., Arce, H.-M. C., Markman, E. M., & Dweck, C. S. (2007). Subtle linguistic cues affect children's motivation. *Psychological Science*, *18*(4), 314–316.

Deci, E. L. (1992). The relation of interest to the motivation of behavior: A self-determination theory perspective. In K. A. Renninger, S. Hidi, & A. Kapp (Eds.), *The role of interest in learning and development* (pp. 43–70). Hillsdale, NJ: Erlbaum.

Deci, E., L., & Moller, A. C. (2007). The concept of competence. In A. J. Elliot and C. S. Dweck (Eds.), *Handbook of competence and motivation* (pp. 579–597). New York City, NY: The Guilford Press.

Dickinson, E. R., & Adelson, J. L. (2015). Choosing among multiple achievement measures: Applying multitrait-multimethod confirmatory factor analysis to state assessment, ACT and student GPA data. *Journal of Advanced Academics*, *27*(1), 4–22. doi: 10.1177/1932202X15621905

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

Dweck, C. S. (2006). *Mindset: The new psychology of success: How we can learn to fulfill our potential.* New York City, NY: Ballatine Books.

Dweck, C. S., & Leggett, E. L. (1988). A social-cognitive approach to motivation and personality. *Psychological Review*, *95*(2), 256–273. doi: 10.1037/0033-295X.95.2.256

Dweck, C. S., & London, B. (2004). The Role of Mental Representation in Social Development. *Merrill-Palmer Quarterly*, *50*(4), 428–444.

Dweck, C. S., & Molden, D. C. (2007). Self-theories. Their impact on competence motivation and acquisition. In A. J. Elliot and C. S. Dweck (Eds.), *Handbook of competence and motivation* (pp. 122–140). New York City, NY: The Guilford Press.

Eccles, J. S., Lord, S., & Midgley, C. (1991). What are we doing to adolescents? The impact of educational contexts on early adolescents. *American Journal of Education*, *99*(4), 521–542.

Elliot, A. J. (2007). A conceptual history of the achievement goal construct. In A. J. Elliot and C. S. Dweck (Eds.), *Handbook of competence and motivation.* (pp. 52–72). New York City, NY: The Guilford Press.

Elliot, A. J., & Dweck, C. S. (2007). Competence and motivation: Competence as the core of achievement motivation. In A. J. Elliot and C. S. Dweck (Eds.), *Handbook of competence and motivation.* (pp. 3–12). New York, NY: The Guilford Press.

Elliot, A. J., Faler, J., McGregor, H. A., Campbell, W. K., Sedikies, C., & Harackiewics, J. M. (2000). Competence valuation as a strategic intrinsic motivation: A mediational analysis. *Personality and Social Psychology Bulletin*, *26*(7), 780–794.

Elliot, A. J., & McGregor, H. A. (2001). A 2×2 achievement goal framework. *Journal of Personality and Social Psychology*, *80*(3), 501–519. doi: 10.1037/0022-3514.80.3.501

Elliott, E. S., & Dweck, C. S. (1988). Goals: An approach to motivation and achievement. *Journal of Personality and Social Psychology*, *54*(1), 5–12. doi:10.1037/0022-3514.54.1.5

Farrington, C. A., Roderick, M., Allensworth, E., Nagaoka, J., Keyes, T. S., Johnson, D. W., & Beechum, N. (2012). *Teaching adolescents to become learners. The role of non cognitive factors in shaping school performance: A critical literature review.* Retrieved from the University of Chicaco Consortium on Chicaco School Research website: https://consortium.uchicago.edu/sites/default/files/publications/Noncognitive%20Report.pdf

Fitzakerley, J. L., Michlin, M., L., Paton, J., & Dubinsky, J. M. (2013). Neuroscientists' classroom visits positively impact student attitudes. *PLoS One*, *8*(2), 1–14. doi: 10.1371/journal.pone.0084035

Fullan, M. (2017, September). *Leading a coherent system of continuous improvement.* Presented at the InnovateEd. Districts on the move., Corona-Norco Unified School District, CA.

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. doi: 10.1016/j.appdev.2003.09.002

Graham, S., & Hudley, C. (2007). Race and ethnicity in the study of motivation and competence. In A. J. Elliot and C. S. Dweck (Eds.), *Handbook of competence and motivation.* (pp. 392–413). New York City, NY: The Guilford Press.

Gutman, L., & Midgley, C. (2000). The role of protective factors in supporting the academic achievement of poor African American students during the middle school transition. *Journal of Youth and Adolescence*, *29*, 223–248.

Kamins, M. L., & Dweck, C. S. (1999). Person versus process praise and criticism: Implications for contingent self-worth and coping. *Developmental Psychology*, *35*(3), 835–847.

Kenthirarajah, D., & Walton, G. M. (2015). *How brief social-psychological interventions can cause enduring effects: Emerging trends in the social and behavioral sciences: An interdisciplinary, searchable and linkable resource* [Wiley Library Online version]. doi: 10.1002/9781118900772

Lucariello, J. M., Nastasi, B. K., Anderman, E. M., Dwyer, C., Ormiston, H., & Skiba, R. (2016). Science supports education: The behavioral research base for psychology's top 20 principles for enhancing teaching and learning. *Mind, Brain, And Education*, *10*(1), 55–67.

McLeod, S. (2016). Bandura-Social Learning Theory. Retrieved from www.simplypsychology.org/bandura.html

Midgley, C., Kaplan, A., & Middleton, M. (2001). Performance-approach goals: Good for what, for whom, under what circumstances, and at what cost? *Journal of Educational Psychology*, *93*(1), 77–86. doi: 10.1037/0022-0663.93.1.77

Midgley, C., Maehr, M., Hruda, L., Anderman, L., Freeman, K., Gheen, M., . . . Urdan, T. (2000). *Manual for the patterns of adaptive learning scales.* Ann Arbor, MI: University of Michigan

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.

Mullis, I. V. S., Martin, M., Foy, P., & Hooper, M. (2016). *TIMSS 2015 International Results in Mathematics*. Retrieved from Retrieved from Boston College, TIMSS & PIRLS International Study Center website: http://timssandpirls.bc.edu/isc/publications.html

Northwest Evaluation Association. (2011). *Technical manual for Measures of Academic Progress (MAP) and Measures of Academic Progress for Primary Grades (MPG)*. Retrieved from the Northwest Evaluation Association website: www.nwea.org

Northwest Evaluation Association. (2015). *Linking the smarter balanced assessments to NWEA MAP assessments.* Retrieved from the Northwest Evaluation Association website: www.nwea.org/

Pajares, F. (1995). Self-efficacy in academic settings. (pp. 1–38). Papers presented at the annual meeting of the American Educational Research Association, San Francisco, CA.

Patrick, H., Anderman, L. H., Ryan, A. M., Edelin, K. C., & Midgley, C. (2001). Teachers' Communication of Goal Orientations in Four Fifth-Grade Classrooms. *Elementary School Journal*, *102*(1), 35–58.

Paunesku, D., Walton, G. M., Romero, C., Smith, E., Yeager, D. S., & Dweck, C. S. (2015). Mind-set interventions are a scalable treatment for academic underachievement. *Association for Psychological Science*, 1–10. doi: 10.1177/0956797615571017

Pintrich, P. R. (2000). Multiple goals, multiple pathways: The role of goal orientation in learning and achievement. *Journal of Educational Psychology*, *92*(3), 544–555. doi: 10.1037/0022-0663.92.3.544

Project for Education Research that Scales. (2017). Retrieved from https://www.perts.net

Redmond, B. (2016). Self-efficacy and social cognitive theories. In PSYCH 484 Wikispaces. Retrieved from https://wikispaces.psu.edu/display/PSYCH484/7

Schmidt, J., Shumow, L., & Kackar-Cam, H. (2015). Exploring teacher effects for mindset intervention outcomes in seventh-grade science classes. *Middle Grades Research Journal*, *10*(2), 17–32.

Schunk, D. H., & Pajares, F. (2007). Competence perceptions and academic functioning. In A. J. Elliot and C. S. Dweck (Eds.), *Handbook of competence and motivation.* (pp. 85–104). New York City, NY: The Guilford Press.

Sternberg, R., J. (2007). Intelligence, competence, and expertise. In A. J. Elliot and C. S. Dweck (Eds.), *Handbook of competence and motivation.* (pp. 122–140). New York City, NY: The Guilford Press.

Stevens, T., Hamman, D., & Olivarez, A. (2007). Hispanic students' perception of white teachers' mastery goal orientation influences sense of school belonging. *Journal of Latinos and Education*, *6*(1), 55–70.

Stipek, D., & Gralinski, J. H. (1996). Children's beliefs about intelligence and school performance. *Journal of Educational Psychology*, *88*(3), 397–407.

Stipek, D. J. (1986). Children's motivation to learn. In T. M. Tomlinson & H. J. Walberg (Eds.), *Academic work and educational excellence* (pp. 197–221). Berkeley, CA: McCutchan.

Sun, K., L. (2015). *There's no limit: Mathematics teaching for a growth mindset*. (Unpublished doctoral dissertation). Stanford University, Palo Alto, CA. Retrieved from http://purl.stanford.edu/xf479cc2194

Suzuki, L., & Aronson, J. (2005). The cultural malleability of intelligence and its impact on the racial/ethnic hierarchy. *Psychology, Public Policy, and Law*, *11*(2), 320–327. doi: 10.1037/1076-8971.11.2.320

The Nation's Report Card. (2015). Retrieved from https://nationsreportcard.gov/

Turner, J. C., Midgley, C., Meyer, D. K., Gheen, M., Anderman, E. M., Kang, Y., & Patrick, H. (2002). The classroom environment and students' reports of avoidance strategies in mathematics: A multimethod study. *Journal of Educational Psychology*, *94*(1), 88–106. doi:10.1037/0022-0663.94.1.88

Urdan, T., & Turner, J. C. (2007). Competence motivation in the classroom. In A. J. Elliot and C. S. Dweck (Eds.), *Handbook of competence and motivation.* (pp. 297–317). New York, NY: The Guilford Press.

Walton, G. M. (2014). The new science of wise psychological interventions. *Association for Psychological Science*, *23(1)*, 73–82. doi: 10.1177/0963721413512856

Weiner, B. (2007). Motivation from an attribution perspective and the social psychology of perceived competence. In A. J. Elliot and C. S. Dweck (Eds.), *Handbook of competence and motivation.* (pp. 73–84). New York City, NY: The Guilford Press.

Wigfield, A., & Wagner, A. L. (2007). Competence, motivation, and identity development during adolescence. In A. J. Elliot and C. S. Dweck (Eds.), *Handbook of competence and motivation.* (pp. 222–239). New York, NY: The Guilford Press.

Yeager, D. S., Paunesku, D., Walton, G. M., & Dweck, C. S. (2013, June 10). *How can we instill productive mindsets at scale? A review of evidence and an initial R & D agenda*. A White Paper prepared for the White House meeting on Excellence in Education: The Importance of Academic Mindsets, Washington, DC. Retrieved from https://labs.la.utexas.edu/adrg/files/2013/12/Yeager-et-al-RD-agenda-6-10-131.pdf

Yeager, D. S., Romero, C., Paunesku, D., Hulleman, C. S., Schneider, B., Flint, K., … O'Brien, J. (2016). Using design thinking to improve psychological interventions: The case of the growth mindset during the transition to high school. *Journal of Educational Psychology*, *108*(3), 374–391.

Yeager, D. S., & Walton, G. M. (2011). Social-psychological interventions in education: They're not magic. *Review of Educational Research*, *81*(2), 267–301. doi: 10.3102/0034654311405999

Yeager, D. S., Walton, G. M., & Cohen, G., L. (2013). Addressing achievement gaps with psychological interventions. *Phi Delta Kappan*, *94*(5), 62–65.

APPENDIX A

Growth Mindset Lesson on Brain Development

Objectives:

Students will understand that intelligence can be developed.

Students will understand that the brain is malleable.

Students will understand that doing challenging work is the best way to make your brain stronger and smarter.

Materials Needed:

Projector

Computer, internet connection with access to YouTube

Paper and pencils for students

Brainology Article

Watch Together and Discuss:

"Growing your mind" by Khan Academy (3:04)

https://www.youtube.com/watch?v=WtKJrB5rOKs

- How do people become more intelligent?
- How does the diagram of the neurons "At birth vs At age 6" demonstrate this?
- What does the second diagram of the nerves of animals living in a cage versus animals living with other animals and stimulating toys demonstrate?
- How are our brains like muscles?
- When do our brains grow the most?

"Neuroplasticity" by Sentis (2:03)

https://www.youtube.com/watch?v=ELpfYCZa87g

- What is neuroplasticity?
- How does neuroplasticity work?
- How can you "rewire" your brain?

Brainology Article:

Teacher read aloud while students follow along.

Class or Small Group Discussion:

Share a time when you overcame a struggle in learning or learned to solve a problem.

Teachers – when students share, reinforce examples that indicate hard work, strategies and getting help from others.

Independent work:
Write a letter to a future/new student to your class. (Tell students that their letter may be given to new students who arrive throughout the year who did not get hear the lesson today.) Students' letter or project should include three topics. They can use the following sentence starters.

Dear new student,

I'm writing to tell you about an important lesson you missed. We learned about how our brain develops. I learned…

We watched several videos about how our brain grows. My favorite example is…

An example of a time when I struggled to learn and then overcame it is…

Sincerely,

Homework Options:
Assign students to watch one of the following videos.

London Taxi Drivers – How learning the "knowledge" changes the brain (3:46)
https://www.youtube.com/watch?v=KI6r3HqCk1k

The Backwards Brain Bicycle – Smarter Every Day (6:47)
https://www.youtube.com/watch?v=gfCPa5hPpTg

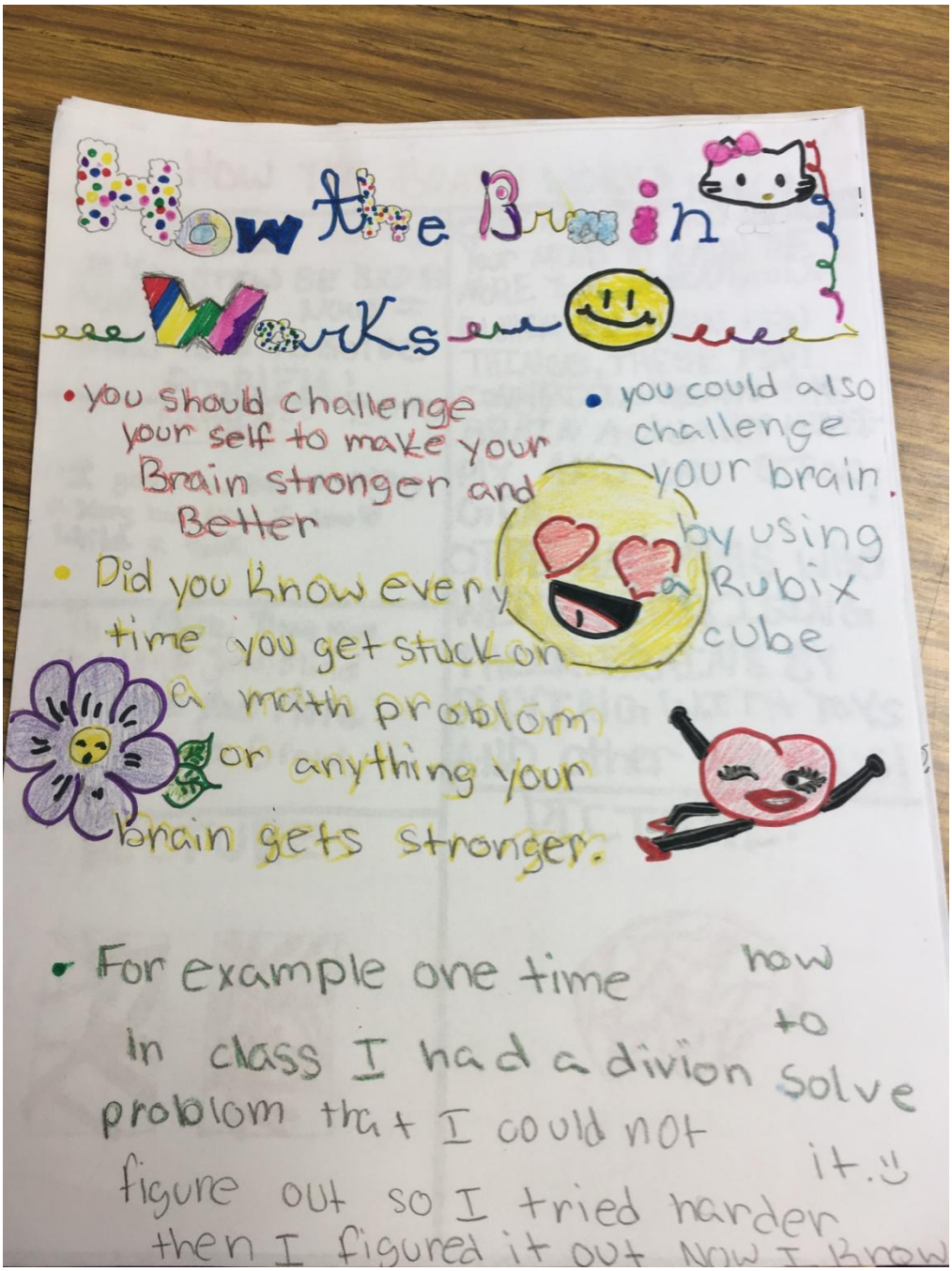
Tell students get a piece of paper and crumple it up. Straighten out the paper and have students trace the lines representing neurons and dendrites connecting and growing in their brain.

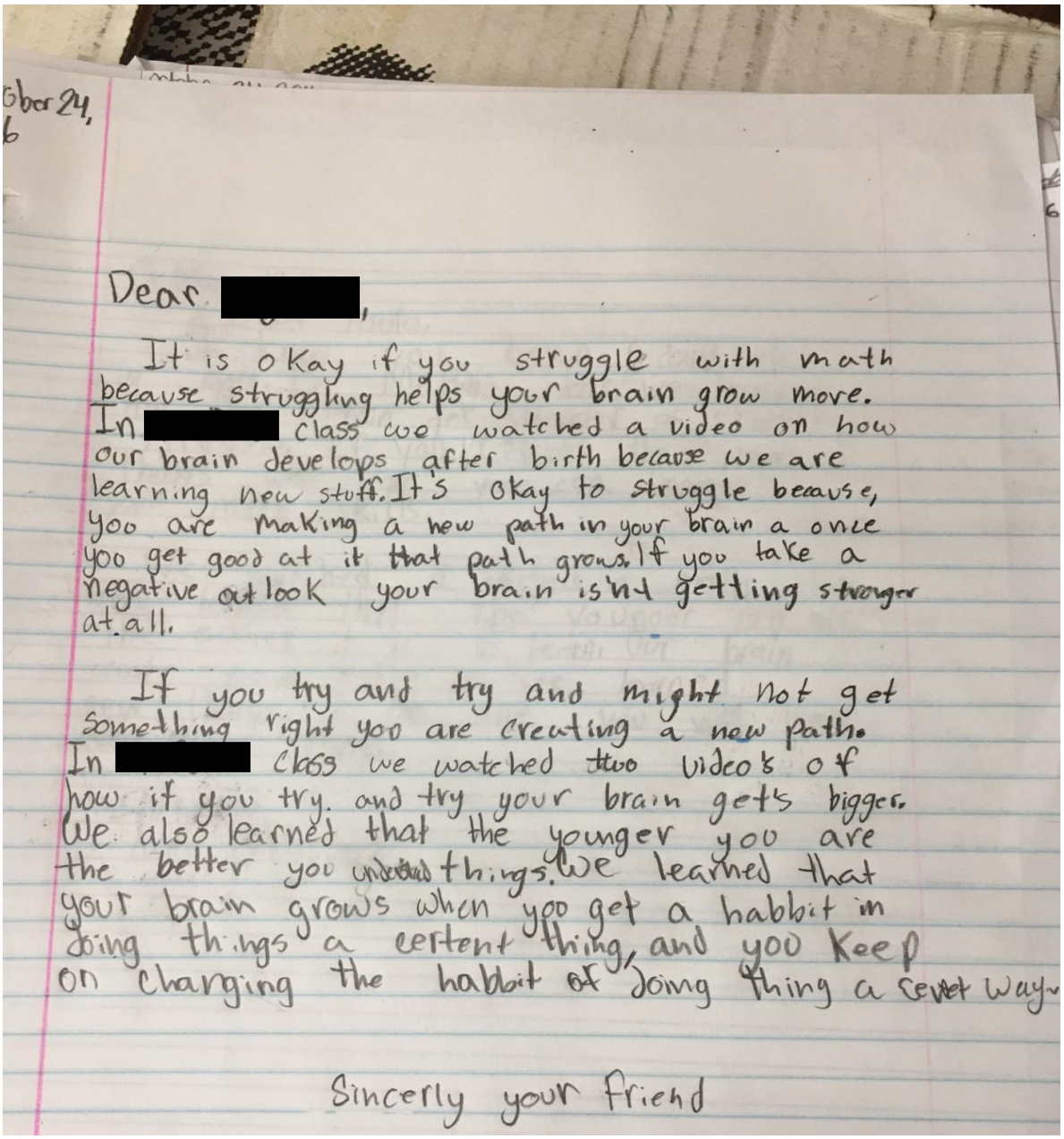
Follow Up/Closure - Day 2
Students share videos they watched.
Give students time to finish letter, project and drawing.
Collect (and share with permission) the letters. Post and/or share with a new student. Post student drawings or have them save in their notebooks to remind them of how their brain grows with challenging work.

Lesson resources from Project for Education Research that Shares – PERTS (www.perts.net)

APPENDIX B

Student Work Samples



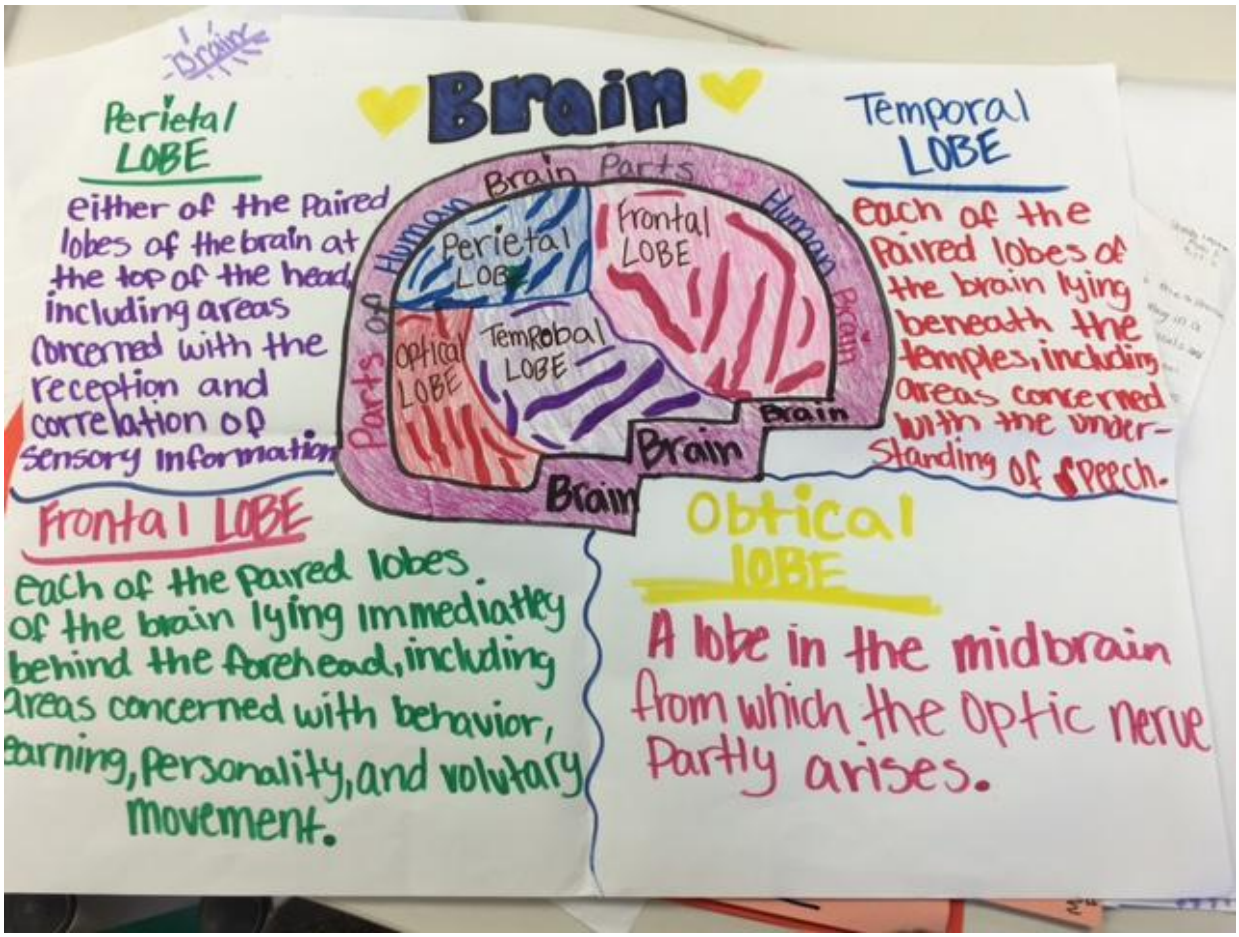


Dear [redacted],

It is okay if you struggle with math because struggling helps your brain grow more. In [redacted] class we watched a video on how our brain develops after birth because we are learning new stuff. It's okay to struggle because, you are making a new path in your brain a once you get good at it that path grows. If you take a negative outlook your brain isn't getting stronger at all.

If you try and try and might not get something right you are creating a new path. In [redacted] class we watched two video's of how if you try and try your brain get's bigger. We also learned that the younger you are the better you understand things. We learned that your brain grows when you get a habbit in doing things a certent thing, and you keep on charging the habbit of doing thing a sevet way.

Sincerly your friend


Brain
Parietal LOBE
either of the paired lobes of the brain at the top of the head, including areas concerned with the reception and correlation of sensory information
Brain Parts
Human Brain
Parts of
Parietal LOBE
Frontal LOBE
Optical LOBE
Temporal LOBE
Brain
Brain
Brain
Temporal LOBE
each of the paired lobes of the brain lying beneath the temples, including areas concerned with the under-standing of speech.
Frontal LOBE
each of the paired lobes of the brain lying immediatley behind the forehead, including areas concerned with behavior, learning, personality, and volutary movement.
Optical LOBE
A lobe in the midbrain from which the optic nerve partly arises.

APPENDIX C

Student Assent Form

Date _____

Dear sixth-grade student,

I am doing a study to learn about student motivation and engagement in learning math. I am asking for your help because I want to hear what you think about your math classroom. It is important for educators to ask students about their thoughts on learning so you can help us become better educators.

If you agree to be in this research study, you will complete a survey with fourteen questions. The survey will be take on your iPad and take about 15 minutes to complete. Your teacher will not be in the classroom when the survey is given, and your individual answers will not be shared with your teacher or principal.

You can ask questions about the student survey and research study at any time. If you decide at any time you do not want to finish the survey, you can stop.

The questions will be only about what you think and your opinions. There are no right or wrong answers because a survey is not a test.

If you sign this paper, it means that you have read this and that you want to be in the research study. If you do not want to be in the research study, do not sign this paper. Being in the study is up to you and no one will be upset if you do not sign the paper or if you change your mind later.

Thank you,

Sheryl Tecker
Director of Programs and Assessment
La Habra City School District

Your Signature: _____ Date _____

Your Printed Name: _____

APPENDIX D

Parental Informed Consent Form

Dear Parent(s),

I am conducting a research study on Growth Mindsets in all sixth-grade classrooms in La Habra City School District. The research study examines the impact of a lesson on brain development, and students' perception of classroom goals, on their academic achievement in math. The study will last through the Fall of 2017. This research study is for my dissertation and is part of the requirements for my doctoral degree at Concordia University, Irvine, CA.

I am writing to inform you of a student survey that will be administered during class time and to give you the opportunity to opt your child out of the survey and research study. Participation in this study involves having your child complete a 14 question survey on their I-Pad. The survey should take approximately 15 minutes to complete.

The Superintendent, Dr. Culverhouse, and Assistant Superintendent, Teresa Egan, have approved this research study for implementation in sixth-grade at both Middle Schools.

One significance of the research study is learning how the Growth Mindset research can be practically applied by classroom teachers. By participating, the students will be helping teachers learn how to improve student motivation and engagement in their learning.

Dr. Blanca Quiroz, University Dissertation Chairperson, Math Academic Coaches and I will be the only people with access to the achievement and survey data collected. Students' identification number, rather than their names, will be used to sort and analyze data.

Participating in the student survey is voluntary. You may contact me with any questions or concerns regarding your child's participation. My phone number is 562-690-2392, and my email is stecker@lahabraschools.org. You may also speak with your school community liaison, who has been informed of this research study and has a copy of the survey questions.

Sincerely,

Sheryl Tecker
Director of Programs and Assessment

Please return only if you do NOT want your child to participate in the research study.

☐ I do not give permission for my child's academic and survey data to be included in this research study.

Student
Name:_____

Signature of Parent/Guardian:

_____

Printed Name of Parent/Guardian:

_____

Date: _____

APPENDIX E

Focus Group Parental Consent Form

Dear Parent(s) of _____,
I am conducting a research study on Growth Mindsets in La Habra City School District. The research study examines the impact of students' beliefs about intelligence, and the impact of students' perception of classroom goals, on their academic achievement in math. The research study will last through the Fall of 2017. This research study is for my dissertation and is part of the requirements for my doctoral degree at Concordia University, Irvine, CA.

I am writing to inform you that based on the results of a student survey, your child has been selected to provide additional information in a focus group. A focus group is a small group of eight to twelve students who will be asked follow-up questions regarding their perceptions of their classroom goal structure. The focus group will occur during school hours and will take approximately one hour to complete. I will lead the focus group along with two Math Academic Coaches. Teachers will provide makeup work if needed and allow your child to turn in any missed work on the following day. During the focus group, I will be making an audiotape recording of students' responses for my research team to listen to and take notes from.

The Superintendent, Dr. Culverhouse, and Assistant Superintendent, Teresa Egan, have approved this research study for implementation at both Middle Schools.

One significance of the research study is learning how Growth Mindset research can be practically applied by classroom teachers. Listening to what works from students' perspectives will help educators learn how to improve student motivation and engagement in their learning.

Dr. Blanca Quiroz, my University Dissertation Chairperson, the Math Academic Coaches, and I will be the only people with access to the data collected during the focus group. Students' names will not be identified with their responses. All data and documentation will be destroyed by December 30, 2017.

Participation in the focus group and use of information from your child is voluntary. You may contact me with any questions or concerns regarding your child's participation. My phone number is 562-690-2392, and my email is stecker @lahabraschools.org. You may also speak with your school community liaison, who has been informed of this research study and has a copy of the questions.

☐ I give permission for my child to participate in the focus group. I understand that the focus group will be recorded and used by the research team.

☐ I do not give permission for my child to participate in the focus group.

Parent Signature: _____ Date _____

The extra copy of this consent form is for your records.

APPENDIX F

Teacher Consent Form

Practical Applications of Growth Mindsets in Sixth-Grade Math Classrooms

The study which you are being asked to participate is designed to investigate practical applications of growth mindset research in sixth-grade math classrooms. This study is being conducted by Sheryl Tecker under the supervision of Dr. Blanca Quiroz, Professor and Dissertation Chairperson, with Concordia University, Education Doctoral program. This study has been approved by the Institutional Review Board, Concordia University Irvine, in Irvine, CA.

The research study examines the impact of a classroom lesson on brain development, and students' perception of classroom goals, on their academic achievement in math. The research study also analyzes students' and teachers' opinions regarding what works in creating a classroom environment that supports growth mindsets.

Your participation is voluntary and refusal to participate will involve no penalty. You may discontinue participation at any time. You may select your level of participation, and any level of participation is appreciated.

Should you elect to participate in the teacher survey, your responses will be kept confidential. The survey responses will be collected via a Google Form and aggregated with other responses from other participants. Identifying information, such as your name, school name or math class will not be revealed, and all responses will be kept in private rather than shared computer files.

Participation in this research will conclude by December of 2017. There are no foreseeable risks to your participation in this research. Instead, you may benefit from learning more about Growth Mindset research and strategies for your classroom instruction.

Student work may be photographed and used as evidence of student learning and understanding how their brain works. If a student or teacher name is visible on the student work, it will be cropped out of the photograph. Based on responses from the Student Survey, 8-12 students will be asked to participate in a focus group. Students will be asked questions about classroom goals, mistakes, praise, feedback and preferred math tasks. Student responses will be recorded, and they will be told to not refer to specific teacher names in their responses. It is possible that students will forget this rule and mention a teacher name. The audio recording will only be listened to by the researcher, two math academic coaches, and the dissertation chairperson. The audio recording will be destroyed upon publication of the dissertation.

If you have any questions regarding the research, please contact Sheryl Tecker, Director of Programs and Assessment at 562 690-2392/stecker@lahabraschools.org. Research results will

be published and shared with all participants after the study is complete. Copies of the dissertation can be obtained from the La Habra City School District, Office of Programs and Assessment.

I have read the information above and agree to participate in your study. My level of participation is:

___Student Survey

___ Professional Development Series and Teacher Survey

___ Decline to participate

Signature _____ Date _____

Printed Name _____

The extra copy of this consent form is for your record.

APPENDIX G

IRB Consent

[Ticket #3249] EDD IRB Application - Expedited Review - Tecker (Quiroz) Inbox x

Office of Institutional Research <oir@cui.edu>
to me

Concordia University Irvine - Office of Institutional Research

Hello sheryl.tecker@eagles.cui.edu,

This message is from the Concordia University Irvine Office of Institutional Research.

TICKET ID:**#3249**

Date: **Feb 01, 2017 @ 03:14 pm**
Creator: stecker@lahabraschools.org
Summary: **EDD IRB Application - Expedited Review - Tecker (Quiroz)**

If you have any additional information regarding this case respond to this email. Please remember to keep "**[Ticket #3249]**" in email topic.

On Feb 28, 2017 @ 07:34 am Melanie Hamon wrote:

Approved

CONCORDIA UNIVERSITY IRVINE INSTITUTIONAL REVIEW BOARD PROTOCOL REVIEW

IRB Protocol Number: #3249

IRB Approval Date: 2/27/17

Dr. Quiroz,
Congratulations! Your students' research proposal has been approved by Concordia University-Irvine's IRB. Work on the dissertation research indicated within the initial e-mail may begin. This approval is for a period of one year from the date of this e-mail correspondence and will require continuation approval if the research project extends beyond a year.

If you make significant changes to the protocol during the approval period, you must submit a revised proposal to CUI's Institutional Review Board (IRB). Please write your IRB # and "EDD IRB Application Addendum # (and the IRB Protocol number)" in the subject line of any future correspondence.

The researcher indicated data will be destroyed at the conclusion of the study. It is recommended that the researcher keep all data secure for up to three years after the conclusion of the study. This will provide you with future reference for purposes of further publication or questions that may arise. The data must be destroyed after three years from the conclusion of the study.

If you have any questions regarding the IRB's decision, please contact me by replying to this e-mail or by phone at 949-214-3354.

Kind Regards,

Kellie Albrecht, Ph.D.
EDD IRB Reviewer