STRENGTHENING POST-SECONDARY READINESS BY CULTIVATING

GROWTH MINDSETS

A Doctoral Thesis Presented to the
Faculty of the College of Education
University of Houston

In Partial Fulfillment
of the Requirements for the Degree

Doctor of Education

by

Elliott Jordan Witney

December 2016

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Go Cubs!

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Abstract

Educators and educational systems repeatedly debate and design policy, build

strategic plans for schools and school systems, and write daily classroom lesson plans to

address widening gaps in academic performance and postsecondary success across lines

of advantage. The implications of these widening gaps are extraordinary. Many efforts

show promise and are worth further exploration. These reform efforts are not enough.

Other factors – often psychological in nature – affect children during key life transitions

such as middle to high school and must be considered as part of a holistic reform

strategy. Research conducted in fields like experimental social psychology identifies

complementary approaches that have dramatic and often surprisingly lasting effects for

some children. One example is growth mindset – the belief that talent is not innate but

can be developed. During student transitions from 8th to 9th grade, can short, cost-

effective mindset interventions improve academic performance as well as improve

resilience when work becomes more difficult? This is an archival study (AS) conducted

on one of the high schools in a national study (NS) piloting a brief mindset intervention.

This AS sought to understand the effects on 508 9th graders (268 males, 240 females) at

one of the pilot schools – a demographically diverse, suburban high school. The results

of the study include: increased growth mindsets in students generally, including an 8%

improvement for the treatment group and a 7% improvement for students who qualified

for free or reduced-price meals (FARM) regardless of whether or not they received the

treatment; academic improvement for students who do not qualify for FARM; and,

academic improvement for students who held a C- or higher GPA in 8th grade.

Keywords: growth mindset, academic performance, social psychology, challenge-seeking, education reform, transition

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Chapter I

Introduction

Academic readiness and postsecondary achievement gaps in public education exist and continue to widen across lines of advantage. These gaps exist between students from high-income and low-income families on standardized test scores, grades, high school completion rates, and postsecondary enrollment and completion rates (Bailey & Dynarski, 2011; Cahalan & Perna, 2015; Mortenson, 2010; Reardon, 2011, 2013; Reardon, Kalogrides, & Shores, 2016). Unaddressed, children living in poverty are likelier to graduate high school with less freedom, prepared with fewer life options. Educational reform efforts focused on increased academic readiness and closing long-term postsecondary completion gaps have been tried, with varying degrees of effectiveness in large and small contexts across the nation – in classrooms, schools, school districts, states and even at the federal level. Although many efforts have failed, others show promise at beginning to close these gaps for some students under some conditions. These efforts may provide insight into comprehensive educational reform efforts would address educational challenges holistically, considering the entire learning ecosystem of children as they progress through schooling. Focusing solely on academics, for example, does not appear to be enough.

There are other factors that exist in learning and schooling environments – often psychological in nature – that prevent children from reaching their potential which should be considered as part of comprehensive reform; single strategic solutions such as raising academic expectations or requiring mandatory annual high stakes testing do not appear to be enough. Social psychologists dating back to Lewin (1952) have found that an array of

psychological forces affect students and influencing performance, motivation, and even a child's willingness to persist when work increases in difficulty. These forces seem particularly potent at key life transitions such as the transition from middle to high school, when increased academic expectations compound for the challenges facing vulnerable early adolescents. Although these social and psychological forces (e.g. motivation, confidence following failure) have been shown to affect students living in poverty the most (Eccles, 2012), comprehensive strategic reform should consider the impact of social and psychological forces, as well as the effects of various interventions being tested, more broadly and begin to target interventions where they show the most promise and utility. The effects may be most complex in diverse high schools in communities such as suburban communities, or suburbs, whose demographics have changed and diversified economically over the last fifteen years. In many major cities across the United States, families living in poverty have simply fled from urban city centers for largely economic reasons (Kneebone & Berube, 2013; Juday, 2015).

Numerous randomized control trials in the field are beginning to show positive and surprisingly lasting effects by addressing some of these psychological forces – including stereotype threat (Aronson, Fried, & Good, 2002; Good, Aronson, & Inzlicht, 2003; Cohen, Garcia, Apfel, & Master, 2006), motivation (Hulleman & Harackiewicz, 2009), academic stress (Ramirez & Beilock, 2011; Yeager, Lee, & Jamieson, 2016), trust (Yeager, Purdie-Vaughns, Garcia, Apfel, Brzustoski, Master, Hessert, Williams, & Cohen, 2013), social belonging (Walton & Cohen, 2011), and academic self-regulation (Yeager, Henderson, Paunesku, Walton, Spitzer, D'Mello, & Duckworth, 2014). The interventions used in these experiments – though not magic (Yeager & Walton, 2011) –

show enough promise for some children at certain moments in their lives that they should be considered as part of larger and more comprehensive efforts because they can be brief and non-intrusive to a school experience, affordable, and easily scalable.

Perhaps the most tested of these interventions showing promise, as part of a more comprehensive reform effort to close achievement gaps, is one focusing on fostering growth mindsets in students. Mindset interventions have shown to have numerous positive effects on beliefs about effort and behaviors that lead to increased academic achievement – perhaps most in students living in poverty (Claro, Paunesku, & Dweck, 2016) and those who previously performed poorly in school (Yeager, Romero, Paunesku, Hulleman, Schneider, Hinojosa, Lee, O'Brien, Flint, Roberts, Trott, Greene, Walton, & Dweck, 2016). Students with the belief that talent and intelligence are malleable and can be developed – who have what is known as a growth mindset – are far more likely to persist when facing challenges than those who believe talent and intelligence are immutable, or who have a fixed mindset. This is particularly important during life transitions, as students with growth mindsets tend to embrace challenges – explaining them as opportunities to learn. In contrast, those with fixed mindsets tend to avoid difficulty because challenges are perceived as proving something innate about their intelligence. They are likelier to avoid, give up, or quit. As a result, students with growth mindsets tend to do better academically and demonstrate resilience in a number of challenging academic situations and at increasing a student's resilience and willingness to take on new challenges instead of giving up (Aronson et al., 2002; Blackwell, Trzesniewski, & Dweck, 2007, Study 1; see Burnette, O'Boyle, VanEpps, Pollack, & Finkel, 2013; Good et al., 2003; Romero, Master, Paunesku, Dweck, & Gross, 2014;

Stipek & Gralinski, 1996; Yeager & Dweck, 2012). Recent research conducted in national samplings of students in the United States and Chile suggest that these interventions may even improve performance (Yeager et al., 2016) and lessen the effects of poverty on achievement (Claro et al., 2016) at scale.

This study seeks to expand on what is known already about the effects of growth mindset interventions on academic performance and on a student's willingness to embrace challenges during the key life transition from middle to high school. Although an increasingly strong research base indicates that social-psychological interventions have an effect on reducing critical psychological forces affecting students during these transitions, there is more to be learned.

Rather than waiting until students graduate high school and enroll in higher education, the purpose of this study is to determine the effects of mindset interventions on academic performance and a child's willingness to seek out challenges during the transition into 9th grade a single economically diverse high school. Knowing this could help schools and school systems prioritize when, how, for whom, and under what conditions to scale the intervention. Having greater clarity of its effects in diverse, suburban high schools whose demographics are shifting may also begin to open doors for additional research.

In addition, an increasing body of research indicates that teachers and other adults in a school play a critical role in developing and nurturing growth mindsets. It appears that although direct messages sent by adults ("I like how much effort you used") can have effects on mindsets, it is often the indirect messages adults send – especially messages that are influenced by adults' own mindsets after encountering failure – that cultivate

growth or fixed mindsets in students (Heider, 1958; Rosenthal & Jacobson, 1968; Jones & Nisbett, 1971; Weiner, 1986; Dweck, 2006; Haimovitz & Dweck, 2016).

Pairing academic reform efforts with the most promising types of psychological interventions, therefore, still is likely not enough to overcome achievement gaps for students living in poverty. A plan must also be put into place in schools and school systems that pair these student-focused interventions with a strategy for adults that develops their ability to send direct and indirect messages that cultivate growth mindsets. This chapter explores the context for why addressing mindsets as part of comprehensive improvement efforts offers a glimpse into one approach that could be a cost-effective and scalable piece of the larger reform puzzle.

Shifting Poverty and the Effects

While achievement gaps exist and continue to widen, cities across America finds rising levels of poverty shifting beyond their urban cores, as economically disadvantaged families are displaced from urban to suburban locations (Kneebone & Berube, 2013). A combination of city revitalization efforts that change urban neighborhoods rapidly while attracting more educated and higher-income residents as well as new waves of development in suburbs is forcing poor families outside into inner-ring (those closest to downtowns) and outer-ring (those further out, requiring a longer commute) suburbs (Juday, 2015). In Houston, TX, for example, the percent of families living in poverty grew in Houston's suburbs by 102.9% from 2000 to 2011 – with a higher percentage of families living in poverty in suburbs than the city (Kneebone & Berube, 2013). This movement has diversified schools and school districts, with achievement gaps becoming more obvious as a result. Cities like Houston see suburban communities facing newer

short- and long-term challenges associated with these gaps across lines of advantage.

Postsecondary Gaps and Economic Implications

Nationally, postsecondary success rates continue divide across lines of advantage, with lasting economic implications. Nationally, children living in the highest-income families are more than eight times likelier to obtain a bachelor's degree by the age of 24 than low-income families – 77% vs. 9%. This gap is wider than it was in 1970, when highest-income families were six times more likely (Cahalan & Perna, 2015).

Much like the economic disparity in postsecondary success, in demographically diverse states such as Texas these gaps are prevalent across ethnic subpopulations, too. In a study of 324,316 Texas students tracked from 8th grade through postsecondary, 27% of White students earned a postsecondary credential within six years of graduating high school while only 11.4% of Black students and 11.6% of Hispanic students earned a similar credential (National Center for Higher Education Management Systems, 2012).

The economic implications of these disparities are huge. In that same Texas study referenced above, 258,296 of those students never earned a postsecondary credential at all. The difference in lifetime earnings those who earn a high school diploma and an Associate's Degree is approximately $423,000, and the difference between a high school diploma and a Bachelor's Degree is approximately $964,000 (Carnevale, Rose, & Cheah, 2011). Assuming each of the 258,296 students earned a high school diploma – which did not happen – and each of those students instead earned an Associates degree, that represents nearly $109 trillion in additional lifetime earnings for Texas children. If each of those children instead earned a Bachelor's, the economic implications total $249 trillion in lifetime earnings.

Intensity of Academics and Structural Reform

In order to increase opportunity and open doors for children living in poverty and for Black and Hispanic/Latino minority children, more students from these backgrounds must graduate high school ready to succeed in their postsecondary context. A child's readiness for postsecondary success is a critical element in whether or not that child achieves postsecondary success. Conley (2010) defines readiness as "the level of preparation a student needs in order to enroll and succeed— without remediation—in a credit-bearing general education course at a postsecondary institution that offers a baccalaureate degree or transfer to a baccalaureate program." Yet in 2014, the readiness levels of minority students lagged beyond other students significantly. While 42.6% of students overall scored at the College and Career Readiness benchmark score on the SAT, only 15.8% of African American and 23.4% of Hispanic children scored at that level (The College Board, 2014).

To address academic readiness, schools and school districts must elevate the rigor and academic intensity of the high school experience of its students. According to Adelman in *The Toolbox Revisited* (2006), "The academic intensity of the student's high school curriculum still counts more than anything else in pre-collegiate history in providing momentum toward completing a bachelor's degree." (p. xviii) Creating an equitable level of rigor and high expectations for every child is a necessary step. Numerous attempts have been made structurally to take this step.

Educational Reform Efforts

Structural Reform. Major attempts at structural reform and professional development (Gamoran, 2001), as well as policy changes, have been tried in an effort to

establish an equitable level of expectations for every child in every school. National Common Core standards and Texas's efforts to draft the Texas College and Career Readiness Standards (Texas Education Agency, 2009) are two such examples. Assessments like the State of Texas Assessments of Academic Readiness (Texas Education Agency, 2011) that align to more rigorous standards are also being used to increase expectations for all children. Policy efforts are being made, too, such as Texas House Bill 5 (HB5). The intent of HB5 was to increase student choice and student engagement while decreasing unnecessary state testing. More recently, Texas House Bill 1842 (HB1842) Districts of Innovation was passed in order to empower schools or school districts with greater local control over policy-making – potentially freeing schools or school districts from rules or laws that prohibit reform. Both HB5 and HB1842 show promise at improving outcomes for students, but these reforms also require complex systems leadership for students to reap the full benefits.

Proof Points. Many of these efforts show evidence of success; classrooms, schools, and even school systems have proven that some performance gaps can be narrowed. It is clear that teachers have the ability to dramatically affect student learning in a single year. There are celebrity/hero stories like that of Jaime Escalante, a Math teacher in East Los Angeles made famous in a film called *Stand and Deliver* (Labunka et al., 1988). His students from predominantly low-SES, Latino communities routinely passed the Advanced Placement (AP) Calculus exam at disproportionately high rates as compared to their peers with similar backgrounds (Mathews, 1988, 2010). More comprehensively, TNTP found dramatic results at a larger scale in their study of the value-added learning outcomes for 20,000 teachers across four large, geographically

diverse urban school districts. TNTP found that approximately 20% of these teachers helped their students learn two to three months more in Math and Reading, and five to six months more compared to low-performing teachers (TNTP, 2012).

Beyond teachers, school systems such as charter school management organizations (CMOs) like KIPP have shown to have "positive, statistically significant, and educationally meaningful impacts" on student performance in elementary and middle schools, and high schools for students who enroll in KIPP for the first time in high school (Tuttle et al., 2015). Systems of schools like those found in New Orleans, Lawrence, MA, and the Houston Independent School District have also created holistic reforms intended to raise achievement and close performance gaps; each shows promise, but each is limited in its generalizability (New Schools for New Orleans, 2015; Empower Schools, 2014; Fryer, 2014). States like Tennessee have even legislated reform efforts at the state level intended to address these gaps, with some limited – and early – positive evidence (Chalkbeat Tennessee, 2015).

These examples of classroom, school, CMO/district, and state efforts offer hope that performance across lines of advantage can be overcome in isolated situations under some conditions. Scaling what is working across a larger number of classrooms, schools, and systems deserves further attention. Relying solely on these approaches is not enough, though. Given the nature of the barriers to each of these approaches, they are difficult to scale more expansively. Sometimes the barriers are political or policy-related; other times the barriers derive from the reality that each of these solutions requires resources (people, time, and money) that may already be limited.

Psychological Implications on Reform

Simply scaling these efforts will not be enough, though. There are students missing out on the effects of elevated standards, due in large part to a number of psychological factors shown to affect student performance and the type of effort-seeking behavior needed for students to persist when work becomes difficult and succeed long-term. These factors are also particularly impactful during key life transitions such as middle to high school and high school to higher education. Simply put, if a child does not have the motivation to engage with difficult material, the level of rigor in coursework is irrelevant.

Social psychologists dating back to Lewin (1952) emphasize the importance that motivation plays in overall achievement. Elevated expectations can motivate some; for others, though, higher expectations become a psychological force or barrier to motivation. As expectations in classrooms increase, the need to address these phenomena increases because many students demonstrate what is called the fundamental attribution error. Those students perceive that encountering difficulty says more about them as people – an error in attribution – than the situation in which they find themselves (Cohen & Garcia, 2014).

Social-psychological interventions in randomized field experiments have been tested extensively to determine which may improve overall outcomes for students by addressing the entire social system, including numerous factors affecting overall performance (Ross & Nisbett, 1991) and by reducing some of the restraining forces that hold student back (Garcia & Cohen, 2012; Yeager & Walton, 2011). An increasingly large number of experiments and studies conducted as early as the 1970s show that

psychological interventions can be used to produce meaningful, lasting effects on student achievement by addressing the forces or barriers that inhibit motivation and ultimately performance (J. Aronson et al., 2002; Cohen & Sherman, 2014; Good et al., 2003; Hulleman & Harackiewicz, 2009; Ramirez & Beilock, 2011; Walton & Cohen, 2011). More recently, a large number of randomized control trials conducted in the field are showing that numerous psychological forces can be effected, such as stereotype threat (Aronson et al., 2002; Good et al., 2003; Cohen et al., 2006), relevance and motivation (Hulleman & Harackiewicz, 2009), academic stress (Ramirez & Beilock, 2011), social belonging (Walton & Cohen, 2011), and academic self-regulation (Yeager et al., 2014).

These interventions typically address subjective student self-perceptions through targeted interventions rooted in social psychology. These may provide some of the most powerful and cost-effective strategies to reduce barriers and address overall inequality (Garcia & Cohen, 2012; Walton, 2014; Wilson, 2011; Yeager & Walton, 2011). These in turn could produce positive effects on postsecondary readiness and subsequently increase postsecondary completion rates.

Growth and Fixed Mindsets. Two implicit theories of intelligence that people believe influence a number of psychological and performance-oriented factors including: overall student effort when the work becomes difficult; beliefs about the role that effort, asking for help, and trying new strategies play in becoming "smart"; and, ultimately student performance overall (Yeager & Walton, 2011).

The first is the belief that talent and intelligence are fixed traits (entity theory) – that we are born with a fixed amount of both that does not change (Dweck, 2006). This fixed mindset leads to students who tend to avoid hard work and give less effort when the

difficulty of work increases; demonstrate unproductive and negative effort beliefs like "To tell the truth, when I work hard at my schoolwork, it makes me feel like I'm not very smart"; demonstrate less resilience, defined as "whether students respond positively to challenges" (Blackwell et al., 2007; Yeager & Dweck, 2012); and, generally underperform academically – a phenomenon that seems to affect students at the lowest levels of income the greatest (Claro et al., 2016).

Students who believe that intelligence and talent are malleable and can be learned (incremental theory) develop what is referred to as a growth mindset. These students react to difficulty much differently than those with a fixed mindset. They believe that they can grow their brains and talent – that those traits can be developed through effort, asking for help, and trying new strategies (Dweck, 2015). When students with growth mindsets encounter higher standards, they typically stick with challenges more consistently and with greater motivation. According to Dweck (2006), "People in a growth mindset don't just *seek* challenge, they thrive on it. The bigger the challenge, the more they stretch" (p. 21). Students with growth mindsets tend to seek more difficult tasks and demonstrate greater resilience when facing obstacles of failure. Developing a growth mindset seems most important during life transitions, when students are the most vulnerable (Eccles, 2012).

Psychology of Life Transitions. Social-psychologists have found that a number of psychological factors hold particular significance during key life transitions – middle to high school, high school to college, and college to life. The middle to high school transition has shown to be especially challenging and often leads to children dropping out of school (Eccles, 2012). Having a growth mindset during these times seems to have a

positive effect on performance during the high school to college transition of students who have typically under-performed (Yeager et al., 2013) and also during the middle to high school transition (Blackwell et al., 2007), but there is more to learn.

Purpose of the Study

This study seeks to expand on what is already known about growth mindset interventions and their effects on academic performance and challenge-seeking behavior during the transition from middle school to high school by looking closely at its effects in a single, economically diverse high school. While this study does not consider other school-based conditions that affect performance such as climate (Shouse, 1996; Phillips, 1997; Lee & Smith, 1996), the findings could help educational reform strategies consider for whom a mindset intervention may have the greatest effects. Specifically, this study builds on early evidence that a growth mindset may temper the effects of poverty on academic achievement (Claro et al., 2016) by understanding the specific effects of the mindset intervention on children who qualify for free and reduced-priced meals (FARM). In addition, this study seeks to expand on what is already known about the effects of a single mindset intervention on previously low-performing students. A growing amount of research seems to indicate that the effects on academic performance are strongest for previously low-performing students, and this study adds to that research (Cohen, Garcia, Purdie-Vaughns, Apfel, & Brzustoski, 2009; Hulleman & Harackiewicz, 2009; Wilson & Linville, 1982; Yeager, Henderson, et al., 2014). If a mindset intervention can have positive effects on these groups, a higher number of these children should successfully complete high school and have better long-term life prospects.

Research questions. This study addresses three key questions that will enhance

the existing literature about mindsets.

1. How does a single mindset intervention increase growth mindset, improve academic performance, and impact a child's willingness to seek out challenges?

2. Does a child's level of poverty moderate the effects of this mindset intervention?

3. If students were previously low-performers in 8th grade, what is the effect of the intervention on their growth mindset, academic performance, and willingness to seek out challenges – depending on whether or not they got the treatment?

If a mindset intervention has positive effects on performance and influences a child's willingness to seek out challenging material instead of giving up or quitting, it follows that a higher percentage would demonstrate the resilience required to succeed under more intense high school academic experiences.

Chapter II

Review of the Literature

Educational achievement and opportunity gaps continue to widen (Reardon, 2011; Reardon et al., 2016) in diverse urban and suburban communities (Kneebone & Berube, 2013) throughout the United States – with lasting effects on academic readiness, postsecondary completion rates, and ultimately long-term human potential; these effects are experienced disproportionately by specific groups of students. Attempts at structural reform show promise in classrooms, schools, districts, and even states at addressing some of the challenges these groups experience. Too often, though, the effects are isolated, limited, or cost-prohibitive.

These structural changes often entail elevated student expectations such as more rigorous academic expectations. A growing body of research building since the mid-20th century suggests that structural changes like these alone address a large but limited piece of a more holistic reform strategy. This research shows that other factors, often psychological in nature, inhibit children's ability to reach their potential. A growing body of research suggests that short, cost-effective psychological interventions during key life transitions may enhance and supplement any existing efforts to improve academic performance through increased rigor. Interventions that address student mindsets about the nature of intelligence, in particular, offer unique promise as a complement to this work. Mindsets in particular seem to be a key psychological reason that some children demonstrate resilience and persist while others give up when work increases in difficulty.

This literature review is designed to accomplish three goals. First, it will present the relevant context both about the demographics of achievement inequality in urban and suburban communities as well as what is known about the key factors affecting postsecondary completion rates. Second, this review provides the most relevant historical context for contemporary mindset interventions to clarify the rationale, scope, and potential benefit of this study as part of a larger educational reform effort. Third, this review will explain the foundation of evidence helping to shape an action plan that is intended to operationalize key lessons learned from the study.

For the purposes of this review, strong evidence is based either on objective data such as that from the Census Bureau or research that meets the following criteria: conducted by a credible author; includes a large, diverse sample or includes multiple studies that together are large and diverse; includes effects that are generalizable; includes a methodology that is appropriate to the research problem; and, is aligned to the sample in this study.

Moderate strength falls short on the same criteria in at least one area. In some cases, the sample sizes are not diverse enough or are too small to generalize the findings. In other cases, the research is strong but lacks alignment to this study – perhaps a study was conducted with elementary school or college students instead of high school students. In each case, it will be made clear which aspect weakens the evidence.

Weak research falls short on several of these criteria. These studies are not always intended to imply that the research should be disregarded. As a matter of fact, some examples of weak research in this study reflected weak research at the time that has been strengthened significantly over time through further study. In each case, it is clear

where this research fits into the overall body of evidence known or unknown about this study.

Widening achievement gaps

Educational achievement and opportunity gaps continue to widen (Reardon, 2013) in diverse urban and suburban communities (Kneebone & Berube, 2013) throughout the United States – with lasting effects on academic readiness, postsecondary completion rates, and ultimately long-term human potential in a dynamic and global economy; these effects are experienced disproportionately by specific groups of students.

Socioeconomic status. Academic inequality has existed across economic lines for decades. Reardon (2011) offers strong evidence of this in his extensive analysis of the last fifty years of data focused on gaps such as these, specifically evaluating gaps in academic performance among children from varying income levels. Beginning with the Coleman Study (Coleman et al., 1966), a seminal study describing the relationship between family socioeconomic status and student achievement, Reardon analyzed the evidence of achievement gaps since then. After evaluating math and reading skills of children using twelve nationally representative studies, he notes strong evidence of widening achievement gaps as early as the mid-1940s, with particularly strong evidence since the 1970s. More recently, a strong analysis of 200 million standardized math and reading tests given to 3rd through 8th graders between 2009 and 2012 shows wide performance gaps across economic lines found that 6th graders in the wealthiest school districts, for example, are performing several grade levels higher than those living in the poorest school districts (Reardon et al., 2016).

Race and ethnicity. Similarly, Reardon, Kalogrides, and Shores (2016)

discovered moderate to strong evidence across these standardized tests of academic

performance gaps between White and Black or Hispanic students. The only criticism of

this research given how extensive it has been is that it exists only through 8th grade, and

this study considers high school. These gaps have existed for decades, according to

strong research, and exist in vocabulary, reading, math, and intelligence tests (Nisbett,

2009; Phillips, Brooks-Gunn, Duncan, Klebanov, & Crane, 1998; Reardon, 2011).

Postsecondary completion rates. In addition to academic performance during

the PreK12 experience, similar gaps exist and are widening across lines of advantage

related to postsecondary completion, leading to long-term and enduring implications for

the nation. There is strong evidence to suggest widening gaps in bachelor's degree

completion rates of students from the highest and lowest quartiles of family income.

Mortenson (2010) compared income levels to education attainment from 1970-2009

using data from the Census Bureau and the Current Population Survey. In this study

representing forty years of data, the gap increased from 34% (6.2% for lowest quartile,

40.2% for highest quartile) in 1970 to 74.1% (8.3% for lowest quartile, 82.4% for highest

quartile) in 2009. The gap in Bachelor's degree attainment by age 24 has widened since

1970, as well. In 2013, children from highest-quartile family income were eight times

more likely to earn a Bachelor's degree (77% vs. 9%), compared to six times more likely

in 1970 (40% vs. 6%) (Calahan & Perna, 2015).

Research conducted by Bailey and Dynarski (2011) supports and enhances these

findings. This study analyzed educational attainment between 1940 and 2007, looking

specifically at college entry, persistence, and graduation. Analyzing data from the

census, the American Community Study (ACS), and the National Longitudinal Surveys

of Youth (1979 and 1997) to focus on educational attainment. Not only were children

living in families with higher income levels likelier to graduate from college; the college

entry and completion rates grew most for children living in families with the highest

income levels and grew the least for those children living in families with the lowest

income levels. Although this study offered some explanation about possible causation,

there is nothing in the methodology to suggest that these explanations offer strong

evidence.

In addition to the gaps that exist in postsecondary success across economic lines,

there is strong evidence in states like Texas that gaps across racial lines exist, too. The

National Center for Higher Education Management Systems (2012) evaluated higher

education credential (certificate, associate's degree, or bachelor's degree) completion

rates of the three cohorts of public school students in Texas who started 8th grade in a

Texas public school in 1996, 1997, or 1998 (n = 883,260). Approximately 20% earned a

postsecondary credential overall, but 27.6% of White students earned a higher education

credential while only 11.4% of Black and 11.6% of Hispanic students did.

The changing dynamics in suburbs. These performance-based dynamics are

most obvious in communities that include diverse populations (Reardon et al., 2016).

One such example that is increasingly diverse is the American suburban area, or suburb.

It is difficult to create an operational definition of a suburb due to a number of factors

(Baldassare, 1986). Baldassare defined suburb ambiguously as "the buffer between our

central-cities and rural areas" (1986). Kneebone and Berube (2013) define a suburb

using a compromise between the U.S. Census definition, which are areas outside of

census-identified "principal cities," and what some researchers use, which is anything outside the first-named city in a metropolitan area.

A weak but compelling amount of evidence exists that suburbs originated in post-Roman Western Europe, with speculation that urban taxation drove poorer residents outside city centers to previously rural areas (Harris & Larkham, 1999). Although suburbs seem to have existed since then, the most relevant aspects of the contemporary suburban experience trace their origins back to post-World War II. Strong research points to a number of economic, political, and social push and pull forces at play in America after the war that led to increased suburbanization (Kneebone & Berube, 2013; Kruse & Sugrue, 2006). These authors note that economic incentives were offered to build homes and communities outside the urban core of a city. Rothstein (2014) traces the history of suburbanization and provides strong evidence that these post-World War II economic subsidies were given to white families and not black families; as populations grew in suburbs, the growth was with white families.

In a comparison of total population in the city versus the population in the suburban ring, Farley (1976) showed that populations increased overall from 1950 to 1960 in cities (+1%) but significantly in the ring during the same period (+71%). Cities like Cleveland (-4%), Saint Louis (-12%), and Minneapolis (-4%) lost population in their cities while populations in their rings grew in the same cities (+94%, +69%, and +105%). In cities like Houston that grew in the city during that same period (+54%), the ring nearly doubled (+93%).

Strong evidence exists that city and suburban populations are changing. Juday (2015) uses the analogy of the donut (Renn, 2014) to shape a strong body of evidence

describing a change in city and suburban demographics since the 1990s. Whereas the old

donut included a decaying city center surrounded by thriving suburban communities, the

new donut sees the reverse – city revitalization efforts, decreasing crime rates in city

centers, and other incentives such as shorter commute times that seem to appeal to more

educated, wealthier residents. These and other residents tend to be higher-income

residents that are drawing newer waves of development, which in turn drive poor families

out of the inner-ring. As a result, suburban poverty increases.

Poverty levels have widened significantly in suburbs since the early 2000s.

Kneebone and Berube (2013) used census data and the American Community Survey

(ACS) to note that the nation's poor population grew from 33.9 million to 46.2 million

from 2000 to 2010. In Houston, as an example, the percentage of families living in

poverty who live in the suburban areas grew by 102.9% from 2001 to 2011. In addition,

in 2011 there were 35,000 more poor people living in suburbs than the city (Rice, 2013).

The operating definition of suburb is further complicated by the reality that

governmental entities such as the Texas Education Agency (TEA) classify school

districts with a number of different categories. TEA uses nine categories: major urban,

major suburban, other central city, other central city suburban, independent town, non-

metropolitan: fast growing, non-metropolitan: stable, rural, and charter school districts.

Major suburban districts in Texas are defined in this way and will form the operating

definition of suburb in this study:

> "A district is classified as major suburban if: (a) it does not meet the criteria for
>
> classification as major urban; (b) it is contiguous to a major urban district; and (c)
>
> its enrollment is at least 3 percent that of the contiguous major urban district or at

least 4,500 students. A district also is classified as major suburban if: (a) it does not meet the criteria for classification as major urban; (b) it is not contiguous to a major urban district; (c) it is located in the same county as a major urban district; and (d) its enrollment is at least 15 percent that of the nearest major urban district in the county or at least 4,500 students. (Texas Education Agency, 2014)"

Academic performance in suburban schools. There are no studies to be found that specifically compare academic performance in suburban schools or school districts before and after the levels of poverty changed. Given the strong research base showing that students living in poverty underperform in numerous factors, though, it follows that suburban schools now face new achievement gap-focused academic challenges. According to the Texas Academic Performance Report in 2015 (Texas Education Agency Division of Performance Reporting, 2015), for example, African-American and Hispanic/Latino students in three different major suburban districts underperform their White peers in academic proficiency. This seems consistent with a strong body of evidence cited earlier about achievement gaps across lines of advantage.

Structural Reforms

These widening gaps have not been ignored. In fact, a large number of different strategies have been tried at small and large scales to affect the disparities in performance. Evidence of inequality in performance exists is strong and has existed for decades, despite considerable investments of effort and resources. The changing, dynamic demographics in cities throughout the United States make it difficult to extrapolate strong evidence-based reform-oriented practices because the context of communities differ and change – including but not limited to the phenomenon of

urban/suburban population shifts. The following research attempts to highlight what has been learned through various reform efforts; the limitations of context should not be ignored.

More rigorous standards. Policy efforts have been made both nationally and by individual states to address widening achievement gaps. The National Governors Association Center for Best Practices and Council of Chief State School Officers (2010) published the Common Core State Standards (CCSS) with the expressed goal of ensuring that "all students, regardless of where they live, are graduating high school prepared for college, career, and life." CCSS implementation is still relatively new and inconsistent across the United States. The Brown Center on Education Policy at Brookings has done the most extensive study of the academic results of states that have implemented CCSS, using the National Assessment of Educational Progress (NAEP). The effects on academic performance in 4th grade reading from 2009-2013 in strong implementers of CCSS are small. It is difficult to put those results into context, though, because comparison groups during the same time period are limited. Comparisons to Texas and Alaska, two states that did not adopt CCSS, are promising – as those states saw declines in NAEP scores during the same period. Given the small effects, though, CCSS is inconclusive. Although Texas did not adopt the CCSS, the state has attempted similar policy efforts.

One such effort was the Texas College and Career Readiness Standards (TCCRS). Passed as part of the 79th Texas Legislature as Texas House Bill 1 (HB1), the goal of these new standards was to define standards that would ultimately lead to increasing numbers of students who graduate Texas high schools and college, and ultimately drive

stronger career outcomes. These standards were created through vertical teams that included secondary and postsecondary faculty (Texas Education Agency, 2009).

Tougher tests. In conjunction with rigorous standards such as the CCSS and TCCRS, both federal and state governments have legislated mandatory, rigorous testing as part of their efforts. Used to assess mastery of the CCSS, the Partnership for Assessment of Readiness for College and Careers (PARCC) is a suite of annual, year-end tests marketed as measuring readiness for success in college and career (Partnership for Assessment of Readiness for College and Careers, 2016). In Texas, the State of Texas Assessments of Academic Readiness (STAAR) program was implemented first in spring of 2012, is the newest state-mandated tests for students intending to measure more rigorous standards (Texas Education Agency, 2011).

Critics of PARCC and STAAR offer a number of arguments for why these tests should be reconsidered. Critics of federally-mandated tests like PARCC point to the number of instructional days lost to testing, a shifting focus in classrooms from teaching to test prep, questions about the validity of the assessments, cost, and even the often-lasting negative psychological effects testing can have on children (Ravitch, 2010).

In Texas, critics of STAAR – including parent and community groups such as Texans Advocating for Meaningful Student Assessment (TAMSA) – make similar arguments. TAMSA called their members to action in 2015 with a legislative agenda that included among its recommendations a reduction in mandatory testing and elimination of student performance requirements for grade promotion and high school graduation (Texans Advocating for Meaningful Student Assessment, 2015).

Increased academic choice. States like Texas have attempted to tackle widening

achievement gaps with different approaches than just increasing the rigor of standards

and adding more mandated testing. Texas passed House Bill 5 (HB5), designed both to

reduce the number of mandatory state tests during high school but also to increase choice

in student learning. This approach was a reaction to a number of sequential legislative

sessions that ultimately increased mandatory state tests to fifteen and limited student

choice in high school course selection for students intending to matriculate into a four-

year college. HB5 not only reduced the mandatory state tests to five; it also established a

single foundational graduation plan that is then supplemented by one of five focus areas

called endorsements (STEM, Business and Industry, Public Services, Arts and

Humanities, and Multidisciplinary) intended to increase student choice and flexibility in

course selection, which in turn was intended to increase motivation (Texas Association of

School Administrators, 2013).

Greater district flexibility and local control. In addition to student choice and

flexibility in course selection, Texas House Bill 1842 (HB1842) was passed in the Spring

of 2015 including a small section called Districts of Innovation that was designed to

empower local districts with greater flexibility and accountability in governance. Schools

or school districts can gain local control over policy-making previously held by the state

– potentially freeing schools and school districts from rules or law that prohibit reform

(Texas Education Today, 2015).

HB5 and HB1842 were designed ultimately to improve student outcomes. Due to

the newness of implementation, neither HB5 nor HB1842 can offer clear evidence of

success. To leverage the full promise of these efforts, too, complex school systems

leadership will be required at times. As such, there may be inevitable limitations to scalability.

Evidence of success. There is evidence, however, that can be cited that the widening gaps in achievement can be decreased. Teachers, schools, and systems of schools are finding effective ways to address these gaps for children in general and specific groups of students in particular. Although each of these examples has limitations both to generalizability and scalability, taken together they offer strong evidence that under the right conditions and with the right approaches achievement gaps can close.

Teachers. Individual teachers have proven to make a dramatic difference in the academic trajectory and performance of children. There are strong examples of teachers memorialized in books and film as a result of their excellence in the classroom. An example of this is Jaime Escalante, a Math teacher in East Los Angeles made famous in a book called Escalante (Mathews, 1988) and a film called Stand and Deliver (Labunka et al., 1988). Escalante's students from predominantly low-income families regularly outperformed students of comparable backgrounds on rigorous assessments like the Advanced Placement exam.

Beyond the near-celebrity of some teachers, TNTP published strong and compelling evidence that teachers in regular schools as part of large school systems can ensure their students show dramatic gains in Math and Reading (TNTP, 2012). In the study, TNTP analyzed the value-added learning outcomes for 20,000 teachers across four large, geographically diverse urban school districts. TNTP found that approximately 20% of these teachers helped their students learn two to three months more in Math and Reading, and five to six months more compared to low-performing teachers.

There are some limitations to this study and the body of research it represents. It is not clear what longitudinal effects a single strong year in a classroom can have on enduring student performance. It is also not clear what happens within those schools over time, particularly since many successful teachers leave the classroom either to become administrators or to leave the profession. Last, the measures used to analyze teacher performance were limited; there were no measures focused on social-emotional development or classroom climate, for example. It is clear, however, that teachers can create game-changing results in classrooms in a single year.

Schools and systems of schools. In addition to teachers, there are some schools and systems of schools that have demonstrated some positive outcomes under some conditions. Charter school management organizations (CMOs) such as KIPP, for example, were found to show "positive, statistically significant, and educationally meaningful impacts" on student performance in elementary and middle schools, and high schools for students who enroll in KIPP for the first time in high school (Tuttle et al., 2015). Although this study represents only one organization, its strength is enhanced by three elements of the methodology. First, KIPP is a national network of schools that operate in numerous communities around the country. As a result, the findings reflect an array of communities that span the country and are not isolated to a single community or city. Second, the performance of students attending KIPP schools was compared to students who wanted to attend. These students simply were not selected in randomized lotteries. Those who criticize student performance in charter schools such as KIPP often posit the understandable argument that students attending charter schools are already likelier to perform successfully because their families sought choice in schools. Children

whose parents were already inclined to seek choice, the argument goes, skew the results when compared to children whose parents are perceived not to care as much. Given that this study compared the so-called "KIPP effect" by comparing students who were selected in a randomized lottery to those who were not selected in the same lottery, this study controls for that argument. Third, the study was longitudinal; student performance extends beyond a single year. Still, this study offers strong evidence that whole schools in neighborhoods around the country can improve enduring student performance.

Beyond classrooms and schools, experiments in governance at scale are showing early evidence that under certain conditions, whole systems or districts of schools can demonstrate improved student performance in historically low-performing communities (New Schools for New Orleans, 2015; Empower Schools, 2014). In New Orleans and Lawrence Public Schools, their respective states freed up the traditional rules and regulations governing those communities due to lasting underperformance. Paired with this change in the rules, the communities were held to greater standards of accountability than before as well. The results in both have shown some promise, though there are limitations and even cautions to consider.

In New Orleans, there is weak and controversial but compelling evidence that citywide strategic and policy reforms can lead to improvement. Prior to the destruction caused by Hurricane Katrina the state of Louisiana had formed the Recovery School District (RSD) – the first all-charter district in the United States, as part of an effort to improve performance in the city (Kimmett, 2015). After Katrina, the changes in governance significantly increased the number of choice and charter options for families and increased competition for students; these choice and charter schools were afforded

more freedom to operate, paired with greater accountability for student performance.

Academic performance (increase of 30% scoring basic or above in 3rd-8th grade on state

tests) and graduation rates (increase of nearly 20%) have improved. Criticisms of this

model, however, abound. Organizations like the Network for Public Education note that

academic performance and graduation rates still lag behind dozens of other states in

America as well as districts within the state (Heilig, 2015), charter school students may

perform lower in 8th grade to their traditional school counterparts (Lopez & Olson,

2015), and some community members have opposed reforms for a number of reasons

(Kimmett, 2015). In addition to these concerns, there are other weaknesses to this

research that must be considered. The city's political and demographic context before

and after Hurricane Katrina makes it a unique case that is difficult to generalize. In

addition, there is minimal evidence that academic success in elementary and middle

schools is translating into high schools and there is some evidence that the lowest-

performing students are disappearing from the data by dropping out or leaving their

schools. (Gabor, 2015). Despite these legitimate criticisms, the gains in performance and

graduation rates are worth further exploration.

Similar to the RSD, Lawrence Public Schools (LPS) offers some early evidence

of success at whole-system reform. LPS was a persistently low-performing school

district in the state of Massachusetts. It had been taking into receivership by the state

after showing the worst academic results in the state for several years in a row. Similar to

New Orleans, LPS was given greater freedom in governance and greater accountability to

student performance. Different than the RSD, though, LPS approached reform in

partnership with the local union and community. Their approach, referred to as an "open

architecture" approach for schools, pairing a mix of traditional schools in the district and outside school operators (Empower Schools, 2014) with a leaner, redesigned central office. Like the RSD, LPS has seen significant improvement in academic performance. Also like the RSD, while gaps are closing in performance, students are still underperforming many peers across the state and country. Unlike the RSD, there is no evidence of community opposition to the reform approach.

School districts like Houston Independent School District have also engaged in holistic efforts to address performance gaps, with some success. In one moderately strong study, researchers found that implementing strategies that had shown to improve student achievement in charter schools could improve math performance at scale in traditional public schools (Fryer, 2014). Critics of these efforts point to the expense ($60 million, including $18 million in privately-raised philanthropy), lack of impact on reading performance, and math scores that declined once most interventions were removed (Downing, 2014). Like New Orleans and Lawrence, however, there is enough evidence of success to warrant further exploration as a systemic approach to reform.

Tennessee's Achievement School District (ASD) offers weak but compelling evidence that statewide reform can improve performance in low-performing schools. The ASD was created by the state to target the lowest-performing 5% of schools statewide. With a strategic approach more similar to the RSD than LPS, the ASD has attempted to attract high-performing CMOs to take over the lowest-performing schools in an attempt to increase performance and narrow gaps. Reports show students in ASD schools making faster gains than their peers in math and science (Achievement School District, 2015). Results in reading scores declined, similar to statewide averages. Limitations to this

research include the reality that the ASD is still relatively new, and the gains cited are based solely on state test scores; as a result, generalizability of the findings is difficult to do. In addition, much like the RSD there have been concerns about efforts to engage the community (Chalkbeat Tennessee, 2015), which could pose long-term challenges to embracing and even expanding the effectiveness of this approach.

Although efforts have been made that show short-term effects in classrooms, schools, and districts, there are only small numbers of examples that show evidence of change and even fewer that point to enduring change. Many of those that show promise are relatively new, and consideration must be paid to the endurance of systemic change, too.

Increased academic readiness as a strategy. Addressing academic performance on state tests does not appear to be the only critical performance factor affecting a child's ability to succeed beyond high school; as such, simply narrowing performance gaps on state tests has not proven to increase postsecondary success rates. There are other factors that seem to be more predictive and lead to lasting success.

College and career readiness. Graduating high school ready to succeed in a postsecondary environment is one such predictor of postsecondary success. Conley et al. (2006) published moderately strong evidence describing what truly graduating ready to succeed beyond high school would entail. Using two studies commissioned by College Board to validate college readiness, the researchers evaluated syllabi and expectations in best-in-class entry-level college courses both in math and science. Using these studies, Conley defined college readiness in this way: "The level of preparation a student needs to enroll and succeed—without remediation—in a credit-bearing general education course

at a postsecondary institution that offers a baccalaureate degree or transfer to a

baccalaureate program (p.5)." Given the breadth of syllabi studied, this research is

compelling.

Conley strengthened the research base about what it takes to succeed beyond high

school and offered examples of what some schools around the country are doing (Conley,

2010) to develop college and career readiness. He proposed a conceptual framework that

outlined four areas describing true college readiness. Students must have developed all

of the following domains to succeed: 1, key cognitive strategies, or the habits of mind

required first level college courses such as research; 2, key content knowledge, including

academic skills such as writing as well as core academic knowledge; 3, academic

behaviors, such as study skills; and 4, contextual skills and awareness, or the types of

knowledge about college that helps students navigate that new learning environment.

The examples used in this study came from a diverse number of communities around the

country and are examples from high school, so there is alignment to this study. Despite

this, the evidence of what works remains weak because of the limited number of

examples around the country of places that are developing each of these domains. It does

seem clear that academic preparedness must be supplemented by other factors.

Academic intensity. In addition to Conley's work, Adelman published strong

evidence about what predicts postsecondary success; his research further supports the

assertion that improved performance on state tests alone is not enough. Commissioned

by the United States Department of Education, this study followed a nationally

representative cohort of students from high school through their mid-20s who attended a

four-year college at any time. Its findings mirror those originally discovered in a study

called Answers in the Toolbox (1999), conducted on a cohort of students scheduled to graduate in 1982. Both studies identify the same finding – that the academic intensity of a child's high school experience, measured by Carnegie Units, is the most predictive factor. It follows from this research that in order to increase postsecondary success, students must take harder coursework during high school.

Why Social Psychology?

Despite the promising evidence found in some classrooms, schools, and systems of schools, there are still other factors – often psychological in nature – that also must be considered as part of a holistic strategy. Attempts to increase the level of expectations for students without addressing other psychological factors can have limited effect, though. Increased expectations motivate some, but they create psychological barriers in others. Social psychologists dating back to Lewin wrote about the distinguishing effects that different psychological forces have on individual and group motivation (1952). In this study, Lewin differentiated the forces affecting people as they transition from indecision to decision. He found that a number of different forces influence people. Although the context of his study is different, subsequent research strengthened Lewin's premise that multiple forces must be considered in balance – some that motivate individuals to make a decision ("force toward change") and others that simply reduce the "resistance to change."

Several studies have shown that social-psychological interventions in particular can be effective approaches to improving performance by reducing the effects of these forces. Ross and Nisbett (1991) published an extensive and compelling explanation of why these approaches work to unlock motivation. Their book synthesized decades of

research and hundreds of studies and suggests strong evidence that social-psychological interventions can be effective help to redirect behavior by addressing the specific circumstances in which an individual operates – specifically "the actor's construal of the situation" (p. 11). These interventions, applied under the right conditions, can help to reduce some of the obstacles or restraining forces that inhibit motivation.

Reducing these forces through social-psychological interventions seems to improve achievement of students in schools. Garcia and Cohen (2012) summarized and synthesized more than one hundred books and experiments that collectively present strong evidence that interventions can have a positive effect at reducing psychological forces and often positively improve student outcomes. Their research points to the classroom as a complex tension system that consists of dynamic and often-conflicting psychological forces at play on every student, affecting each student differently. They also note the effects of interventions vary depending on the timing of the intervention; some interventions are only effective, for example, if they are administered at moments of high stress, thus "interrupting a downward slide in functioning" (p. 342).

The psychology of life transitions. One time in a child's life during which these interventions may be most impactful is during a key life transition, such as the transition from elementary to middle school, middle school to high school, high school to higher education, and higher education to the workforce. The research suggests that these moments are particularly ripe for intervention due to a number of different social factors including exclusion and changes in how peers treat each other that typically lead to declining academic performance (Yeager & Dweck, 2012). In a comprehensive study summarizing almost 100 data sets and studies in an attempt to capture the status of

American children and adolescents, Eccles (2012) found strong evidence that children are affected negatively on a number of indicators during the transition from middle to high school. This is particularly true in poor and under-resourced communities.

Benner (2011) found similar evidence. He reviewed 37 studies about middle to high school transitions and collected findings from a variety of focus areas (e.g. grade point average, psychological functioning, connectedness, and school climate), sample sizes (ranging from 26 to ~12,000), race/ethnicity, and sample descriptions. He found strong evidence that the high school transition affects some students more than others, that successfully navigating the transition can have lasting life implications that are either positive or negative, and that the sociocultural context of the high school influences a number of factors. There are key questions left unanswered in the research, though. One such example relevant to this study is the relationship between the race/ethnicity of the student and the racial composition of the student body overall. Although the research is limited, Benner notes that transitions for African American and Hispanic students are more likely to be negative if students entered a sociocultural context with fewer same-race peers.

Psychological interventions as a strategy. A large and increasingly strong body of evidence is building that shows the positive effects of brief social-psychological interventions on a number of different factors affecting students in school, from performance to other psychological variables such as stereotype threat (Aronson et al., 2002; Good et al., 2003; Cohen et al., 2006), mindset (Blackwell et al., 2007, Destin & Oyserman, 2009), relevance and motivation (Hulleman & Harackiewicz, 2009), academic stress (Ramirez & Beilock, 2011), social belonging (Walton & Cohen, 2011), and

academic self-regulation (Yeager et al., 2014). Many of these interventions have surprising effects on long-term academic performance.

These interventions are reproducible and cost-effective (Garcia & Cohen, 2012; Walton, 2014; Wilson, 2011; Yeager & Walton, 2011). Brief interventions like the one used as part of this study that are administered for the right students at the right time, the evidence suggests, can be effective at improving outcomes.

Similarly, Yeager and Walton (2011) found that brief social-psychological interventions can affect student outcomes. They studied thirteen different experiments – nine in depth – using interventions with middle school, high school, or college students. These studies addressed several different psychological factors that affect students in school. Taken separately, each study provides weak evidence that social-psychological interventions positively affect student outcomes for some students. Taken together, these studies offer strong evidence that social-psychological interventions can positively affect student outcomes, seemingly by reducing the effects of psychological factors affecting students. The authors caution that each of these interventions requires further study to better understand specifically which students benefit the most and under what conditions.

Growth and Fixed Mindsets

Origins of contemporary attitudes about intelligence. Student beliefs and self-perceptions about intelligence can have large and lasting effects on their performance (Blackwell et al., 2007). These self-perceptions are influenced by societal attitudes about intelligence, and those attitudes trace their history back over 100 years (Dweck, 2006).

The nature of intelligence has been explored for generations. Psychologists, statisticians, and other researchers have long attempted to understand intelligence; only in

the last century has this interest translated into attempts to quantify in single numbers the nature of intelligence. The first direct corollary to the Intelligence Quotient (IQ) tests used to reduce intelligence to a single quantitative number dates back to 1905, when Alfred Binet and others were commissioned by the French government to develop ways to determine which children required additional support in schools - particularly when the existing French schools were not seen to adequately support children (Dweck, 2006). A strong analysis of Binet's life and research emphasizes that Binet himself spent significantly more time looking at intelligence quantitatively, even though he himself did not believe the early IQ test was a valid or reliable measure of permanent inborn intelligence (Dweck, 2006).

  Rosenthal and teacher expectations. In the 1960s, researchers began looking more broadly at intelligence – not just whether or not people are born with a quantifiable amount of intelligence. The generally accepted belief at the time was that intelligence is something innate and immutable, in large part due to the propensity to measure intelligence quantitatively dating back to Binet. It was not until the 1960s that Rosenthal and Jacobson (1968) showed weak but intriguing evidence that teacher expectations could influence some student outcomes – if teachers thought their students were poised to be successful, some students in those classrooms were more successful than those whose teachers were told nothing. These "expectancy effects," more colloquially known as a "self-fulfilling prophecy" or "The Pygmalion Effect," provided early evidence that adult perception of their students' potential may influence outcomes. The strength of this finding is weakened by the reality that expectancy effects were not found across the

whole study. Conducted at the Oak School, a lower-middle class elementary school, effects were only found for children in grades one and two.

Several studies following this landmark finding attempted to understand in more depth the influence teacher expectations and teacher behaviors can have on classroom performance. Generally the research is strong that teacher expectations influence student performance, although there are varying degrees of strength in each study. Examples of groups shown to be affected by teachers include young African American children (Rist, 1970; J. Aronson et al., 2002; Cohen, G. L., & Steele, C. M., 2002; Good et al., 2003; Yeager et al., 2013) as well as young women (Sadker and Sadker, 1995; Walton, G. M. & Spencer, S. S., 2009; Beilock, S. L., Gunderson, E. A., Ramirez, G., & Levine, S. C., 2010). Limited research has been done on the effects of teacher behavior on Hispanic students.

Although the effects of each of the above studies vary, it seems clear that teachers can have a positive or negative effect on short- and long-term student outcomes – and that those effects are felt differently by different groups of students. As a result, the strongest studies require a methodology that includes diverse, representative samples and data analysis that explores results not only from the whole sample but also specific groups within the sample.

Attribution theory. It is not just teacher perceptions and expectations that can influence student outcomes. A second, related theory known now as attribution theory, suggests that how students explain difficulty and failure to themselves also plays an influential role. Heider (1958) first proposed this theory after discovering that people attempt to attach meaning and attribute causes to behaviors. His early work formed the

foundation for social psychology, developed further by researchers such as Jones and Nisbett (1971) and Weiner (1974). These researchers shaped Heider's early work into a framework that identified a strong relationship between one's self-concept and overall achievement. Subsequently, researchers began attempting to understand the attributions individuals made both achievement and to mistake-making or failure.

Helpless and mastery-oriented attributions. Seligman and Maier (1967) are credited with the earliest research on helpless attributions, an aspect of attribution theory that ultimately contributed to mindset research. Dweck built on this early work by focusing on helpless attributions in children – specifically how students explained failure – and efforts to understand attributions of children who persisted versus those who gave up or quit after a mistake or failure. Her first published study was conducted only on twelve students – all of whom demonstrated learned helplessness after making mistakes. In a 1975 study, she found evidence that extensive attribution retraining (25 sessions) could reduce perceptions of helplessness – a barrier to motivation – and ultimately improve motivation and performance in children (Dweck, 1975).

Dweck later conducted studies with fifth- and sixth- grade students that revealed patterns about how students respond to failure – either with helpless response or a mastery-oriented response (Diener & Dweck, 1978). Students were given the opportunity to solve problems successfully before the difficulty level increased. As soon as students faced difficulty, two distinct and different responses emerged. Some students persisted; others gave up and explained the circumstances with phrases like "I guess I'm not very smart" – an attribution perceived to be beyond their locus of control.

Fixed mindset: Entity theories of intelligence. It is this attribution that is now known known as the entity theory of intelligence, or fixed mindset (Dweck, 2006; Yeager & Dweck, 2012). People with this self-concept believe that intelligence is innate and immutable. Several randomized experiments and longitudinal studies from numerous educational contexts and diverse samples contribute to this strong body of evidence (Blackwell et al., 2007; Dweck, Chiu, & Hong, 1995; Dweck, 2006; Dweck & Leggett, 1998; Yeager & Dweck, 2012). Each of these studies shows consistent evidence that people who conceive of themselves in this way agree with statements such as "Your intelligence is something about you that you can't change very much," "If I have to try hard, I'm not smart," or "There's no point in trying if I'm not a natural" (Blackwell et al., 2007).

There is also a strong body of evidence suggesting that people who have a fixed mindset do not believe they can improve, and as a result tend to give up more easily and are prone to helpless attributions (Dweck, 1975; Yeager & Dweck, 2012), avoid challenges (Dweck & Leggett, 1988; Mueller & Dweck, 1998), hold unproductive beliefs about effort (Blackwell et al., 2007), and are generally less resilient overall (Dweck, 1975, Nussbaum & Dweck, 2008). In addition to giving up more easily, six studies of fifth grade students (N = 128, 51, 88, 51, 46, and 48) in a northeastern city even found that giving students with fixed mindsets certain types of praise can decrease their motivation to persist when facing challenges or setbacks in the future (Mueller & Dweck, 1998).

Growth Mindset: Implicit theories of intelligence. The second that contrasts with the fixed mindset is known as the incremental theory of intelligence, or growth

mindset (Dweck, 2006; Yeager & Dweck, 2012). There is a strong research base suggesting that people with this self-concept believe that intelligence and talent can grow through effort, asking for help, and trying new strategies (Paunesku et al., 2013; Dweck, 2015). There are a number of studies of varying strengths, different sample sizes, and that represent diverse demographics that all seem to show similar results: there are people who believe intelligence can be developed and attribute situations and circumstances differently than those with fixed mindsets.

Dweck and Leggett (1988), for example, synthesized a number of studies analyzing how students explained success or failure when solving difficult problems. In this research, they found that there was a striking difference in how students thought about problem solving between those with an implicit theory of intelligence (fixed mindset) and those with an incremental theory (growth mindset). Students with a growth mindset focused their energy on strategy and effort and were likelier to keep trying, while those with a fixed mindset gave up more easily. Hong et al. (1999) conducted three studies that further strengthened this evidence – finding in three studies (N = 97, N= 168, N=60) that students with a growth mindset were more likely to try hard after encountering failure than those with a fixed mindset.

Chiu, Hong, and Dweck (1997) published five different studies of nearly 500 students total in New York and China that further corroborated this research, and their research pointed to differences in how fixed and growth mindsets play out in social situations. These studies were conducted entirely with students attending elite universities who already have achieved academic success in their lives; even under these conditions, it was clear that fixed and growth mindsets exist. Although this study focused

on college students, which weakens its strength in relation to this study, the differences in social situations is relevant to the high school transition because of the complex social dynamics students face when entering high school.

Yeager and Dweck (2012) further analyzed the evidence base by evaluating 75 articles or books, 52 of which published within ten years of their study. They found stronger and consistent evidence that a growth mindset can affect performance and a number of other outcomes across a number of different samples, methodologies, and locations. Students with growth mindsets can perform better academically and demonstrate higher levels of resilience when facing academic or social challenges that require effort. Notable in this research, too, is weak but convincing evidence that students with fixed mindsets can develop growth mindsets despite holding a fixed mindset for years.

Claro, Dweck, and Paunesku (2016) offer strong evidence that having a growth mindset affects students the greatest at the lowest levels of income, although growth mindsets still have effects on performance at the highest levels of income. This is the first study conducted with a nationwide sample of high school students to understand in more depth the effects on performance of having a growth or fixed mindset. Completed in Chile, this study wove mindset survey questions into nationally mandated standardized tests to determine the performance of students who had growth or fixed mindsets. The study considered all public school tenth graders who answered at least one mindset item and one mandatory standardized test ($n = 168,203$ and $n = 168,553$ for mathematics and language, respectively); performance on the tests were cross-referenced with family income, by decile. Although performance gaps existed in every decile, the performance

gaps were greatest at the lowest deciles. This strong relationship between mindset and achievement is noteworthy given the consistent findings and huge sample size. The strength of this study is diminished only by the fact that the study was conducted in Chile, not the United States.

Criticisms of mindset research. Despite the extensive strong evidence supporting mindset as a key factor that affects students in numerous ways, there are criticisms of this research. The most consistent criticisms of growth mindset research derive either from a narrow-minded understanding of the research or criticisms about how practitioners attempt to operationalize the research.

Author and lecturer Alfie Kohn is one such critic (Kohn, 2015). He acknowledges that the body of evidence that exists is extensive and notes that Dweck draws on decades of good data. Instead, he criticizes how practitioners are using his research – specifically in over-valuing effort and over-emphasizing praise as a technique.

Generally speaking, Kohn's concern that practitioners are misusing what they learn from Dweck's work is valid. Despite the extensive body of evidence Dweck's work draws from and contributes to, that evidence is still limited; as such, it is important that practitioners understand the research and its limitations when trying something new in their classrooms or schools. The trouble with Kohn's criticisms of Dweck's work, however, is that she herself has published similar concerns about how those in the field of education are using her research. Beyond Dweck, two of her frequent collaborators published an article cautioning that social-psychological interventions are not magic (Yeager & Walton, 2011). These researchers note that small, brief interventions focused on mindset and other psychological factors have undeniable short and long-term effects.

Despite these effects, they warn that these are not magic and are not to be implemented haphazardly.

Kohn's first specific criticism, that Dweck's work somehow overvalues the importance of effort in society, simply shows his lack of understanding about her research. In a response to Kohn and others (Dweck, 2015), she clarifies that effort is not the only way those with a growth mindset can improve their talents and intelligence. In addition, people can ask for help and try new strategies.

His second specific criticism, that praise as a technique should not be used, is consistent with his ongoing criticisms about extrinsic motivation (Kohn 1993). Kohn argues that praising effort is no different than "verbal doggie biscuits." According to the research, though, Dweck has never advocated for teachers to praise students. Instead, she has studied the effects of different types of praise on students. It is hard to imagine eradicating all praise from education, particularly given the holistic role teachers play in their students' lives. Given the preponderance of opportunities for teachers to give and receive feedback, Dweck seems to argue that it is critical when thinking about changing mindsets to consider the role feedback should play. Feedback that focuses on the person is less effective than feedback that targets specific areas that can change – such as one's effort, attempting new strategies, and asking for help.

Indirect behaviors, not praise. In addition to Dweck's own clarity about the role praise should play, Haimovitz and Dweck (2016) offer weak but compelling evidence that suggests mindsets are developed less by what is said and more what is unsaid through indirect behaviors from adults that foster mindsets in children – particularly after experiencing failure. In one study, seventy-three parent-child dyads of

fourth- and fifth-grade students from two schools in San Francisco were studied to determine the relationship between parent mindsets about failure, their intelligence mindsets (e.g. fixed or growth), parental perceptions of their children's competence in school, and their children's mindsets. There was a significant relationship between the parent mindsets about failure and their children's mindsets. In a second study, 160 parents of students were given similar surveys and then provided a scenario asking them to react to their child's failure in school. Similar to the first study, there was a significant relationship between a parent's failure mindsets predicted how they would react to the hypothetical scenario. Further study is required, but these two studies do offer early evidence that indirect behaviors may foster growth or fixed mindsets more than explicit praise or verbal messages.

Variables and Measures

  Mindset interventions in general. Of all the social-psychological interventions that could be integrated into a holistic education reform strategy, mindset interventions may show the strongest promise for a number of reasons. First, there is a strong research base to draw from that spans decades that suggest mindset interventions in particular can have effects on performance and effort-seeking behavior during the transition from 8th to 9th grade. Mindset interventions to date are some of the strongest and best-researched psychological interventions to use in schools, although Yeager and Dweck (2012) note that many of these interventions must be customized precisely to the age and context of certain students to have the largest effects. There is a large body of strong evidence spanning decades (Dweck, 1975; Dweck & Leggett, 1988; Yeager & Dweck, 2012) suggesting these interventions can be successful at improving outcomes for some

students. There is strong evidence that mindset interventions can improve beliefs about effort (Dweck, 2006; Blackwell et al., 2007; Yeager & Dweck, 2012). Effort, simply put, is a way to improve and not an indictment of one's fixed intelligence.

Measures. In addition to the ongoing success found in many contexts for these interventions, the measures used to assess levels of growth mindset are defined and offer weak but aligned evidence of success as ways to assess theories of intelligence, beliefs about effort, and other motivational variables affecting students (Blackwell et al., 2007). Two different studies (N = 373 and 93) of 7th graders used scales measuring using Likert-type scales, and these scales also provided qualitative information about student self-concepts and perceptions. Although there appears to be no technical adequacy established in these scales, they have been used in other studies with similar, comparable utility.

Some interventions have been tested more extensively, and mindset interventions are one such example; their effects on performance and effort beliefs are moderately strong. Blackwell (2002) looked specifically at mindset interventions and their effects on math grades and beliefs about effort during the junior high to high school transition. The study is weak but compelling evidence that mindset interventions can have positive effects, particularly on students who under-performed previously. The weakness of this study comes from the relatively small sample size (N = 99), the fact that this study was conducted entirely in one school in Manhattan, and the students were all relatively low-achieving to begin with. The lack of heterogeneity in the study makes its findings difficult to extrapolate to other contexts.

Further research was completed by the same researcher, though, which strengthened the evidence that mindset interventions can have a positive effect on performance and attitudes about effort during middle school to high school transitions (Blackwell et al., 2007). Although still confined to Manhattan, this article included two studies. The first included a much larger sample size (N = 373) with stronger variability in performance among the students entering the study – some were underperforming and others were not. The second study used a similar sample size (N = 99) and similarly under-performing group of students, but the sample included a more diverse sample. The intervention was more extensive – an eight-session workshop that may be difficult to replicate in other contexts, too. All three studies – Blackwell's in 2002 and both of these from 2007 found that being exposed to a mindset intervention led to similar positive effects on performance and beliefs about effort while also seeing a decrease in ability-based "helpless" attributions. To enhance this body of evidence, more diverse sample sizes in different parts of the country will help. In addition, the sociocultural context of Manhattan is much different than other cities and suburban areas; more research needs to be done with representative samplings in other contexts to gain greater confidence in these findings.

In a randomized study of 109 African American and White undergraduates at Stanford University, a small intervention focused on teaching students that intelligence is malleable and can be developed improved attitudes about intelligence and academic grades in African American students compared to their White peers (Aronson et al., 2002). This study focused on college and not high school students, did not include

Hispanic students, and was conducted at an elite university instead of a diverse public high school.

In a randomized field study of 139 seventh-grade students attending a demographically diverse school in Texas, an intervention that included several in-person and email mentoring opportunities between college and middle school students found that standardized test scores improved in math and reading for males and females (Good et al., 2003), with the effects strongest for females. This study included a diverse student body including African American, Hispanic, and White students. This study also analyzed performance in math, which is relevant to the research questions. The only misaligned aspect of the methodology is that the sample comes from middle school, not high school, students.

In addition to these larger studies, other smaller studies using different interventions focused on similar psychological barriers to motivation offer similar evidence as to the effects interventions can have on performance. Cohen et al. (2009) found in three independent studies ($N = 133$, 149, and 134) focused on writing about one's self-value improved performance in math of African American students. Wilson and Linville (1982) attempted to change the attributions that college students at Duke University ($N = 71$) held who were already struggling academically relative to their peers and found that performance improved, the percentage of students leaving college declined, and even had lasting effects after one year. In addition to those studies, Yeager et al. (2014) found in three double-blind experiments ($N = 44$, 44, and 76) that interventions focused on reducing mistrust improved the writing performance of low-performing 7th graders.

Mindset interventions have even shown effects at the college level (Tough, 2014), although the body of research is weak. The only study to date was conducted at the University of Texas-Austin, which sought to understand the effects of psychological interventions on helping students who were considered disadvantaged (defined as African America, Hispanic, or first-generation college students) stay on track to graduate. In the study, every freshman was assigned randomly to the experimental or control group. The experimental group received two interventions – one focused on growth mindset and the second focused on combatting perceptions that they may not belong at that university. Researchers analyzed how much credit students had earned by the end of the first semester – 12 credits meaning students were on track to graduate on time. While no effects were found among advantaged students and the percentage of students earning 12 credits remained at 90%, the percentage of disadvantaged students earning 12 credits rose from 82% to 86%, effectively cutting the gap in half between advantaged and disadvantaged students. Although there are some parallels between the transition into high school and the transition into college, there are some real differences that weakens the strength of this study. Specifically, UT-Austin is an elite university with selective admission criteria that makes it hard to compare to a public high school. Still, the evidence gathered in this study show promise about what may be possible as African American and Hispanic students transition into high school.

Scalability. Despite their promise, many of these interventions are limited in scalability. In some cases, the intervention requires too much effort to make it a viable option for schools across the country. Blackwell et al. (2007) tested a mindset intervention that showed strong effects on academic performance for middle school-aged

children – particularly as they encountered more difficult math problems. This intervention would be difficult to scale, though, because it requires an eight-session workshop that is difficult to replicate.

Recently, researchers have begun to explore the possibility of delivering mindset interventions to students using an online interface. In a double-blind, randomized experimental field study, students (N = 1,594) in 13 geographically diverse high schools around the United States received brief online mindset interventions (Paunesku, Walton, Romero, Smith, Yeager, & Dweck, 2015). The interventions had the strongest effects on performance of students who were already struggling. This reflects findings in previous studies (see Cohen et al., 2009; Wilson & Linville, 1982; Yeager, Henderson, et al., 2014). Although the results are promising both in their effects and scalability, this evidence in particular is limited by its newness and requires further study.

Mindset interventions in this study. The mindset intervention used in the National Study (NS) The mindset treatment used in this study was a revised version of previous mindset treatments that had been used in other research. The so-called "old" treatment included a four-page scientific article that students read, titled "You Can Grow Your Intelligence" (Blackwell et al., 2007). In addition, students generated a personal example of learning and getting smarter, writing a letter encouraging a future student who may be struggling in school not to feel "dumb" (see Aronson et al., 2002), coined by researchers as the "saying-is-believing" exercise (Walton & Cohen, 2011; Walton, 2014; Yeager et al., 2016).

Free and reduced meals (FARM). The variable used to determine relative levels of poverty in this study was derived from income eligibility for 9th grade free and

reduced meals program (FARM). Families fill out school meal applications at the

beginning of the school year as part of registration, and student eligibility is based on a

formula that includes federal poverty guidelines, income, and household size (U.S.

Department of Agriculture, Food and Nutrition Service, 2014).

Race and ethnicity. The race and ethnicity of students was determined by

parental reporting at the beginning of the year on school registration materials in the

school district. In the NS, students were categorized through the schools as Asian, Black

or African American, Hispanic or Latino, American Indian or Alaska Native, Multi-

Racial, Native Hawaiian or Pacific Islander, White, or Other (Yeager et al., 2016). For

the purposes of this study, race and ethnicity were not used for any analysis, though that

type of research is encouraged.

Prior achievement. As part of the NS, researchers developed a composite

variable of prior academic achievement in 8th grade to use in data analysis that had been

(e.g. Yeager, Johnson, et al., 2014). To create this composite, they averaged 8th grade

GPA in core classes and 8th grade state test scores. The researchers used this, but

adjusted it to accommodate for potential differences across cities and states. They used a

z-score of 8th grade core subject GPA (Math, Science, and English, with a range of 0 to

4.0) and state test scores. From this, there was a mean of zero and an SD of 1 within each

school. Second, the researchers tested whether adding fixed effects for school to

statistical models changed results. They did this because there was some missing 8th

grade data that could not be produced for 9th graders. Because this missing data could

have affected low achievers in 8th grade differently, the researchers did not exclude those

students to avoid affecting moderation tests. Last, they added a self-reported measure of

prior achievement, asking the following question of students: "Thinking about your skills and the difficulty of your classes, how do you think you'll do in math in high school? (Response options: 1 = Extremely poorly, 2 = Very poorly, 3 = Somewhat poorly, 4 = Neither well nor poorly, 5 = Somewhat well, 6 = Very well, 7 = Extremely well). In addition, the researchers z-scored the findings, borrowing from previous research (Hulleman & Harackiewicz, 2009). Together, these scores formed a composite weighted average, and the researchers reported this composite had a mean of 0 and an SD of 1 in the full sample (Yeager et al., 2016).

9th grade point average (GPA). The researchers in the original study collected final grades from the first semester of 9th grade. For the NS, the researchers converted any 0-100 scaled grades to a 0 to 4.33 scale, using the school's letter and number grade conversion. Researchers coded courses as core or not, and end of term grades for the core subjects were averaged. Students enrolled in multiple courses in a given core area (e.g., two math classes), grades in each core area were averaged into a single core subject grade (e.g. "math" grade). The composite core subject grade was then averaged into a student's final grade variable (Yeager et al., 2016).

Previous poor performance. Researchers used the same data to calculate Prior Achievement to create a new variable to use to determine the effects on previously low-performers. This new variable was created by assigning a 1 to students whose GPA averaged to a D+ or below and a or 0 to those whose GPAs did not. The researchers predicted that the mindset intervention would most positively affect those students who previously performed poorly, mirroring previous research (Cohen et al., 2009; Paunesku

et al., 2015; Wilson & Linville, 1982; Yeager, Purdie-Vaughns, et al., 2014; Yeager et al., 2016).

    Challenge-seeking behavior. To gauge the likelihood that students would seek out new challenges as opportunities to learn (i.e. demonstrate a growth mindset) instead of avoiding them for fear not doing well (i.e. demonstrate a fixed mindset), the researchers provided students at Time 2 with two different hypothetical scenarios requiring a forced choice. In the first, students could select an easy task that probably would not lead to greater learning or a hard task from which they would likely learn something. This built on previous research (e.g., Blackwell et al., 2007; Mueller & Dweck, 1998). This is the scenario:

        "Imagine that, later today or tomorrow, your math teacher hands out two extra credit assignments. You get to choose which one to do. You get the same number of points for trying either one. One choice is an easy review—it has math problems you already know how to solve, and you will probably get most of the answers right without having to think very much. It takes 30 minutes. The other choice is a hard challenge—it has math problems you don't know how to solve, and you will probably get most of the problems wrong, but you might learn something new. It also takes 30 minutes. If you had to pick right now, which would you pick?" (1 = the easy math assignment where I would get most problems right, 0 = the hard math assignment where I would possibly learn something new).

Learning Theory and Professional Development

Something must be done to address widening achievement gaps in schools and school systems that serve demographically diverse children. While there are strategies to consider that may have systemic effects, these can be time-consuming, costly, and limited by changes in personnel and focus. Given the evidence that brief, cost-effective psychological interventions can have positive effects on some groups of students, integrating mindset interventions into the high school transition for 9th graders is a key component of any action plan. This intervention alone, though, will not be enough to address the magnitude of the challenge facing students as they transition into high school. Despite the short- and long-term promise of brief mindset interventions as part of the strategy to improve student performance and effort-seeking behavior, it is the ongoing and daily interactions with teachers and other adults in the lives of students that must also be addressed. Given the research indicating that teachers and other adults in a school play a critical role in developing and nurturing growth mindsets, direct messages sent by adults can affect mindsets, but the indirect messages adults send must also be addressed in any practical plan to foster stronger growth mindsets (Heider, 1958; Rosenthal & Jacobson, 1968; Jones & Nisbett, 1971; Weiner, 1986; Dweck, 2006; Haimovitz & Dweck, 2016).

This action plan leverages not only what is known about the effects of social-psychological interventions; this plan also addresses aspects of learning theory that shapes a plan for teachers.

Foundation of action plan. Fostering a strong growth mindset in students appears to be critical to their success as the rigor and intensity of coursework increases.

Although psychological interventions may play a role as part of a larger strategy, teachers and teacher expectations throughout an academic year play a critical role in fostering these mindsets. Designing an action plan that teaches or reinforces key learning from the research is not enough; the actual design must also leverage adult learning strategies that show strong evidence of success.

70-20-10 model. Adults learn mostly from doing, but there is value on developmental coaching and feedback as well as formal opportunities to learn through periodic training or reading (Center for Creative Leadership, 1996). In a model derived from extensive research in several different industries, the Center for Creative Leadership (CCL) found that approximately 70% of how professionals develop is through job-embedded professional development that stretches their knowledge and skills incrementally; 20% is developed through developmental relationships that lead to formal and informal coaching and feedback; and, 10% develops from formal training such as coursework, professional development sessions, or reading literature. Although there is no definitive research suggesting those exact ratios, a prudent plan seems to be one that considers each of these three components. What is not known is the effect formal training may have if it is designed using strong and moderate evidence-based practices as part of the training; nevertheless, a design that considers each of these components seems most effective. The action plan associated with this study constitutes what CCL would consider the 10%, although it intends to leverage evidence-based practices that could influence or affect the remaining 90% of a professional's learning.

Transtheoretical model of change. Changing teacher practice over time is critical to developing teachers who are better able to nurture growth mindsets in their

students. Changing practice, however, is difficult. One theory originated in the helping

fields such as psychotherapy to consider when developing a plan is the transtheoretical

model of change (TTM). This research builds on a strong research base and suggests that

individuals (e.g. leaders, teachers) differ in their readiness for change: pre-contemplation,

contemplation, preparation, action, and maintenance (DiClemente & Prochaska, 1998).

One-size-fits-all professional development approaches could fail as a result if they do not

consider the individuality of participants' readiness to change. Throughout the action

plan for this study, care is paid to change, how people change, and how to integrate

experiences – to maximize change within a given training and across multiple trainings.

Spaced practice. Adult learning emphasizes the power of spacing out practice

opportunities across numerous sessions, rather than just massed practice. There is strong

research suggesting that practice spread throughout the year will improve any skill

(Brown et al., 2014). The research is strong that although massed practice can lead to

learners perceiving they have developed skills, it is spaced practice – spread at least one

week apart – that leads to the greatest improvements in skills and abilities.

Interleaving and interleaved practice. Quality adult learning provides

opportunities over time to revisit previous learning as part of a training approach that

connects two or more subjects or skills and revisits those skills numerous times, spaced

over several sessions (Brown et al., 2014). Learning from this practice, referred to as

interleaving or spiraling, is different than large amounts of similar practice in that it has

been found to lead to more durable learning. In addition, this approach has been shown

to improve the ability to discriminate between contexts and problems. Given how

contextual mindset can play out with different students at different times in schools, it is

important to develop learning modules that challenge teachers to consider mindset from different contexts in this way.

Coaching and consultation. There is strong evidence that school-based consultants can positively facilitate change in teacher practice (Roach, Kratochwill, & Frank, 2009; Hall & Hord, 2011). These can often be cost-prohibitive efforts, though, as schools are not always able to invest in individuals who coach and consult or in flexible scheduling that allows others to coach and consult in another's classroom. Given the research from CCL on developmental relationships and the strong research about the effectiveness of these efforts, though, it seems prudent to bring coaching and consultation into a yearlong approach.

Feedback. Looking at a large number of effect sizes in educational contexts, the research is clear that a key component of learning is feedback (Hattie, 2012; Hattie & Timperley, 2007). This is true for students, and it is also true for adults (Brown et al., 2012). Feedback will be integrated into the trainings offered throughout the year as part of this plan as well as the ongoing coaching and consultation integrated into the plan. This feedback will be intended to provide "useful information about the effects of an action in light of a goal" (Wiggins, 2014) or will help to motivate someone to progress along the continuum toward changing practice.

Recursive processes in self-affirmation. Social-psychologists have discovered through a weak but growing body of research that interventions can be applied that interrupt a cycle of failure in which mistakes lead to mistakes. These interventions focus on breaking that cycle and often manifest themselves as written prompts (Cohen & Sherman, 2014; Cohen et al., 2009; Yeager & Walton, 2011). There will likely be

teachers as part of this effort who themselves have a fixed mindset; given the challenge teaching presents so many educators, it is possible that those teachers will be unable to nurture growth mindsets in their students if they themselves are struggling. While this intervention will not be utilized universally for all teachers, there will be writing prompts ready for use if it is perceived that they might be helpful.

Nudging. Nudging should also be integrated thoughtfully into the action plan as part of the overall efforts to change teacher practice when necessary but also as a mechanism to reinforce learning from spaced trainings. There is a strong body of evidence gathered through numerous experiments in a number of different fields of study including behavioral science, economics, medicine, and education that suggests small changes in social situations – or nudges – can have large effects on behavior (Thaler & Sunstein, 2008). These can be brief, affordable ways to reinforce learning between trainings. These could include reminders such as text messages, emails, or postcards. These could also take the form of more subtle nudges such as physical groupings during trainings that nudge collaboration and sharing. Integrating nudges into training can help to ensure durable learning and stronger outcomes.

Conclusions

It is clear from the research that there are widening achievement gaps across lines of advantage both in performance and in postsecondary success. As cities and suburban areas change, the dynamics in communities are changing; as communities diversify, those gaps may become more obvious.

It is also clear that in order to close those gaps, expectations must increase for some students. Students who hold an entity theory of intelligence – or fixed mindset –

may give up when the expectations increase while those who hold implicit theory – or growth mindset – demonstrate greater resilience. This is particularly noticeable during key life transitions such as the transition from middle school to high school. Brief interventions that are social-psychological seem to improve performance for some students under some conditions by reducing psychological forces that exist in complex social situations like a classroom or a school.

Mindset interventions in particular show promise as part of a holistic reform effort focused on narrowing performance gaps because they can improve performance for low-performing students and change beliefs and effort. Students with a fixed mindset must learn to see adversity as an opportunity to learn more by trying harder, asking for help, or attempting different strategies. Mindset interventions seem to address both of these areas.

There is much still to learn about the effects of mindset interventions – particularly during the transition from middle to high school in demographically diverse high schools in suburban areas. It is not clear from the research, for example, which specific groups in highly diverse schools are affected the most by these brief mindset interventions. It is also not clear from the research what effects mindset interventions have on groups of different students and their willingness to take on new challenges.

Teachers are present in the lives of students continually during the first semester of high school, and as a result have the ability to nurture a growth or fixed mindset. Paired with any interventions being applied in school must be supplemental and complementary training for teachers. This training should leverage contemporary

research on evidence-based practices for adult learning as well as what is known about

social psychology in general.

Chapter III

Methodology

Achievement gaps continue to widen across lines of advantage – affecting low-income children the most. Reform efforts are being made in classrooms, schools, districts, states, and even at a national level in attempts to improve educational outcomes. Research suggests that one of the most critical factors that lead to long-term success for students is the ability to successfully complete rigorous coursework during high school. Fields such as social psychology identify that successfully completing rigorous coursework requires more than just increased learning standards and performance-focused accountability. During key life transitions, such as the middle to high school transition, many students face psychological forces that affect their resilience and willingness to persist when engaging with challenging coursework. This seems true not just for low-income and minority children, but also for students who struggled academically the previous year. If social psychology can supplement other educational reform efforts and provide affordable and scalable interventions that address these psychological forces, an increasing number of students – particularly low-income and minority children, but also for students who struggled before – may be able to engage with more rigorous coursework and graduate high school more ready academically and psychologically for postsecondary success.

This study attempts to understand the effects of a brief, single psychological intervention focused on teaching students about growth mindset as they transition from middle to high school. Specifically, this chapter describes the method used in a secondary data analysis of a program evaluation conducted during the fall semester of

2014. The original national study (NS) was a student-level, randomized, placebo-controlled double-blind experiment that provided a mindset treatment to some and a placebo to others to see what effects the treatment would have on student performance in math as well as their willingness to seek out challenging material (Yeager et al., 2014). This is an archival data study (AS) of the NS that analyzes the effects of the mindset intervention at one of the high schools, an economically diverse school in a suburban school district in Texas.

Population and Sample

Participants. Researchers in the NS selected schools using a national sampling frame based on the Common Core of Data. Each was a public high school with a 9th grade enrollment totally within a range of 100 and 600 students. The number of students who qualify for special education, are identified as English Language Learners, and who qualify for free or reduced price lunch were not specified in the NS, but the convenience sample of high schools recruited for the pilot NS required that the schools fell within the medium range for poverty indicators (e.g. free or reduced price meals). The percent living below the poverty line in the districts represented by the schools ranged from 5.9% to 41%.

The AS focuses specifically on one of the schools from the NS. The participants in the AS attended a demographically diverse regular public high school in a suburban school district located geographically in the fourth largest city in the United States. The school is located in a predominantly middle-lower class suburban neighborhood where the mean household income of its residents is approximately $50,000 (Been, 2015) in a district with 27.8% of its families living below the poverty line (Yeager et al., 2016). The

samples used both in the NS and AS are described below in Table 1.

Table 1

Participants in NS and AS

Category	Participants in NS	Participants in AS
Sample	N = 3,676 9th grade students	N = 508 9th grade students
Gender	48% female (N = 3,600) 52% male (N = 3,901)	47% female (N = 240) 53% male (N = 268)
Qualify for special education	N/A	7% (N = 36)
Identified as English language learners	N/A	30% (N = 150)
Qualify for free or reduced price meals	N/A	80% (N = 401)
Hispanic/Latino	29%	82%
Black/African American	17%	6%
Native American/American Indian	3%	0%
White, non-Hispanic	30%	9%
Asian American or Other (e.g. multiple racial groups)	21%	3%

Independent Variables

The research design that will be used in this study is an archival data study (AS) of a secondary program evaluation, with IRB approval attained by the Primary Investigator from the University of Houston and the school district to conduct the archival data study. Although the NS was experimental, the AS will be a non-experimental, ex post facto causal comparative analysis. The AS will focus in depth on one of the nine pilot high schools selected to participate in the original national study. The purpose of this chapter is to describe relevant aspects of the NS as well as an in-depth description of the AS.

The analysis that will be conducted in this AS is intended to understand in more depth the answers to two questions that could hopefully help schools and school districts

enhance their efforts to improve performance and the willingness in students to tackle rigorous coursework even when faced with difficulty. First, how does a single mindset intervention improve performance in math grades for economically diverse 9th graders during the critical transition from middle school through their first semester of high school? Second, what effects do these same interventions have on student beliefs about effort and a willingness to seek challenges?

Analysis of each research question will included identical independent variables, but the dependent variables are different. These independent variables will include FARM status, prior achievement during the previous academic year, and whether or not a child was a poor performer the previous academic year. Students' race and ethnicity and English language learner status are covariates in this study that are not included in the analysis but are worth considering in further research.

Free and reduced meals (FARM). Although the effects of mindset interventions have been studied extensively in a number of contexts, one area that has not been studied as consistently is the effects these interventions have on students living in poverty. Recent research conducted with a national sample of 10th graders in Chile, in particular, indicates that mindset may temper the effects of poverty on academic achievement (Claro et al., 2016). For this study, the variable used to analyze relative levels of poverty is derived from income eligibility for 9th grade free and reduced meals program (FARM). Families complete school meal applications at the beginning of the school year as part of registration, and student eligibility is based on a formula that includes federal poverty guidelines, income, and household size (U.S. Department of Agriculture, Food and Nutrition Service, 2014).

Race and ethnicity. The effects mindset interventions have on students of various races and ethnicities also has also not been studied in depth – particularly in diverse high schools whose demographics have changed significantly in the last several years. Race and ethnicity in schools are determined by parental reporting at the beginning of a school year during the registration process. In this study, students were categorized through the schools as Asian, Black or African American, Hispanic or Latino, American Indian or Alaska Native, Multi-Racial, Native Hawaiian or Pacific Islander, White, or Other (Yeager et al., 2016). Although this study will not address the effects of the intervention on different races and ethnicities, further study should be done to better understand the effects.

English language learner (ELLs). Texas statute describes students with limited English proficiency, or English language learners (ELLs), as a student whose primary language is other than English and whose English language skills are such that the student has difficulty performing ordinary classwork in English. (Texas Education Code). This study does not address the effects of the intervention on ELLs, but further study should be done to understand the effects.

Prior achievement. To determine the effects of the mindset intervention on students in 9th grade, it is necessary to compare performance in 9th to prior performance. This AS uses the z-scored composite used in the NS to describe 8th grade prior achievement variable, which is one used in prior intervention experiments with incoming 9th graders (e.g. Yeager, Johnson, et al., 2014). This variable was an average of 8th grade GPA in core classes and 8th grade state test scores. The researchers used this, but adjusted it to accommodate for potential differences across cities and states.

First, the researchers z-scored 8th grade core subject GPA (Math, Science, and English; Range: 0 to 4.0) and state test scores to create a mean of zero and an *SD* of 1 *within each school*. This was done to remove the mean from each school.

Second, the researchers tested whether adding fixed effects for school to statistical models changed results. They did this because there was some missing 8th grade data that could not be produced for 9th graders. Because this missing data could have affected low achievers in 8th grade differently, the researchers did not exclude those students to avoid affecting moderation tests. Instead, they used a third, self-reported measure of prior achievement, assessed at Time 1: "Thinking about your skills and the difficulty of your classes, how do you think you'll do in math in high school? (Response options: 1 = Extremely poorly, 2 = Very poorly, 3 = Somewhat poorly, 4 = Neither well nor poorly, 5 = Somewhat well, 6 = Very well, 7 = Extremely well). This item was the baseline moderator of a brief intervention in prior research (Hulleman & Harackiewicz, 2009). It too was z-scored. The final prior achievement composite was an un-weighted average of the three measures that have been used as the prior achievement variable in prior experiments: 8th grade GPA, 8th grade test scores, and pre-treatment expectancies for academic success. It had a mean of 0 and an *SD* of 1 in the full sample (Yeager et al., 2016).

Previous poor performance. The researchers in the NS created a dichotomous variable to differentiate between students who were previously poor performers in 8th grade (1 = an average GPA of D+ or below) and those who were not (0 = GPA of C- or higher). This will be used in the AS to determine the effects of the intervention on students who previously performed poorly in school. Prior research suggests that grades

will improve with social-psychological interventions by preventing previously low-performing students from doing worse during life transitions (Cohen et al., 2009; Paunesku et al., 2015; Wilson & Linville, 1982; Yeager, Purdie-Vaughns, et al., 2014; Yeager et al., 2016).

Dependent Variables

The first research question will consider three different effects of the intervention – on a child's mindset (growth or fixed), academic performance measured by 9th grade GPA as compared to 8th grade prior performance, and a child's willingness to seek out challenges. The second research question will consider the effects, moderated by poverty. The third research question will look at the same effects, specifically for students who were previously low performers.

Growth or fixed mindset. The first dependent variable that will be considered is whether students maintain a fixed mindset or develop a growth mindset about talent and intelligence as a result of the intervention.

Academic Performance (9th grade GPA). In addition to mindset, change in academic performance will also be considered. To assess this change, researchers in the NS collected final grades for the end of the first semester of 9th grade and converted those grades to a 0 to 4.33 scale. These courses were coded to determine whether they were or were not core courses, and then grades in the core subjects were averaged. When students were enrolled in multiple courses in the same subject (e.g. both Algebra and Geometry), the student's grades were both averaged, with the composite averaging into their final grade (Yeager et al., 2016).

Challenge-seeking behavior. Students will be offered a hypothetical scenario in which they are given the choice between trying an easy review or a hard challenge, both for equal points. This hypothetical scenario is an extension of previous research seeking to understand student beliefs about effort and challenge-seeking behavior (Blackwell et al., 2007; Mueller & Dweck, 1998).

Instruments

Fixed or growth mindset. The researchers used the same three survey items at Time 1 and Time 2 to assess student growth and fixed mindsets: "You have a certain amount of intelligence, and you really can't do much to change it," "Your intelligence is something about you that you can't change very much," and "Being a "math person" or not is something that you really can't change. Some people are good at math and other people aren't." (Response options: 1 = Strongly disagree, 2 = Disagree, 3 = Mostly disagree, 4 = Mostly agree, 5 = Agree, 6 = Strongly agree). These responses were averaged into a single scale both at Time 1 and Time 2. Higher values corresponded to greater levels of fixed mindsets (Yeager et al., 2016).

Challenge-seeking: hypothetical scenario survey. Student beliefs about effort and challenge-seeking behavior was assessed in the NS by offering participants with a scenario that forced a choice between an easy task they would not learn from and a challenging task they might learn from. This was an extension of measures used in previous research (Blackwell et al., 2007; Mueller & Dweck, 1998). Specifically, students were presented with this scenario:

Imagine that, later today or tomorrow, your math teacher hands out two extra credit assignments. You get to choose which one to do. You get the same number

of points for trying either one. One choice is an easy review—it has math problems you already know how to solve, and you will probably get most of the answers right without having to think very much. It takes 30 minutes. The other choice is a hard challenge—it has math problems you don't know how to solve, and you will probably get most of the problems wrong, but you might learn something new. It also takes 30 minutes. If you had to pick right now, which would you pick?

Participants were given two choices (1 = The easy math assignment where I would get most problems right, 0 = The hard math assignment where I would possibly learn something new). Higher values corresponded to the avoidance of challenge, and so this measure should be positively correlated with fixed mindset and be reduced by the mindset treatment (Yeager et al., 2016).

Procedures

School recruitment and training. In the NS, the research firm obtained permission to work with schools through district superintendent offices. Schools designated either one or two School Coordinators, who were then trained by the research firm prior to the first online session with students, with exposure to a training manual that was approximately 56 pages long. The training included how to use the online system, pre-loading class- and student-level information, scheduling computer resources for intervention delivery, and following up with appropriate students to complete make-ups after each session. School Coordinators were responsible for ensuring that students completed the two online sessions within the appropriate windows of time for the interventions. In addition, School Coordinators provided two sets of students' records to

the researchers (Yeager et al., 2016). The principal of the school in the AS selected two School Coordinators.

Schools received $1,000 school award upon commitment to participate. Schools received individual school reports that described benefits (if any) from the program. Schools also received the mindset treatment at no cost to use however they saw fit (Yeager et al., 2016). In addition to these benefits offered to every school, the Primary Investigator for the school in the AS visited the school and gave a lecture about mindset and its applicability in classrooms, schools, and other contexts.

Intervention improvement. The mindset treatment used in the NS and AS was a revised version of previous mindset treatments used in other research. The so-called "old" treatment included a four-page scientific article that students read, titled "You Can Grow Your Intelligence" (Blackwell et al., 2007). In addition, students generated a personal example of learning and getting smarter and wrote a letter encouraging a future student who may be struggling in school not to feel "dumb" (see Aronson et al., 2002), coined the "saying-is-believing" exercise (Walton & Cohen, 2011; Walton, 2014). Prior to the NS, this treatment underwent extensive revision using a design thinking process to improve its effectiveness (Yeager et al., 2016).

The revision process entailed two different but related procedures. The first was a procedure emphasizing user-centered design. Researchers engaged in a number of different qualitative tests with 9th graders – sometimes one-on-one, sometimes in groups of 5 to 20, and sometimes in groups of 20-25 – to test the effectiveness of different aspects of the intervention. The tests allowed the researchers to adjust a number of factors including text formatting, the amount of information per page, and even which

celebrities and role models were quoted as part of the intervention. The second aspect of the revision process leveraged approximately one dozen causal, random-assignment experiments that tested minor revisions to the content in an attempt to improve the treatment. Through this work, the researchers changed both *the mindset message* and the *techniques for internalization* of the mindset message (Yeager et al., 2016).

Changes to the mindset message. According to the NS researchers, in order to increase the effectiveness of the mindset intervention, the researchers adjusted the "old" mindset message in two ways. The first way built on research suggesting that the old treatment over-emphasized "hard work" as the opposite of one's raw ability – that simply working hard without changing the approach one takes to doing something or asking adults for help was enough. This aspect of the mindset message changed because researchers wanted to emphasize that learning happened after changing strategies and asking for help, not simply trying harder at the same strategy. In addition, the researchers found in some students that a stigma was attached to needing to ask for help or trying new strategies (Yeager et al., 2016).

The second way the old mindset changed is that researchers emphasized pro-social reasons to adopt a growth mindset. The old mindset message seemed to over-emphasize independence (i.e. "*You* can grow *your* intelligence") and under-emphasized interdependence – what researchers saw as a communal value that may be especially meaningful for students in lower social classes (Stephens et al., 2014; also see Hulleman & Harackiewicz, 2009). The new treatment emphasized pro-social reasons to adopt a growth mindset such as "People…use the mindset to learn in school so they can give back to the community and make a difference in the world later (Yeager et al., 2016)."

Changes to increase internalization. In addition to changing the actual message in these ways, the researchers in the NS made four distinct adjustments to the old treatment to increase the likelihood that participants would internalize it. First, they added a *descriptive norm* (Cialdini et al., 1991) such as "People everywhere are working to become smarter. They are starting to understand that struggling and learning are what put them on a path to where they want to go." Second, the researchers adjusted the treatment to leverage the evidence-supported notion that adolescents in particular tend to react to adult control, or adolescent *reactance* (Brehm, 1966; Erikson, 1968; Hasebe, Nucci & Nucci, 2004; Nucci, 1996). The intervention, to this end, includes a story from an older student that begins:

"I hate how people put you in a box and say 'you're smart at this' or 'not smart at that." After this program, I realized the truth about labels: they're made up. … now I don't let other people box me in … it's up to me to put in the work to strengthen my brain."

Third, new and more contemporary and relevant celebrities and role models were used to emphasize how a growth mindset can be effective. The researchers selected quotes from Scott Forstall, developer of the first iPhone at Apple, and one of LeBron James's basketball coaches to emphasize that a growth mindset can lead to better outcomes and stronger performance. Finally, the new mindset treatment increased the number of opportunities for participants to customize the intervention. The final page of the second session, for example, asks "what are one or two steps you can take in your classes now to get on [the growth mindset] path? We'll share your ideas with next year's students." The intent behind this specific adjustment was to increase internalization

through dissonance processes (Aronson, 1999) but also to increase the likelihood that the belief will transfer to different academic challenges over the year (Schwarz et al., 2011; Yeager et al., 2016).

Intervention delivery. Students in the NS participated in two different online sessions (Time 1 and Time 2) conducted at the school, during regular class periods, in a school computer lab or classroom. Each of these lasted approximately one class period. The sessions were scheduled and administered by each school, with the expectation that they be administered 1-4 weeks apart and conducted within the first 10 weeks of the school year. Each school in the NS administered the sessions on different dates due to regional differences in school start date and campus-based convenience. Sessions consisted of survey questions, brief educational readings, and targeted writing exercises.

Students were assigned randomly to a treatment or control group. Students heard a standardized script at the start of each computer session before entering a passcode identifying their school and logging in using their first and last names (data which was later de-identified). During the interventions, students wore headphones for two research purposes – in part to help English language learners so that they did not require text read to them, and also because the researchers believed that headphones increased student engagement with the content (Yeager et al., 2016).

In the NS, Time 1 took an average of 24.3 minutes. Hispanic/Latino students took an average of 2.2 minutes longer than other students, presumably because they were more likely to be English language learners and they opted into having all the text to be read to them by the software. Time 2 took an average of 17.95 minutes. Similarly, Hispanic/Latino students took 1.95 minutes longer (Yeager et al., 2016).

In the AS, students were assigned randomly to the control and treatment groups. They completed the online sessions during regular class time for approximately 45 minutes on September 18, September 25, or October 2, 2014 (Time 1) and October 9, 23, and 30 (Time 2). During both sessions, students logged into the online sessions and were directed to treatment or control activities.

Fidelity. The researchers in the NS pointed to three distinct measures that suggested a high fidelity of implementation. The first reflected exposure to and completion of responses in the treated and control groups – did students see and complete the same amount of information? Approximately the same percentage of questions were answered by the treated and control groups during Time 1 and 2, and the percentage of online screens seen both in the treated and control groups in Time 2 was similar. Second, students in both conditions reported no differences in levels of distraction. Third, the researchers surveyed to determine if there were differences in how interesting students perceived the material in the treated and control groups. Although the researchers had been concerned that the control group might find scientific facts about the brain less interesting, the control group reported that they were more interested in their content than the treatment group (Yeager et al., 2016).

Given the alignment between control and treatment groups in the NS, additional data analysis for the AS was not conducted to assess fidelity of implementation.

Fidelity measures. Researchers examined implementation fidelity across conditions by asking students to report on distraction in the classroom, both *peers'* distraction ("Consider the students around you... How many students would you say were working carefully and quietly on this activity today?" Response options: 1= Fewer than

half of students, 2 = About half of students, 3 = Most students, 4 = Almost all students, with just a few exceptions, 5 = All students) and one's *own distraction* ("How distracted were you, personally, by other students in the room as you completed this activity today?" Response options: 1 = Not distracted at all, 2 = Slightly distracted, 3 = Somewhat distracted, 4 = Very distracted, 5 = Extremely distracted) (Yeager et al., 2016).

In addition, researchers in the NS surveyed participants in the treatment and control conditions to determine how *interesting* the materials were ("For you personally, how interesting was the activity you completed in this period today?" Response options: 1 = Not interesting at all, 2 = Slightly interesting, 3 = Somewhat interesting, 4 = Very interesting, 5 = Extremely interesting), and how much they *learned* from the materials ("How much do you feel that you learned from the activity you completed in this period today?" Response options: 1 = Nothing at all, 2 = A little, 3 = A medium amount, 4 = A lot, 5 = An extreme amount). This helped researchers investigate for a possible confound in the results (Yeager et al., 2016).

Random assignment. In the NS, random assignment to condition was effective. There were no differences between conditions in terms of demographics (gender, race, and ethnicity) or in terms of prior achievement within any of the 9 schools or in the full sample. There were also no pre-treatment differences between conditions in terms of fixed mindset (Yeager et al., 2016).

Data Analysis

Although further study should be done to more thoroughly understand the effects mindset interventions could have on different races and ethnicities as well as English

language learners, this study seeks to answer three key questions about mindsets that can inform a more customized reform strategy. Understanding for whom and under what conditions different interventions are useful will help to shape this customization. The questions in this study are these:

1. How does a single mindset intervention increase growth mindset, improve academic performance, and impact a child's willingness to seek out challenges?

2. Does a child's level of poverty moderate the effects of this mindset intervention?

3. If students were previously low-performers in 8th grade, what is the effect of the intervention on their growth mindset, academic performance, and willingness to seek out challenges – depending on whether or not they got the treatment?

If a mindset intervention has positive effects on performance and influences a child's willingness to seek out challenging material instead of giving up or quitting, it follows that a higher percentage would demonstrate the resilience required to succeed under more intense high school academic experiences.

Research question #1. In order to determine the effects of the intervention on student performance and glean insights that could potentially turn into practical actions at scale for schools and school systems, the AS will analyze performance in a few ways. First, the AS will determine the effects of the mindset intervention on students who demonstrated a fixed and growth mindset before and after the intervention. From this, an analysis will be conducted to determine the effects on academic performance during the first semester in 9th grade as compared to 8th grade performance to identify trends in overall performance between the treated and control groups. In addition to mean performance, descriptive statistics will be used to determine standard deviations,

minimum and maximum values, and evaluate differences over time and by group. To gather greater understanding of the specific effects in a diverse school, repeated measures General Linear Model ANOVA analyses will be computed to determine changes in performance scores over time and any changes over time that are moderated by FARM status. In addition to mean performance, a secondary analysis will be conducted to determine the effects on performance for students who were low-performers the year before.

Research question #2. In order to determine what effect on challenge-seeking behavior this intervention might have on students who do or do not qualify for FARM, a similar repeated measures General Linear Model analysis will be used to determine changes in academic performance over time and any changes over time that are moderated by FARM status.

Research question #3. In order to determine what effect on challenge-seeking behavior this intervention might have on students who do or do not qualify for FARM, a similar repeated measures General Linear Model analysis will be used to determine changes in academic performance over time and any changes over time that are moderated by FARM status.

Chapter IV

Results

The purpose of this study was to identify the effects of a brief, cost-effective mindset intervention on first-time 9th graders on their mindset, academic performance, and willingness to seek challenges in the future. Students engaged with the intervention after their transition from middle to high school and were all enrolled in an economically diverse high school in a suburban community. As schools and school systems develop comprehensive educational reform efforts that address short- (e.g. academic performance) and long-term (e.g. postsecondary completion) gaps, developing a greater understanding of who benefits from these interventions could complement existing reform efforts.

This study is an archival data study (AS) of a secondary program evaluation, conducted on first-time 9th graders attending one of the original pilot high schools in a national study (NS), conducted during the first semester of the Fall of 2014 (Yeager et al., 2016). The statistical analyses of three key research questions were conducted by SPSS® version 24. This chapter includes a description of the participants in the sample as well as descriptive statistics of participants, followed by data analysis and results by research question. A subsequent summary of all outcomes is provided.

Research questions

This study seeks to build on previous research by understanding more deeply for whom and under what conditions this intervention has effects on a number of factors that are important to the transition from middle to high school. The research questions are these:

1. How does a single mindset intervention increase growth mindset, improve academic performance, and impact a child's willingness to seek out challenges?

2. Does a child's level of poverty moderate the effects of this mindset intervention?

3. If students were previously low-performers in 8th grade, what is the effect of the intervention on their growth mindset, academic performance, and willingness to seek out challenges – depending on whether or not they got the treatment?

Participants in the Sample

The participants in this sample attended one of the high schools selected in a sample of convenience as part of a pilot national study (NS). This study is an archival study (AS) of that national pilot. Demographics in the NS did not include the number of students qualifying for special education, identified as English Language Learners, or the number who qualified for free or reduced price lunch as a measure of socioeconomic status, but the schools recruited for the pilot NS all fell within the medium range for poverty indicators (e.g. free or reduced price meals) and included at least moderate representation of students of color (Yeager et al., 2016).

The students in the AS attend a demographically diverse regular public high school in a suburban school district within the fourth largest city in the United States. The school is located in a predominantly middle-lower class suburban neighborhood where the mean household income of its residents is approximately $50,000 (Been,

2015). The demographics of the students in the school (Texas Education Agency

Division of Performance Reporting, 2015) are listed in Table 2.

Table 2

Demographics of Sample in AS

Category	High School
Gender	N/A
Qualify for special education	N/A
Identified as English language learners	21%
Qualify for free or reduced price meals	77%
Hispanic/Latino	79%
Black/African American	6%
Native American/American Indian	1%
White, non-Hispanic	11%
Asian American or Other (e.g. multiple racial groups)	3%

Note. N = 2,117 students

Descriptive Statistics

Descriptive statistics were used to describe the sample in the AS. The sample

reflects the students assigned randomly either to the treatment or control group as part of

the NS.

Demographics

Sample. The sample consists of 508 first-time 9th grade students attending the

same high school in a demographically and economically diverse suburban community.

Gender. Although a larger number and percentage of the students participating

in the AS were male, the variance is relatively small. This is reflected in Table 3.

Table 3

Gender in AS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	F	240	47.2	47.2	47.2
	M	268	52.8	52.8	100.0
	Total	508	100.0	100.0	

Special Education (SPED). Thirty-six students participating in the AS qualified

for Special Education, which is 7.1% of the overall sample. This is reflected in Table 4.

Table 4

Special Education in AS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not SPED	472	92.9	92.9	92.9
	SPED	36	7.1	7.1	100.0
	Total	508	100.0	100.0	

English language learners (ELL). Slightly less than one-third of the sample (N

= 150, or 29.5%) was labeled an English Language Learner, as reflected in Table 5.

Table 5

English Language Learners in AS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	ELL	150	29.5	29.5	29.5
	Not ELL	358	70.5	70.5	100.0
	Total	508	100.0	100.0	

Qualify for free or reduced-price meals (FARM). A child's socioeconomic

status was measured using whether or not the family qualified for free or reduced-price

meals (FARM). In the AS, a high percent of the students in the sample qualified for

FARM (N = 401, or 78.9%). This is worth noting because this study sought out to study

the effects of a mindset intervention on students living in poverty, and the relatively large number of students in the sample living in poverty could make any analysis less conclusive. This data is reflected in Table 6.

Table 6

Free or reduced-price meals in AS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	FARM	401	78.9	78.9	78.9
	Not FARM	107	21.1	21.1	100.0
	Total	508	100.0	100.0	

Race and ethnicity. Race and ethnicity were not considered as part of this analysis, but further research may consider the effects of mindset treatments on a number of factors affecting races differently. It is worth noting that the sample analyzed in the AS reflected a diverse 9th grade class. The largest race and ethnicity reflected was Hispanic/Latino students (82%), although other races were reflected in the sample. It is not clear if there would be noticeable differential effects of the intervention if that could be assessed across race and ethnicity. Given the large percent of students that identify as Latino/Hispanic in this study, comparisons for this variable and the dependent variable were not computed. The demographic breakdown follows and is reflected in Table 7.

Table 7

Race and ethnicity in AS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Asian	13	2.6	2.6	2.6
	Black/African American	30	5.9	5.9	8.5
	Hispanic/Latino	415	81.7	81.7	90.2
	Other	2	.4	.4	90.6
	White	48	9.4	9.4	100.0
	Total	508	100.0	100.0	

Intervention. Students in the NS and the AS were assigned randomly to the
control group or the treatment mindset intervention group. Within the sample, nearly
identical numbers of students were assigned to each group, as reflected in Table 8.

Table 8

Control and mindset intervention in AS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Control	256	50.4	50.4	50.4
	Mindset Intervention	252	49.6	49.6	100.0
	Total	508	100.0	100.0	

Scale variables. The following are the descriptive statistics for the scale
variables used in the AS (see Table 9). Included in these scale variables are the relative
level of fixed mindsets at Times 1 and 2, a z scored academic index measuring prior
performance, and a z scored academic index measuring academic performance in 9th
grade.

Table 9

Scale variables in AS

	N	Minimum	Maximum	Mean	Std. Deviation
Time 1 Fixed Mindset	507	1.00	6.00	3.22	1.15
Time 2 Fixed Mindset	508	1.00	5.33	2.87	.85
8th Grade Academic Index	508	-2.35	2.23	.01	.54
9th Grade Academic Index	505	-1.82	1.53	.07	.78
Valid N (listwise)	504				

Challenge-seeking. The following are the descriptive statistics for challenge
seeking status after the intervention was administered (see Table 10).

Table 10

Post challenge-seeking status in AS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Challenge Seeking	231	45.5	47.0	47.0
	Not Challenge Seeking	260	51.2	53.0	100.0
	Total	491	96.7	100.0	
Missing	System	17	3.3		
Total		508	100.0		

Data Analysis

This study is an archival data study (AS) answers the three questions listed above using data from one diverse high school selected from a national pilot study (NS) consisting of high schools across the country piloting a growth mindset intervention (Yeager et al., 2016).

Question 1: How does a single mindset intervention increase growth mindset, improve academic performance, and impact a child's willingness to seek out challenges?

Effects on mindset. The mindset intervention increased the growth mindsets of students overall. Student mindset was assessed at two points in time to determine the level of fixed mindset for the sample, with higher values corresponding to a higher level of fixed mindset. The distribution of mindset scores is provided in Figure 1 at pre-test and Figure 2 at post-test. Generally, mindsets about learning improved – shifting from fixed to growth mindsets. Before the mindset treatment, most of the students tended toward the middle of the distribution curve, distributed fairly evenly between from 1 (high growth mindset) to 6 (high fixed mindset) – with a Mean of 3.22 and a standard deviation of 1.146. After the mindset treatment, a higher number of students developed a

growth mindset (Mean = 2.87), concentrated more closely with a lower standard deviation (0.845).
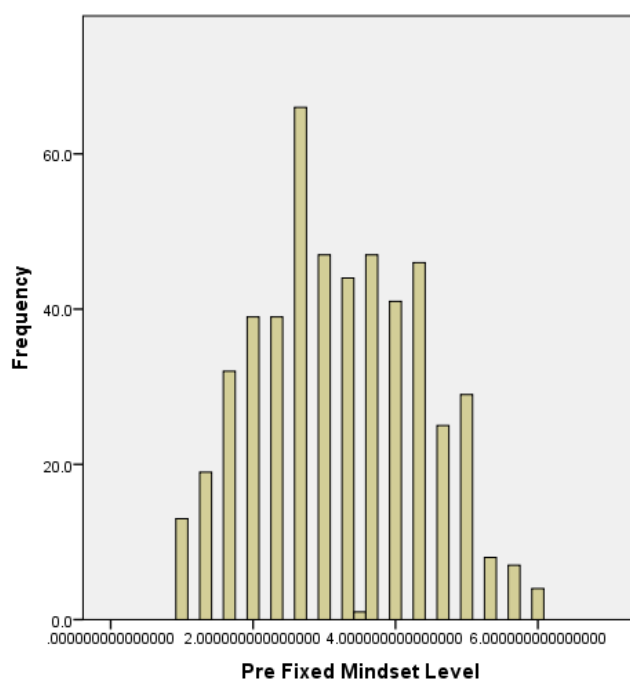

Figure 1. Frequency of mean fixed mindset levels at Time 1 (higher number correlating to higher levels of fixed mindsets).
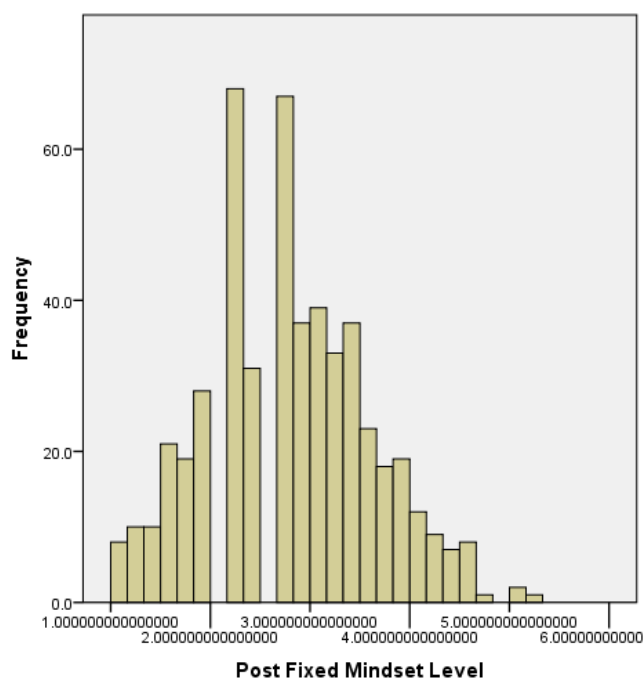

Figure 2. Frequency of mean fixed mindset levels at Time 2 (higher number correlating to higher levels of fixed mindsets)

To assess whether or not mindset changed over time and by treatment, a General

Linear Models Repeated Measures MANOVA was computed (see Table 11). Of the 508

students in the sample, 252 were assigned randomly to the treatment, while 256 were

assigned to the control group. Results of this procedure identified a significant

interaction between mindset scores over time and by treatment level. Wilks' Lambda

was used as the multivariate criterion and resulted in a value of $F(1, 505) = 24.78$, p

$= .00$.

Table 11

Mindset over time

Effect		Value	F	Hypothesis df	Error df	Sig.
Time	Wilks' Λ	.913	48.155	1.000	505.000	.000
Time * Mindset Intervention	Wilks' Λ	.953	24.784	1.000	505.000	.000

Subsequent analysis revealed that mindsets improved over time for both control

and mindset intervention groups at post-test, but the significant interaction was noted for

the treatment group. Means for both groups were plotted over time and are provided

below in Figure 3. The graph reflects the mean mindset scores before and after the

intervention by control and treatment groups. This graph clearly shows a reduction in the

level of fixed mindsets and thus increased growth mindsets for both groups, with the

largest reduction in fixed mindsets of the treatment group – a reduction of more than 8%
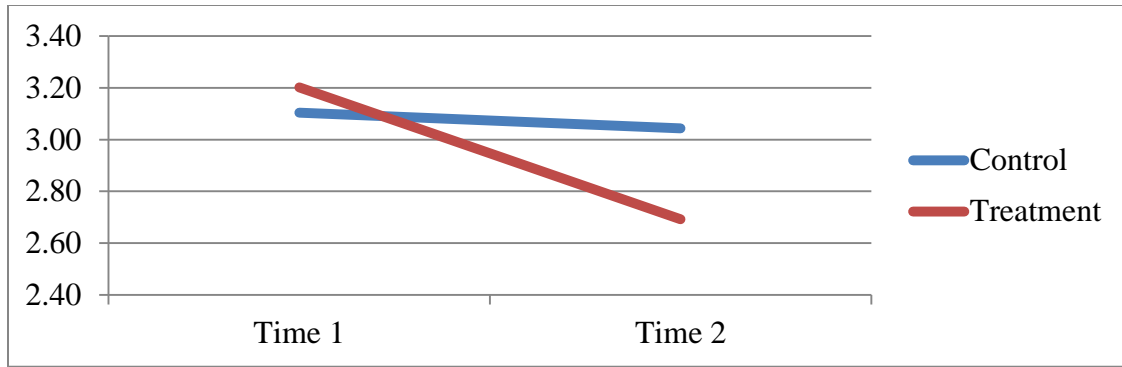
on the 6-point mindset scale.

Figure 3. Level of fixed mindsets before and after the intervention.

Effects on academic performance. In order to assess whether or not the mindset treatment had significant effects on academic outcomes, a General Linear Models Repeated Measures ANOVA was computed. Wilks' Lambda was used as the multivariate criterion and resulted in a value of F (1, 503) = 2.21, *p* = .14 (see Table 12). Results of this procedure identified that academic performance did not change significantly over time and did not interact with mindset. Specifically, those who participated in the growth mindset intervention did not have significantly better academic outcomes over time.

Table 12

Effects of mindset treatment on academic outcomes over time

Effect		Value	F	Hypothesis df	Error df	Sig.
Time	Wilks' Λ	.995	2.756	1.000	503.000	.097
Time * Growth Mindset	Wilks' Λ	.996	2.211	1.000	503.000	.138

Effects on challenge-seeking. To assess the effects of the mindset intervention on challenge seeking behavior, challenge-seeking level was cross-classified with mindset treatment. See the results in Table 13 below. Chi-square analyses failed to detect a significant difference at .05 for challenge-seeking in students either in the treatment or

control groups, X^2(1, N = 488) = 3.01, p=.08, as shown in Table 14 below. Given that this is a replication of known effects, p = .08 may be significant as a one-tailed hypothesis.

Table 13

*Group * Post Challenge Seeking Status Cross tabulation*

Count					
		Post Challenge Seeking Status			
Group	Control	125	121	246
	Mindset Intervention	104	138	242
Total		229	259	488

Table 14

Challenge-seeking behavior

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	3.009	1	.083		

Question 2: Does a child's level of poverty moderate the effects of this mindset intervention?

Effects on mindset. In order to assess the interaction that FARM status may have on mindset, mindset by the mindset intervention, mindset by FARM status, and mindset by time, a General Linear Models Repeated Measures MANOVA was computed, with all data captured in Table 15. There was no interaction found between FARM status and mindset outcomes. There is an interaction over time for mindset status and FARM, with a Wilks' Lambda value of F (1, 500) = 3.98, p = .05. This interaction is not related to the mindset treatment and is further addressed below.

Table 15

Interaction between FARM and mindset, mindset by mindset intervention, mindset by FARM status, and mindset by time

Effect		Value	F	Hypothesis df	Error df	Sig.
Mindset	Wilks' Λ	.962	19.745	1.000	500.000	.000
Mindset * Mindset Intervention	Wilks' Λ	.968	16.424	1.000	500.000	.000
Mindset * FARM Status	Wilks' Λ	.992	3.981	1.000	500.000	.047
Time * Mindset Intervention	Wilks' Λ	1.000	.001	1.000	500.000	.980

An interaction between mindset and FARM levels was found, though unrelated to the treatment. In a comparison of mean mindset levels at Times 1 and 2, Figure 4 displays the results for students who do and do not qualify for FARM status. The mean fixed mindsets for FARM students reduced by 0.43 points, a reduction of more than 7%. This means that students developed stronger growth mindsets.
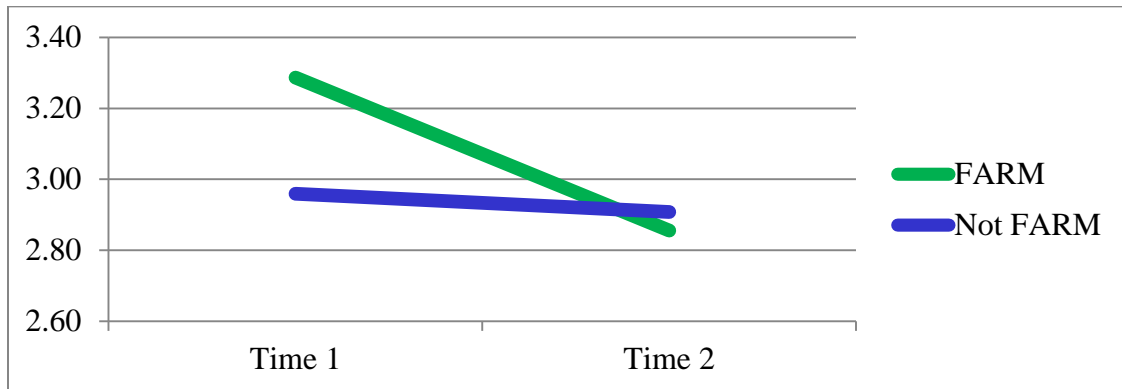

Figure 4. Fixed mindset over time by FARM status.

Effects on academic performance. To assess whether or not the effects of the mindset treatment had significant effects on academic performance over time by mindset and FARM status, a General Linear Models Repeated Measures MANOVA was computed. Results of this procedure identified no significant interaction for academic

performance over time by mindset treatment level and FARM status. Subsequently, changes in academic performance over time by FARM status was explored. Wilks' Lambda was used as the multivariate criterion and a significant interaction for academic performance and FARM status over time was not identified, with the resulting value of F (1, 501) = 7.43, p = 0.01 (see Table 16).

Table 16

Effects of mindset intervention on academic performance by mindset and FARM status

Effect		Value	F	Hypothesis df	Error df	Sig.
Academics	Wilks' Λ	.983	8.604	1.000	501.000	.004
Academics * Mindset Intervention	Wilks' Λ	.995	2.540	1.000	501.000	.112
Academics * FARM Status	Wilks' Λ	.985	7.430	1.000	501.000	.007
Academics * Mindset intervention * FARM Status	Wilks' Λ	.999	.495	1.000	501.000	.482

Although there was no significant interaction for academic performance over time by mindset treatment level and FARM status, there was an interaction in academic outcomes over time for FARM status. Figure 5 displays the mean change in academic performance (z scored, centered at 0) from 8th to 9th grade for students with and without FARM. Grades improved for students with FARM status (0.01) and without FARM status (0.22).
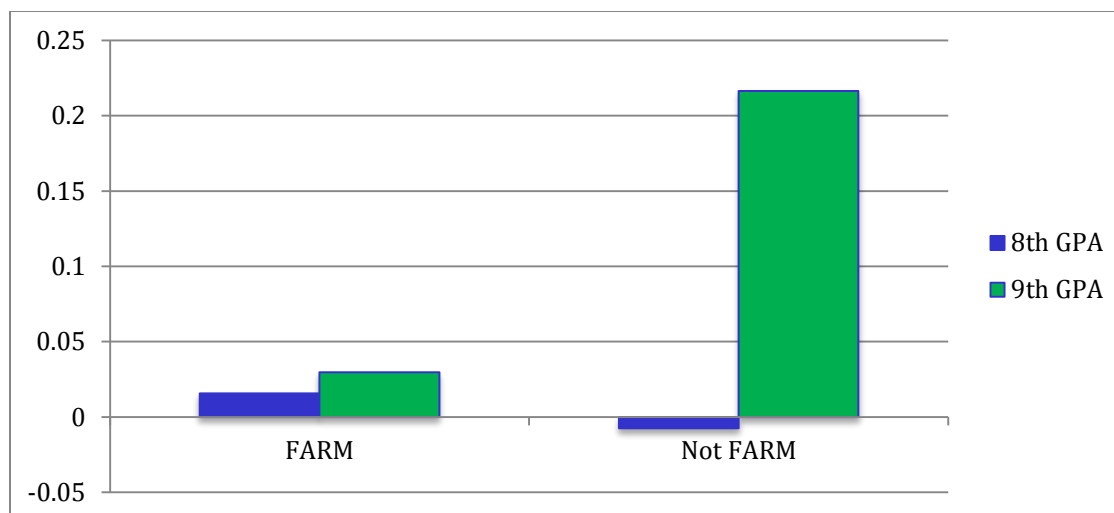
Figure 5. Mean academic performance between 8th to 9th GPA by FARM status.

Effects on challenge-seeking. A chi square analysis was used to determine any differences in challenge seeking by participation in FARM program. Overall, no differences between the groups were determined, X2 = .788, df = 1, p = .375 (see Table 17).

Table 17

Differences in challenge-seeking by FARM status

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	.788	1	.375

The following demonstrates the breakdown of the results of challenge seeking, by FARM status and mindset intervention. There are no significant differences in challenge seeking by FARM for students in the control X^2 (1, N = 247) = 2.920, *p* = .09, or the treatment X^2 (1, N = 244) = .29, p = .59, listed in Table 18.

Table 18

Differences in challenge-seeking, by FARM status

Group		Value	df	Asymptotic Significance (2-sided)
Control	Pearson Chi-Square	2.920	1	.087
	N of Valid Cases	247		
Mindset	Pearson Chi-Square	.290	1	.590
Intervention	N of Valid Cases	244		

Question 3: If students were previously low-performers in 8th grade, what is the effect of the intervention on their growth mindset, academic performance, and willingness to seek out challenges – depending on whether or not they got the treatment?

This question requires analysis associated with whether or not a student was a poor performer in 8th grade. Approximately the same number of students who were not poor performers was assigned to the Control group (N = 194) as the treatment group that received the mindset intervention (N = 181), shown in Table 19. Similarly, approximately the same number of students who were poor performers in 8th grade was assigned to the Control group (N = 61) as the Treatment group (N = 68), also shown below in Table 19.

Table 19

Number of previous poor performers compared to students who were not

8th Grade Academic Status	Group	N
Not Poor Performer	Control	194
	Mindset Intervention	181
Previous Poor Performer	Control	61
	Mindset Intervention	68

Effects on mindset. Mindset levels over time by mindset intervention were contrasted for students who had been identified as poor performers in 8th grade and for

those who had not. The outcomes for the repeated measures General Linear Model

MANOVA for 8th grade students who had been classified as NOT poor performers

identified an interaction for mindset level over time by treatment. F (1, 373) = 25.19, p

= .00, shown in Table 20. When the outcomes for Poor Performers in 8th grade were

analyzed, on the other hand, there was no interaction for mindset level over time by

treatment F (1, 127) = 1.46, p = .23, also shown in Table 20. To determine the nature of

these outcomes, descriptive outcomes are provided in the subsequent box plots.

Table 20

Effects of mindset on previous poor performers in 8th grade

8th Grade Academic Status	Effect		Value	F	Hypothesis df	Error df	Sig.
Not Poor	Mindset	Wilks' Λ	.930	27.912	1.000	373.000	.000
Performer	Mindset * Mindset Intervention	Wilks' Λ	.937	25.187	1.000	373.000	.000
Previous	Mindset	Wilks' Λ	.840	24.149	1.000	127.000	.000
Poor Performer	Mindset * Mindset Intervention	Wilks' Λ	.989	1.460	1.000	127.000	.229

Figure 6 displays the effects of the mindset intervention on students, with higher

mean values corresponding to higher levels of fixed mindsets. The intervention

improved mindsets for both groups of students – those who were classified as poor

performers and those who were not. There was also improvement in mindsets for the

control group of previous poor performers. While it is not clear what accounts for this, a

number of factors could have contributed to this that would require additional qualitative

analysis to understand clearly. Examples that would explain the change include peer

influence, adult influence, and even students paying more care the second time they were surveyed.
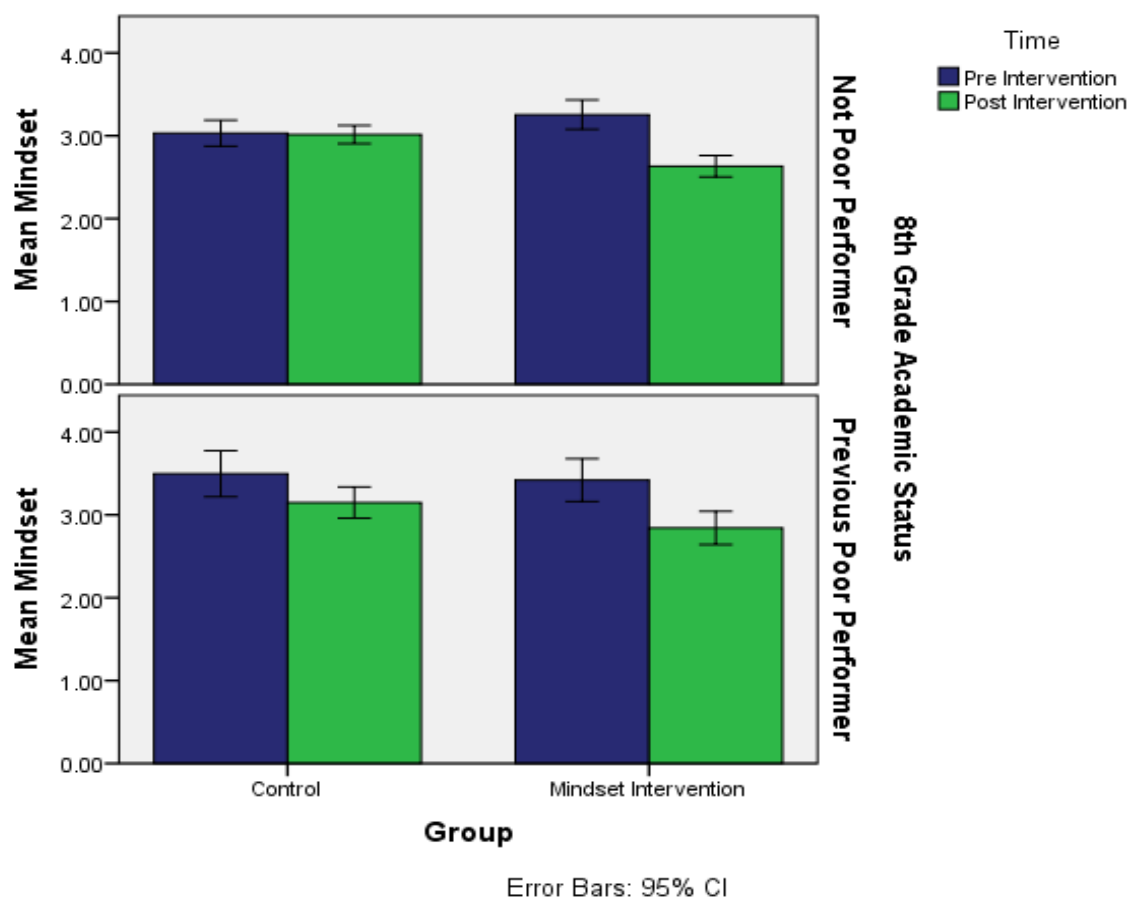
Figure 6. Mean mindset scores over time by prior performance.

Effects on academic performance. The academic performance over time by mindset intervention was contrasted for students who had been identified as poor performers in 8th grade and for those who had not. The outcomes for the repeated measures General Linear Model MANOVA for 8th grade students who had been classified as NOT poor performers identified no interaction for academic outcomes over time by treatment $F(1, 374) = .01$, $p = .92$, and a main effect for time $F(1, 374) = 83.74$, $p = .00$, shown in Table 21. That is, academic performance for this group improved with time. When the outcomes for Poor Performers in 8th grade were analyzed, an interaction

for academic outcomes over time by treatment was identified F (1, 127) = 7.27, p = .01,

also shown in Table 21 below.

Table 21

Effects on academic performance, by previous performance

8th Grade Academic Status	Effect		Value	F	Hypothesis df	Error df	Sig.
Not Poor	Time	Wilks' Λ	.817	83.74	1.000	374.000	.000
Performer	Time * Mindset Intervention	Wilks' Λ	1.000	.010	1.000	374.000	.920
Previous	Time	Wilks' Λ	.370	216.39	1.000	127.000	.000
Poor Performer	Time * Mindset Intervention	Wilks' Λ	.946	7.27	1.000	127.000	.008

Figure 5 below displays the effects of the mindset intervention on academic

performance for those who were and were not previously poor performers. Academic

performance improved for students who were not previously poor performers in both the

control and mindset intervention group, and academic performance decreased for

previous poor performers in both the control and treatment group.
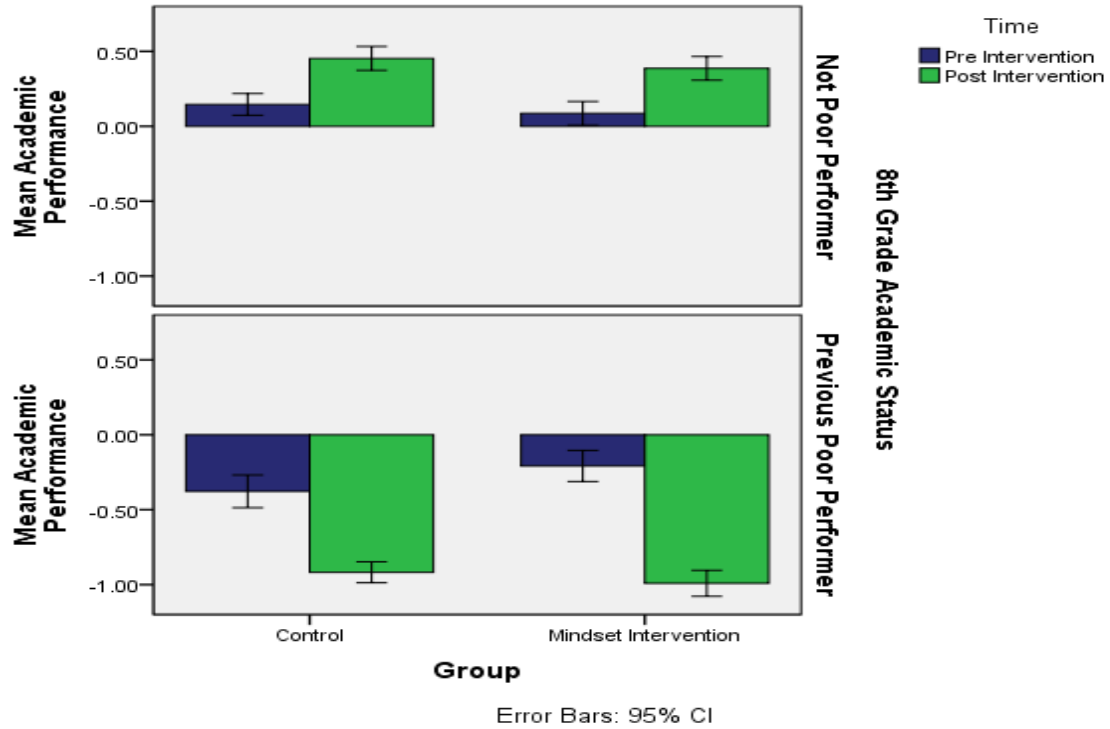
Figure 7. Mean comparison of academic performance at Time 1 and Time 2 of students who were NOT and were previous low-performers.

Effects on challenge-seeking. There were no significant interactions for challenge seeking either for previous poor performers or for those who were not. To assess this, a General Linear Models Repeated Measures ANOVA was computed. Results of this procedure identified no significant interactions for mindset level over time for the two groups by challenge seeking. Wilks' Lambda was used as the multivariate criterion, resulting in a value of F (1, 362) = .79, p = .38 for those who were not poor performers (see Table 22). In addition, Wilks' Lambda was also used as the multivariate criterion for those who were previously poor performers, resulting in a value of F (1, 122) =.18, p = .68 (see Table 22).

Table 22

Effects of mindset on challenge-seeking

8th Grade Academic Status	Effect		Value	F	Hypothesis df	Error df	Sig.
Not Poor Performer	Mindset * Challenge Seeking	Wilks′ Λ	.998	.790	1.000	362.000	.375
Previous Poor Performer	Mindset * Challenge Seeking	Wilks′ Λ	.999	.177	1.000	122.000	.675

Effects on academic performance by challenge-seeking. There is a significant interaction for academic performance over time for the NOT low performing group, by challenge seeking. To assess this, a General Linear Models Repeated Measures MANOVA was computed. Results of this procedure identified no significant interaction. Wilks' Lambda was used as the multivariate criterion, resulting in a value of F (1, 362) = 4.63, p = .03 for those who were not poor performers (see Table 23). There is also not a significant interaction for previously poor-performing students. Wilks' Lambda was also used as the multivariate criterion for those who were previously poor performers, resulting in a value of F (1, 122) = .02, p = .89 (see Table 23).

Table 23

Effects on academic performance by previous performance and challenge-seeking

8th Grade Academic Status	Effect	Wilks′ Λ Value	F	Hypothesis df	Error df	Sig.
Not Poor	Academics	.794	93.864	1.000	362.000	.000
Performer	Academics * Challenge Seeking	.987	4.630	1.000	362.000	.032
Previous	Academics	.376	202.509	1.000	122.000	.000
Poor Performer	Academics * Challenge Seeking	1.000	.020	1.000	122.000	.888

In addition to these results, Figure 8 below shows the mean results for GPA over time by prior performance and challenge seeking. The academic performance of students who were not poor performers in 8th grade improved – whether or not they were willing to seek challenges. The academic performance of students who were previously poor performers who were or were not willing to seek out challenges, on the other hand, worsened.
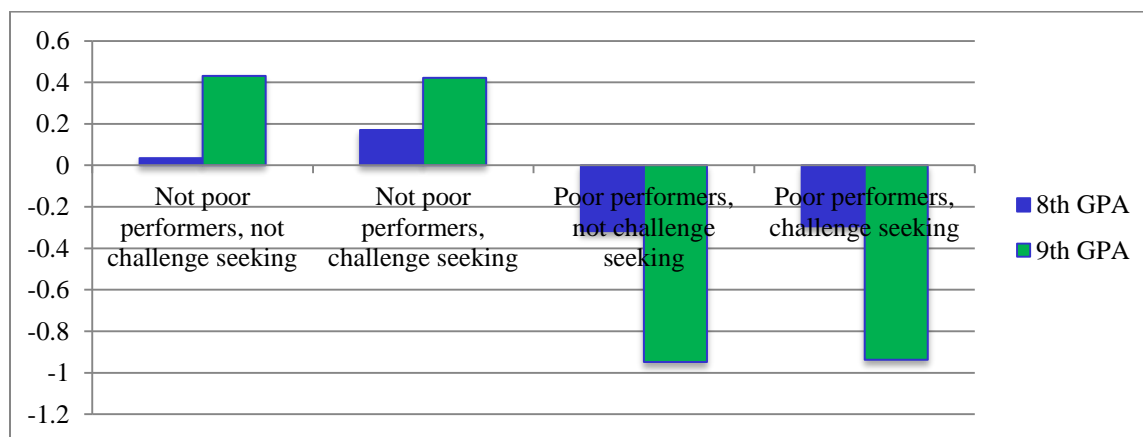

Figure 8. Mean academic performance by prior performance and challenge-seeking.

Summary

This study answered three questions related to the effects of a brief mindset intervention on a number of factors. First, how does a single mindset intervention increase growth mindset, improve academic performance, and impact a child's willingness to seek out challenges? The results varied. Overall, the mindset intervention improved growth mindsets of students, shifting from fixed to growth mindsets. Academic performance did not interact with mindset or change significantly over time. Further study would need to be done to determine if challenge-seeking showed a significant interaction as a one-tailed hypothesis given that this was a replication of known effects.

The second question this study answered is this: does a child's level of poverty moderate the effects of this mindset intervention? Knowing more about the relationship between poverty levels and mindsets is important as schools and school systems serving diverse student bodies consider when and for whom to administer interventions such as this. There was no interaction found between FARM status and mindset outcomes, and there was also no interaction between FARM status and mindset over time. There was an interaction over time for mindset status and FARM, but it was not related to the mindset treatment. Mindsets improved of students qualifying for FARM status by 7%.

Future research will want to consider the long-term effects of this mindset intervention because there was no significant interaction in this study identified on academic performance over time by mindset treatment level and FARM status, for academic performance over time by mindset treatment level and FARM status, or in challenge seeking by participation in FARM; effects could show up later, though. There was an interaction in academic outcomes over time for FARM status – in this case gains in academic achievement for students who do not qualify for FARM status.

Last, if students were previously low-performers in 8th grade, this study sought to understand the effects of the intervention on their growth mindset, academic performance, and willingness to seek out challenges – depending on whether or not they got the treatment? There was an interaction between mindsets and students that were not poor performers, but there was no interaction for previous poor performers despite improvement in mindsets overall for both groups of students. In addition to these effects, there was also an interaction in academic performance both for those who were not poor performers and those who were; the effects were not predicted, though. In the study,

academic performance improved for those who were not previously low-performers and declined for those who were.

There were no significant interactions for challenge seeking either for previous poor performers or for those who were not, but there was a significant interaction for academic performance by challenge seeking over time students for students who were not low performing. There is different than previous low-performers, for whom there was no significant interaction. Interestingly and counter to what was predicted, the academic performance of students who were not poor performers before actually improved – whether or not they were willing to seek out new challenges. The academic performance of students who were previously poor performers (regardless of whether or not they were willing to seek challenges), on the other hand, decreased. This also warrants future study, as there may be effects for previous poor performers over time that would not be noticeable within the first semester.

Summary of Results

Summary

Academic readiness and postsecondary achievement gaps in public education

exist and continue to widen across lines of advantage – from performance on

standardized test scores to postsecondary enrollment and completion rates (Bailey &

Dynarski, 2011; Cahalan & Perna, 2015; Mortenson, 2010; Reardon, 2011; Reardon et

al., 2016). These widening gaps pose moral, social, and economic implications.

Although no single educational reform effort provides a panacea, a number of examples

at the classroom, school, community, and state level that focus on increased academic

expectations and approaches to governance that prioritize local empowerment with clear

accountability show promise in some places at narrowing short- and long-term gaps

(Chalkbeat Tennessee, 2015; Empower Schools, 2014; Fryer, 2014; New Schools for

New Orleans, 2015; Mathews, 1998; TNTP, 2012; Tuttle et al., 2015).

Addressing academic readiness, governance, and strategy alone, though, narrows

the scope of what must be considered as children progress through schooling. Despite

the need to expose children to increased academic intensity in high school if they are to

persist and succeed long-term (Adelman, 2006; Conley, 2010), there are other factors in

schools – often psychological in nature – that affect a child's ability to reach his or her

potential, particularly at key life transition points (Eccles, 2012; Lewin, 1952).

Comprehensive reform should consider the impact of social and psychological forces,

too, including but not limited to communities such as American suburbs in which

demographics have diversified ethnically and economically over the last fifteen years,

with educational implications (Kneebone & Berube, 2013; Juday, 2015; Reardon et al., 2016).

An increasing number of social-psychological interventions show positive and surprisingly lasting effects on a number of psychological forces such as stereotype threat (Aronson, Fried, & Good, 2002; Good, Aronson, & Inzlicht, 2003; Cohen, Garcia, Apfel, & Master, 2006), motivation (Hulleman & Harackiewicz, 2009), academic stress (Ramirez & Beilock, 2011; Yeager, Lee, & Jamieson, 2016), trust (Yeager et al., 2013), social belonging (Walton & Cohen, 2011), and academic self-regulation (Yeager et al., 2014). The interventions, though not magical (Yeager & Walton, 2011), offer affordable and easily scalable complements to other educational reform efforts. The key to their use is to understand more deeply for whom and under what conditions these interventions work so that educators can tailor their support strategies rather than applying a one-size-fits-all approach.

Integrating mindset interventions into the schooling experience is perhaps the most tested, best understood example of an intervention that leads to a number of positive effects – including improved academic performance and increased resiliency as work intensity increases (Chiu, Dweck, Tong, & Fu, 1997; Chiu, Hong, & Dweck, 1997; Yeager, Trzesniewski, & Dweck, 2013; Yeager, Trzesniewski, Tirri, Nokelainen, & Dweck, 2011). Dating back to the early 1900s when scientists began quantifying intelligence, humans typically hold one of two theories of intelligence – either an entity theory or an implicit theory. Those who hold an entity theory believe that intelligence is something you are born with; they tend to give up more easily and avoid hard work. Those with an implicit theory (i.e. growth mindset), on the other hand, believe that effort

is simply an opportunity to learn. They tend to seek out and stick with difficult work longer, believing working hard simply means they are learning. This is particularly noticeable during key life transitions such as the transition from middle school to high school. As academic expectations increase as part of educational reform efforts, growth mindset interventions could lead to the increased likelihood that students see challenges as opportunities to learn instead of an indictment of their innate abilities (Dweck, 2006). The hope then is that mindset interventions would lead to lasting effects on achievement and post-secondary success for some.

Developing a growth mindset may be most necessary for students living in poverty (Claro et al., 2016) and for those who previously underperformed in school (Cohen et al., 2009; Hulleman & Harackiewicz, 2009; Wilson & Linville, 1982; Yeager, Henderson, et al., 2014; Yeager et al., 2016). Increased resilience also has been shown to increase a student's likelihood to taken on challenges in the future, which may be particularly important as a strategy to improve long-term postsecondary success (Aronson et al., 2002; Blackwell et al., 2007, Study 1; Conley, 2010; Yeager & Dweck, 2012).

This study sought to expand on what is known already about the effects of growth mindset interventions on academic performance and on a student's willingness to embrace challenges during the key life transition from middle to high school in order to better understand for whom and under what conditions these interventions are helpful. What effects, if any, could come from simply teaching students that intelligence and talent can improve?

This was an archival data study (AS) of a national study (NS) that attempted to answer in more depth what effects may occur from a brief mindset intervention

administered by a third party through an online platform at one of the NS high schools –

an ethnically and economically diverse school in a diverse suburban community.

Specifically, this study sought to answer three questions to further the knowledge base

about who benefits the most from mindset interventions:

1. How does a single mindset intervention increase growth mindset, improve

    academic performance, and impact a child's willingness to seek out challenges?

2. Does a child's level of poverty moderate the effects of this mindset intervention?

3. If students were previously low-performers in 8th grade, what is the effect of the

    intervention on their growth mindset, academic performance, and willingness to

    seek out challenges – depending on whether or not they got the treatment?

Discussion of Findings

It is worth noting in general that the findings in this study should not prohibit a

school from administering the mindset intervention to every 9th grader during the

transition from 8th to 9th grade – as was done in this study. Although the effects vary on

the surface – some positive, some neutral, and some even potentially negative – any

negative effects require more research to understand the full context to determine

causation; it is likely in those cases that numerous factors completely external to the

study were far stronger than the effects of the intervention. Nevertheless, it is prudent to

understand for whom and under what conditions these interventions may be most

beneficial, as many of the effects are clearly stronger for some students than for others.

First research question. The single mindset intervention used in this study did

increase the number of students developing a growth mindset and also reduced the

standard deviation – thus concentrating the students around higher levels of growth

mindset. While this is a positive outcome, this is not surprising given the evidence base.

Dating back to Rosenthal (1968) and Dweck (1975), the evidence is clear and extensive

that how children think about themselves and explain cause and effect matters, and

children can change their self-construals as they learn more (Ross & Nisbett, 1991). The

evidence is also clear and extensive that brief psychological interventions can lead to

positive effects for some children under some conditions (Cohen & Sherman, 2014;

Garcia & Cohen, 2012; Walton, 2014; Wilson, 2002; Yeager & Walton, 2011; Yeager at

al., 2016).

It is noteworthy that the mindset intervention increased growth mindsets for a

couple of practical reasons that would be relevant to educational practitioners. The first

is that it was administered online and by a third party; this is relatively new and novel and

poses promise for schools that struggle to find the time or personnel to attempt novel

strategies. It is also substantially more cost-effective than some previous mindset studies

that were training- or time-intensive (e.g. Blackwell et al., 2007).

Despite improved mindsets, though, there were no significant interactions in the

sample between the treatment and academic performance. This is not necessarily

conclusive, however, for a number of reasons. The first is logistical – the variable used

was a z scored average of first semester grades, but grades during that semester would

have been collected for students before and after the intervention was administered. It is

possible that there were simply not enough grades collected after the intervention to show

improvements.

Challenge-seeking showed no significant effects at .05. Given that this study is a

replication of known effects, though, it is worth nothing that this may be significant using

a one-tailed hypothesis.

Generally, this aligns to the evidence base because samples generally do not show significant effects in either of these areas. Instead, specific groups such as previously low performers have benefitted most (Cohen et al., 2009; Hulleman & Harackiewicz, 2009; Wilson & Linville, 1982; Yeager, Henderson, et al., 2014; Yeager et al., 2016).

Second research question. The second research question was an attempt to understand more clearly the effects, if any, of the intervention on children living in poverty. This question was an attempt to build on recent research published that indicates having a growth mindset may temper the effects of poverty on performance (Claro et al., 2016).

Although there was no interaction found on mindset outcomes, mindset treatment, or FARM related to the treatment, there are some limitations to this sample that necessitate further study. One example is that a child's level of poverty in this study was determined solely by whether or not that child qualified for FARM status. The financial threshold for qualifying for free meals in public schools is different than qualifying for reduced-price meals, and lumping these categories together limits the specificity of the analysis. Using a measure of poverty that allows for more segmented analysis may have uncovered effects at lower levels of poverty than FARM would allow.

The sample itself may also limit the analysis for this question. Because 80% of the entire sample qualified for FARM and the remaining 20% was split almost evenly between the Control and Treatment groups, it is possible that there were not enough children who did not qualify for FARM to analyze differences in effects effectively.

There was an interaction over time between mindset status and FARM, but it was not related to the mindset treatment. Mindsets improved for FARM students by 7% from Time 1 to Time 2. It is not clear from the data what contributed specifically to this improvement. There is also a chicken or egg argument to be made about this given the large percentage of FARM status students in the sample; did this group's improvement have more to do with their FARM status or just the effectiveness of the intervention at improving mindsets? Despite these considerations, it is promising to see the improvement in mindsets just with a single intervention.

Third research question. The answer to this last research question requires the most follow-up consideration, as its results contradict what was predicted. Generally, the research to date has shown the largest effects in students who underperformed previously (Cohen et al., 2009; Hulleman & Harackiewicz, 2009; Wilson & Linville, 1982; Yeager, Henderson, et al., 2014; Yeager et al., 2016). In this study, the only interactions between the mindset treatment and the sample were in students who were not poor performers in the 8th grade. There was an interaction between mindsets and students that were not poor performers, for example, but there was no interaction for previous poor performers despite improvement in mindsets overall for both groups of students. In addition to these effects, there was an unpredicted interaction in academic performance for both groups – while students who were not poor performers had better grades, the grades of previous poor performers declined.

These academic results also differ from the original conjecture of this study because previous research generally indicates that growth mindset interventions have the greatest effects on academic performance for those who previously struggled. It is

unclear what role the intervention played in academic performance for either group given that the Control and Treatment groups performed similarly – regardless of whether they were or were not previous poor performers. It is unlikely the treatment is a factor in these results. There are a number of other possible factors that should be explored on a single high school campus like this that may contribute to these findings, but further research would need to be conducted to specify for sure. 9th grade performance was based entirely on first semester grades, too, so it is possible the true effects of the intervention on academic performance would take hold later.

There are a number of possible campus-based factors that may help to explain the effects, too, ranging from school climate and levels of student engagement to teacher attitudes about previous leadership priorities. Given all the other research conducted to date pointing to the effectiveness of this intervention, though, there are strong implications that must be contemplated when considering implementation in schools. Schools considering these interventions, for example, should be thoughtful about the experience every child has throughout that first fall semester, and subsequent research should be done to better inform schools of which considerations are most critical.

General limitations. Beyond the limitations described above, there are additional limitations in the study worth noting. Effects were discovered in the national study (Yeager et al., 2016) that were not identified in this sample. Because the effects in this study would have been discovered would be expected to be small in a single-intervention study, meta-analytic thinking (Henson, 2006) would indicate that effect sizes varying from study to study may simply be the result of chance alone. In cases where there are failed results in comparison to previous research or research from the NS, this

warrants a more substantive exploration (i.e. what may be different about this school, or what may be different about the schools that students attended before arriving in 9th grade).

It is also possible that effects – especially on academic performance – showed up later. In research such as Wilson and Linville (1982) as well as the second cohort in Walton and Cohen (2011), effects took hold in subsequent semesters or even academic years. This could be the result of recursive processes or sleeper effects (Kumkale & Albarricin, 2004). After an intervention, in other words, it is possible that some students begin to interpret failure and difficulty differently – regardless of how small the challenge. Thinking differently about individual moments of failure can lead to recursive improvement over time.

In addition to this, the challenge-seeking measure used in the study may pose some limitations. It has been used previously, first by Mueller and Dweck (1998), but this study still uses a single self-reported hypothetical scenario about extra credit to measure a child's willingness to seek out challenges. Whether or not a child would voluntarily select more rigorous high school coursework to better prepare for postsecondary success is not clear from this single measure.

Another limitation is the measure for academics. Grade point averages in general pose limitations to rigorous analysis because they vary in what they mean and how they are developed in schools. Z scoring the grades helped to address that limitation, but it may have been more effective to use tools that are more standardized such as norm-referenced assessments or evidence-based universal screeners. Using these would pose logistical challenges because children transitioning into high school rarely matriculate

from a single middle school (including the students in this study). If an entire school system chose to use the same norm-referenced assessment in 8th grade such as the PSAT, though, it would likely provide more reliable data.

Academic intensity during the transition from middle to high school should also be considered, particularly in high schools in which the middle schools may be under-performing. If a high school raises the level of expectations for students that are simply not ready academically, it is possible that the psychological effects of a treatment like this would be overwhelmed by the practical reality that low-performing students cannot handle the academic load.

In addition to academics, another limitation is that there is no way to know the psychological effects of culture and climate in a school. This seems particularly important in research grounded in social psychology research because the psychological forces affect students differently in different schools. In some schools, developing a growth mindset may be more advantageous and celebrated than in others. In other schools, growth mindset may be far less important than other factors such as safety or teacher expectations. The online, third party-administered nature of the intervention, too, may be a disadvantage in schools with school cultures that do not embrace experiences like this as their own; this may contribute specifically to effects for some children such as previously low-performing students, but further study is required.

A final limitation to this study may be the reality that every 9th grader participated. Having the entire census of students in a 9th grade participating in the study helped to ensure a comprehensive analysis, but it also increased the likelihood that some

students did not take elements of the study seriously. It is possible that during the Time 1, even students in the Control group took the experience less seriously.

Recommendations for Future Research

Despite these limitations, there is promise in this research that should be explored more. There are a number of recommendations for future research that would expand the knowledge base about who would benefit the most from a brief mindset intervention and under what conditions. Although the effects on academic performance for previously low-performing students show promise, it would be helpful to gain greater clarity about the lasting effects on grades. Because of the nature of the NS, only semester grades were used. Analyzing the effects of these brief interventions given only at the beginning of the school year would help to inform whether or not to consider booster interventions later in a child's high school experience.

Similarly, it would be helpful to understand specifically what changes in classroom and school behavior emerges when students develop a growth mindset. The reality that so many students developed a growth mindset as a result of the intervention is helpful to know; having a better understanding of the qualitative effects of that mindset change could help teachers, schools, and even parents understand what they could expect.

What is also unknown and warrants future study are the effects that classroom and school climates – both the high school as well as feeder middle schools – may have on mindset interventions. If students have teachers whose verbal and nonverbal behavior fosters growth mindsets, what effect do those teachers have? Recent research seems to indicate that it is indirect behaviors sent by adults – particularly after failure – that often affect mindsets more than explicit messages (Haimovitz & Dweck, 2016). Are the

effects different for students learning in positive climates that nurture risk-taking and reinforce the power of learning from mistakes and failure, for example?

Despite the findings in this study that there were no significant interactions between students who qualify for free and reduced-price meals (FARM) and mindsets, it is still important to understand the effects of these interventions on students living in poverty. Two possible explanations in this study – the relatively high percentage of students in the sample who qualify for FARM and the reality that FARM as an indicator of poverty may be too general – warrant further investigation. It might be helpful, for example, to use a different measurement of poverty that would allow for greater segmentation in the analysis.

Similarly, race and ethnicity are worth exploring further. Given the changing demographics in communities across the nation, it would be helpful to know more clearly what effects these interventions have on different races and ethnicities. It may be that children who underperform – regardless of poverty level or race and ethnicity still benefit the most from these interventions. In diverse communities attempting to tailor their reform strategies, though, a better understanding is prudent.

Conclusions

There are lasting implications to the academic and postsecondary achievement gaps that are widening across lines of advantage that threaten the viability and competitive advantage of rapidly diversifying communities, cities, and states; something has to be done. Although there are proof points that can be identified and used as evidence of success to help educational policy evolve and educational practitioners improve, there is still much more to do. In addition to policy work and the work of

practitioners, it is increasingly clear that educational reform efforts alone will not work to address the comprehensive needs of every child in schools.

These reform efforts must be supplemented with proven techniques and strategies that can address the softer and sometimes more invisible psychological forces affecting students on their journeys toward success in life. These forces are particularly potent for some children at specific moments along those journeys, including highly vulnerable phases such as early adolescence, as children transition from middle to high school. Identifying interventions that can be integrated into a holistic reform strategy and tailored to the unique needs of different children is prudent.

Of the growing number of interventions being tested that are effective with some children, do not intrude on the educational experience of children, and are both cost-effective and easily scalable, growth mindset interventions are some of the most compelling and promising. Although these interventions are certainly not magic, the effects at improving academic outcomes for some students who struggled before are undeniable. In addition, if more children are willing to try challenging material – whether it is because they learn to seen challenges as opportunities to learn instead of indictments of something innate or for other reasons that further research could help clarify – this should lead to improved grades and hopefully even increased long-term postsecondary success rates.

Despite the promise of these interventions, though, care must be taken to align their use to the evidence of when they are most effective and for whom so that the educational effects can be felt for the people who need them the most. Beyond this, it is also critical to stay aware of contemporary research that should continue to provide

insight into what additional factors must be in place within a school environment that can improve or negate the promising effects of these interventions. There is much still to learn, but it is clear that one size definitely does not fit all.

Beyond a thoughtful and targeted plan for when and how to use interventions, the dynamics in schools necessitate further efforts as well to understand the role adults can play before, during, and after these interventions. Research increasingly indicates that the messages adults send through indirect behaviors are often far more impactful than what they are saying. While the appeal of brief interventions is that they are affordable, scalable ways to improve outcomes, those interventions must be paired with a strategy for professional learning that ensures adults are reinforcing those messages through spoken and unspoken means.

Chapter VI

Action Plan

Vision

In order to contribute to a thriving society, school districts must address the widening performance gaps they see in postsecondary readiness of their graduates, particularly across lines of advantage. To narrow these gaps, the academic intensity of the student experience in high school for students living in poverty must increase. As a result of this, a significantly larger number of these students will be required to enroll in and successfully complete rigorous academic coursework such as Advanced Placement (AP). As the academic intensity increases for a larger number of students, two concurrent considerations must be addressed: supporting the overall academic performance of the students while developing in them the willingness to endure when the work gets more difficult. It is simply not enough just to encourage more 8th graders to sign up for advanced coursework during their 9th grade year.

This plan addresses two critical success factors that affect overall performance of students – the students themselves and their teachers. Given the psychological factors known to effect students during the transition from middle to high school, targeted efforts must be made during and beyond freshmen orientation to scale the types of psychological interventions showing promise at addressing these factors. Explicit efforts must be designed and implemented during the first few weeks of the academic year as well as throughout the year, particularly when the academic expectations are most challenging (e.g. major tests and projects). Second, teachers must learn how to cultivate growth mindsets in their students through awareness-building, training, and ongoing coaching.

The direct and indirect messages adults send through their behavior ultimately plays a larger role in cultivating mindsets than anything a teacher says. This is important especially for teachers attempting to teach a larger number of students in advanced coursework who have not previously taken or succeeded in coursework before.

Freshman Orientation in High Schools

Comprehensive high schools around the country regularly welcome hundreds of 9th graders each fall into their schools with an orientation process that focuses primarily on faculty introductions, student expectations and rule-following (e.g. dress code, discipline procedures, food and beverage rules, acceptable and unacceptable cell phone usage, and attendance and tardy policies), how best to navigate the geography of a large school, and beginning to meet new students in the school. Students might receive their locker number, receive their academic schedule, take a picture for their student identification badge, and sometimes even receive their textbooks.

Typically these orientations are delivered in large whole-group sessions – sometimes with parents or guardians in attendance but often not – in large common spaces such as auditoriums or gymnasiums. An authority figure such as the campus Principal or grade level administrators speak into a microphone while students follow along with a Student Handbook and view a presentation projected on a screen. Sometimes there are small group scavenger hunts or activities that attempt to build community among the students.

Knowing what is expected and where to go while beginning to form relationships with others are all important during transitions. Companies invest heavily in orientations

and onboarding practices for many of these same reasons. The hope through these efforts is to address fundamental needs.

These orientations, however, typically neglect any effort to address key psychological factors that that are showing promise at narrowing performance gaps and building challenge-seeking behavior. One example of this is teaching students about having a growth mindset when work becomes challenging. Supplementing existing orientations with complementary psychological interventions deployed for the right students at the right time could help to ensure students remain in academically intense coursework while also achieving better academic performance.

Professional Development in School Systems

States, regions, cities, and school districts all invest heavily in a number of different professional development opportunities and strategic approaches, and they do this for a number of reasons. These reasons usually satisfy professional credentialing requirements and are efforts to increase capacity and professional skill in order to better serve the children in each of those contexts. Federal and state budgets earmark resources specifically for professional development; school districts employ entire departments to focus exclusively on professional development; and, schools build professional development time into their annual calendars and daily schedules specifically to improve teacher capacity and student performance.

Despite these heavy investments of financial resources and time, student performance gaps persist. Investing more money in professional development is not the answer. One study suggests that urban districts invest as much as $7,000 per teacher on in-service days and on training (Miles et al., 2004). Rather than doing more of the same,

a change in how adults are trained that adapts contemporary, evidence-based research about how adults change practice and learn new skills should offer a compelling alternative to simply spending more money.

Often professional development in districts, for example, is measured by hours spent in training and not by improved teacher competence. Professional credentialing requirements may contribute to this phenomenon, as sign-in sheets that only measure seat time spent in trainings rather than mastery of content or measurable improvements in skills are used to extend credentials such as teacher certification. Because of this, the metrics used to track effectiveness exist mostly as inputs (e.g. number and length of trainings). Occasionally districts will gather attitudinal surveys. Rarely will districts attempt to correlate improved teacher skills or increased student performance to investments in specific professional development strategies, though.

How will the plan fit into this context?

Cultivating a growth mindset in students requires a differentiated approach that directs efforts both at students as well as their teachers. As a result of this, there are two distinct but related strategic approaches articulated here. The first is a redesigned high school orientation for entering 9th graders that extends beyond the first two weeks of school through the first few months of a child's 9th grade experience. This orientation would integrate the types of psychological interventions showing promise at developing a growth mindset and improving performance, particularly when academic expectations increase.

The second strategic approach articulated here consists of a yearlong professional development plan that should ensure teachers learn not only the importance of cultivating

a growth mindset in students but also how to do so using process-focused feedback instead of person-focused feedback (Kamins & Dweck, 1999). This plan leverages contemporary science about how adults change, how adults learn best, and how adults acquire new technical skills and knowledge in ways that endure. This plan includes specific professional development trainings to be delivered to teachers, and it also includes ongoing coaching support to ensure teachers grow.

Integral to this approach is Universal Design for Learning. Typical learning goals – "traditional," so to speak – often include design barriers that make learning for all hard or unlikely. Instructional designers must remain cognizant of three critical obstacles when designing goals that are useful for learners – representation barriers; action and expression barriers; and, engagement issues. For learners with disabilities, how material is expected to be *represented* must be considered so that learners with visual impairment, physical limitations, or other disabilities can demonstrate mastery. When planning for action and expression, designers must be aware that how learning is to be made visible must be possible for all children – particularly those who may struggle with a particular form of expression (e.g. cursive handwriting). Last, for learning to be most useful designers must consider how best to engage – or even invest – learners in the material being presented.

UDL designers plan proactively as they design learning goals and incorporate options and choices to increase the likelihood that all learners will be able to demonstrate mastery. To mitigate against representation barriers, for example, UDL goals may include options for how children may interface with a text – audio, digital text, or video). By offering choice, learners with impairments or disabilities should still be able to find a

way to learn and *express* their learning. Once participants in sessions are asked to demonstrate their learning, UDL designers offer choice in how that material can be demonstrated. Rather than expecting a handwritten report, for example, a UDL designer may suggest writing a report, making a film, or creating a diorama. To *engage* a higher percentage of learners, too, UDL designers provide choice and opportunities to learn that align with what various learning styles would need.

After designing a learning goal, planners who consider UDL principles in design will then gather the appropriate instructional materials needed to ensure success for all learners. While typical teachers may photocopy dozens of handouts for a week, a UDL designer will identify a variety of different types of texts and materials – from digital media that can be manipulated to photos and audio. While typical teachers may prepare a lecture that they intend to deliver for twenty minutes, UDL designers gather tactile materials, a collection of picture books, audio recordings, and a variety of other materials that allow different children to explore the learning in different ways. While typical teachers replicate a similar structure every day for days in a row, UDL designers "mix it up" with variety so that more learners are reached more frequently.

UDL designers plan the way personal trainers plan for their clients. Exercising the same way every day using identical exercise equipment limits muscular and cardiovascular growth over time and can lead to avoidable plateaus. In the same way, learning can be stifled and plateau in a classroom if teachers are always utilizing the same instructional techniques every day.

UDL designers gather materials that capture the attention of a range of different learners and different learning styles within a classroom. Common considerations

include digital and audio text as well as printed text; slides, graphic organizers, and video presentations with captioning instead of just lecture; and, three-dimensional models, websites, and other opportunities to engage the tactile learner instead of just doing worksheets.

Student Orientation

Students will be administered a mindset survey three times during their transition from middle to high school. The first such survey will be used as a baseline. While students engage in course selection, they will complete the survey. In most cases – particularly for those students who already attend school in the same district they will attend for high school – this would happen during the spring. Regardless of when a rising 9th grader completes his or her course selection, they will take the survey.

Within the first two weeks of school, students will receive the first of the two growth mindset interventions. Like the University of Texas-Austin study, this administration will be communicated as simply a regular part of orientation. Beyond the regular logistical and team-building activities that exist in orientation, approximately 30 minutes will be used to administer the intervention to every 9th grader.

One week after receiving the intervention, students will then complete a second version of the mindset survey given to them when they registered for courses. Rather than administering it during the intervention, the intent is to wait a week so that students will have the opportunity to internalize the lessons delivered during the intervention.

A booster mindset intervention will be administered before the first quarter of school ends. This booster builds on the first and has been tested previously. Pairing two interventions but administering them spaced apart in time allows not only for the learning

to be internalized for but students to experience enough typical high school experiences for the second intervention to hold greater psychological meaning.

A third booster intervention will be administered two weeks before final exams, although this booster has not been tested. No previous study has used a third intervention or second booster intervention due to the timings of each study. In this case, it is believed that giving students an opportunity prior to final exams to revisit the power of having a growth mindset when work becomes difficult may have positive effects on students. Rather than taking an extensive amount of time designing this intervention, this intervention will simply be a writing task that mirrors the experience students had during orientation in the college study. Students at that time were asked to reflect in writing on a challenge they were able to overcome. Similarly, the third intervention will be an opportunity for the students to write about at least one major obstacle they were able to overcome during their transition into high school. Regardless of whether the obstacle was personal or academic in nature, students will also be asked to reflect in writing about which growth mindset technique they used – effort, asking for help, or attempting new strategies. They will also be given the opportunity to share what they have learned by overcoming that obstacle and to speculate on how they might approach similar challenges in the future.

Equipping Teachers to Cultivate Mindsets

Professional learning. Teachers control limited amounts of flexible time in their schedules given the numerous roles they play. As such, time during an academic year that develops in teachers a specific knowledge base and set of skills is time that must be used judiciously. The plan outlined below is one that anticipates no more than three in-

person sessions spread throughout the year. Subsequent supports are individualized depending on teacher needs and their relative stage of concern. Each of the modules focuses on developing a specific set of knowledge and skills related to cultivating mindsets and is designed to align and enhance the experiences 9th graders are having throughout their orientation. These modules and subsequent coaching are not intended to create teachers who are expert in fostering growth mindsets in every child. Rather, they are intended to build a knowledge base and preliminary set of skills that can get a teacher started down the path of cultivating mindsets in others.

Mindset session one. The first module – Mindset One – serves as an introduction to what is known to date about mindsets as well as why it is important to educators working with students who are considered an URM or economically disadvantaged. In addition, this session is designed to humanize the material through personalization so that teachers realize how pervasive mindset can be – even into the lives of high performing teachers. These sessions will be introduced as three separate but related adult learning sessions. The slides for each session will follow a description of the session.

Mindset One opens with a clear overview both of the session objectives as well as the agenda for the session. After that framing, teachers will begin reflecting in a way that will ultimately connect to the purpose of the three sessions – by reflecting on moments during their professional careers when they felt like they were growing as well as times when they perceived they were slumping. The instructor will model a time in his career in which he felt like he was taking a step back. Examples could include times when the instructor was working hard but encountered a formative or summative data point that implied there had not been as much progress as the instructor had hoped or a time when

the work seemed so impossible that the instructor gave up temporarily. The purpose of modeling is to help the teachers begin to open up about experiences that have been hard for them both to introduce the power of having a growth mindset but also to establish a culture in the sessions that allows for vulnerability and increased trust. After reflecting individually, participants will have an opportunity to share with a partner to begin building community but also to engage the learners in the room.

The second phase of the training focuses on providing some background and context for the three sessions – specifically, why would mindset matter? The instructor will begin by telling a personal story about why it matters. The focus of this story should be on students who would have succeeded but gave up at times of failure. Heavy emphasis should be placed on the capacity those students demonstrated during their educational career; not having the right attitude about failure or an adequate level of resilience when work gets hard led to academic stagnation of dropping out.

With that personal context focused on a student, some research will be shared that articulates the landscape of the inequality problem facing children in the United States across lines of advantage. Specifically, the focus will be on the shifting demographics in many cities such as Houston – where families living in poverty who previously inhabited a concentrated center of urban poverty are now moving into the suburbs. With this shift come gaps in postsecondary completion rates across families with varying income levels and underrepresented minorities.

The research is clear that graduating from high school ready for higher education requires an intense academic experience in high school, yet, far too often difficult work sends the message to children that they were not born capable of achieving in rigorous

courses. This sets up the case that having a growth mindset helps children overcome those gaps in performance.

The participants will read "Who Gets to Graduate" (Tough, 2014) as part of a jigsaw activity in which various groups will read different sections of the article and then share out to help everyone understand the whole article. By studying this article, which focuses on the effectiveness of a growth mindset intervention during the transition from high school to college, the participants should leave the session hopeful that fostering a growth mindset earlier in a child's education career might be critical to closing achievement gaps across lines advantage before students leave high school.

Participants will close this session with an opportunity to bring coherence to their thinking through a summarizer and then receive their homework. To continue building their knowledge base about growth mindset while also anchoring the learning to what is most relevant to the participants, they are assigned homework to study one student in depth. Often focusing on more than one student can be overwhelming to someone learning new content. This homework is intended to deepen participant understanding of the material while not overwhelming them between sessions.

MINDSET ONE

STRENGTHENING POST-SECONDARY
READINESS BY
CULTIVATING MINDSETS

[SESSION OBJECTIVES]

- Speculate on the root cause of the achievement gap across lines of advantage
- Describe the attributes of a growth mindset and distinguish it from a fixed mindset
- Describe in your own words why mindsets may be helpful to narrowing performance gaps

[AGENDA]

I. Warm up
II. Donuts
III. Lines of Advantage
IV. Growth vs. Fixed Mindset
V. Summarizer
VI. Anthropology Homework

[WARM UP]

- Chart your career to date
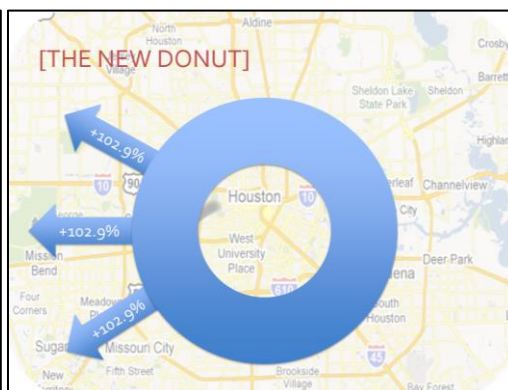- Pick a spot on that career chart that you can explain to a partner
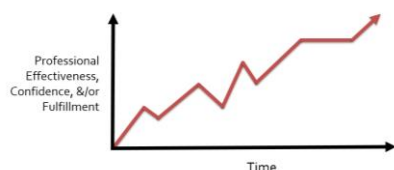
Can brief, cost-effective **mindset interventions** improve academic performance & a willingness to stick with it when the work gets **hard?**
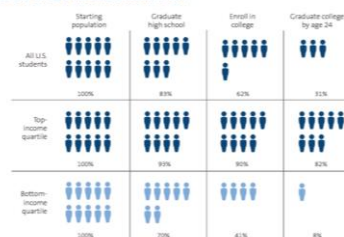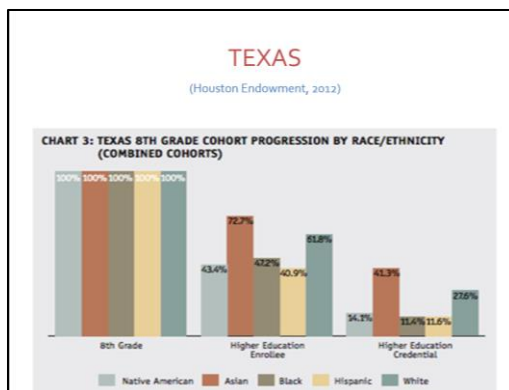

[WHY?]

[THE NEW DONUT]

+102.9%
+102.9%
+102.9%

[FARM]

Based on federal income eligibility standards, student eligibility for **f**ree **a**nd **r**educed-priced **m**eals is determined using a formula that includes monthly or annual income and the number of dependent children in a home.

[LINES OF ADVANTAGE]

ONLY 31% OF ALL U.S. STUDENTS EARN A COLLEGE DEGREE. ONLY 8% OF LOW-INCOME STUDENTS DO.

Source: Mortenson, 2010; KIPP Foundation

TEXAS

(Houston Endowment, 2012)

CHART 3: TEXAS 8TH GRADE COHORT PROGRESSION BY RACE/ETHNICITY (COMBINED COHORTS)

100% 100% 100% 100% 100%

72.7%

43.4% 47.2% 40.9% 61.8%

54.1% 41.3%

11.4% 11.6% 27.6%

8th Grade | Higher Education Enrollee | Higher Education Credential

Native American Asian Black Hispanic White

READINESS.

"The level of preparation a student needs in order to enroll and succeed— without remediation—in a credit-bearing general education course at a postsecondary institution." (Conley, 2007)

ACADEMIC INTENSITY of the
student's high school curriculum
still counts
more than
ANYTHING ELSE
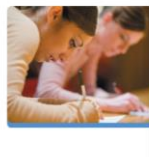toward completing a degree.

(Adelman, 2006)

[PRIOR ACHIEVEMENT]

Researchers developed a variable to use in data analysis that categorized students as being low- or high-performers in 8th grade.

[EFFORTS TO ADDRESS INEQUALITY]

COMMON CORE
STATE STANDARDS INITIATIVE
PREPARING AMERICA'S STUDENTS FOR COLLEGE & CAREER

Texas College and Career Readiness Standards

+ Portfolio Strategy, Open Architecture Strategy, Redesigning Teacher Appraisal, Establishing Performance Pay, Starting Charter Schools, Blended/Personalized Learning, House Bill 5, etc.

[GROWTH VS. FIXED MINDSET]

TWO MINDSETS

Entity Theory
Born smart.

Implicit Theory
Earn smart.
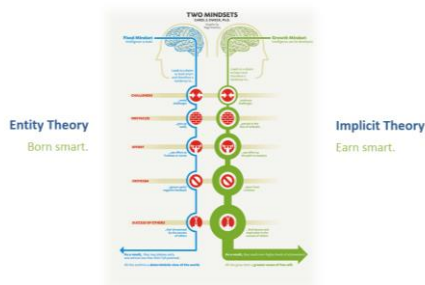
[TRANSITIONS TO COLLEGE]

New York Times
"Who gets to graduate," by Paul Tough

For as long as she could remember, Vanessa Brewer had her mind set on going to college. The image of herself as a college student appealed to her — independent, intelligent, a young woman full of potential — but it was more than that; it was a chance to rewrite the ending to a family story that went off track 18 years earlier, when Vanessa's mother, then a high-achieving high-school senior in a small town in Arkansas, became pregnant with Vanessa.

Vanessa's mom did better than most teenage mothers. She married her high-school boyfriend, and when Vanessa was 9, they moved to Mesquite, a working-class suburb of Dallas, where she worked for a mortgage company. Vanessa's parents

Vanessa Brewer *photo for The New York Times*

INTERVENTION

25-45 minutes
IV: Mindset + Belonging
N = ~7,400 UT Freshmen

RESULTS

DV: % of kids on track to graduate after 1st semester gap between advantaged & disadvantaged students cut in half

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[CHOICE SUMMARIZER]

Draw a visual representation of the most interesting thought you had during this session.

OR

Review your notes and describe to a partner the biggest idea, thought, "ah-hah," or question you're taking from this session.

[HOMEWORK: Anthropology]

"1, Anthropologists practice the Zen principle of 'beginner's mind.' They have the wisdom to observe with a truly open mind. 2, Anthropologists embrace human behavior with all its surprises. They don't judge, they observe. They empathize." -Tom Kelley

Assignment:
Select 1 9th grader who qualifies either as a URM and/or a student who is labeled *economically disadvantaged*. Between now and our next session, watch that student 3 times in 3 different contexts for 7 minutes each. Take notes, specifically related to what you think might be clues about whether s/he has a fixed or a growth mindset. Be ready to discuss at Session 2.

THE FAR SIDE" By GARY LARSON

"Anthropologists! Anthropologists!"

Source: *Ten Faces of Innovation*

Mindset session two. Module two begins similarly to module one in that participants will receive the session objectives and agenda for the day. They will then have an opportunity in small groups to share what they learned from the homework. In those discussions, the instructor will walk around, listen, and challenge groups to begin identifying trends they may notice related to the types of psychological barriers affecting even the most accomplished of learners.

After sharing with the whole group, the session will shift into a cumulative review section designed to revisit previous learnings in order to deepen them so that they endure. Specifically, they will be challenged to reflect back to their session and connect learning from several different aspects of the session. There are numerous connections to make, but the intellectual struggle of this process is more valuable to their learning than getting the right answer. It is through the struggle that they learn more (Brown, Roediger, & McDaniel, 2014).

The rest of the session draws on a body of research first conducted by Kamins & Dweck (1999) that suggests that how we praise students and give them critical feedback cultivates or hinders the development of a growth mindset in students. If we praise or criticize what they are doing or specific steps they have taken, that cultivates a growth

mindset. Praising or criticizing the whole person, such as "You're such a math person," develops a fixed mindset in students.

Participants are taught that growth mindset can be demonstrated through effort, asking for help, or trying a new strategy. Contemporary research suggests that effort alone was overvalued soon after Dweck published her seminal text, *Mindset* (Dweck, 2006). This will be addressed for the participants because asking individuals simply to keep trying harder when their approach is not working does not foster a growth mindset. Participants will then be given the chance in writing to reflect before considering two separate scenarios that are common in schools and should begin to encourage teachers to try new approaches to giving feedback that are targeted toward cultivating growth mindsets.

The first scenario is one in which the whole class struggles except one student. It is not uncommon for a teacher to tell that child something like "You are great at math," which fosters a fixed – not growth – mindset. This scenario may challenge participants to unlearn what they have learned or to begin breaking old habits. The second scenario is also common – a child gets the answer wrong but did most of the work right. A typical response without studying the child's work might be "You'll get 'em next time" or "Maybe you're just not a math person" when in fact the child simply needed a different strategy for one of the steps. The idea of praising or criticizing process instead of the whole person is one that is hard for teachers who have already developed habits to overcome.

This session closes with a slightly more extensive homework assignment than the first. They are asked to do more extensive research about themselves and their habits as

teachers while also becoming more careful and thoughtful about what they say in class. Increasing self-awareness is a critical component of changing habits and practices.

MINDSET TWO

STRENGTHENING POST-SECONDARY
READINESS BY
CULTIVATING MINDSETS

[SESSION OBJECTIVES]

- Describe in your own words the relationship between campus-based performance goals and mindset
- Begin analyzing the relationship between adult actions and student mindsets
  - Process vs. Person Praise

[AGENDA]

I. Welcome & Framing
II. Homework Sharing
III. Cumulative Review
IV. Goals
V. Quiz
VI. Person vs. Process Feedback & Sharing
VII. Scenarios & Role Plays
VIII. Summarizer
IX. Homework

### [HOMEWORK: Anthropology]

THE FAR SIDE® By GARY LARSON

"1, Anthropologists practice the Zen principle of 'beginner's mind.' They have the wisdom to observe with a truly open mind. 2, Anthropologists embrace human behavior with all its surprises. They don't judge, they observe. They empathize." -Tom Kelley

Discussion:
In groups of 4-5, share what you discovered about the student you observed. From the clues you gathered, try to develop your own definition of what a fixed or growth mindset might look like or sound like.

Capture your thoughts on chart paper because we will share.

"Anthropologists! Anthropologists!"
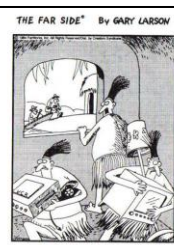
Source: *Ten Faces of Innovation*

[CUMULATIVE REVIEW]

make it stick

"If learners spread out their study of a topic, returning to it periodically over time, they remember it better."
-Brown, Roediger, & McDaniel, *Make It Stick*

"Any information or skill one doesn't actively use tends to be forgotten. Therefore, old learnings should be included in practice and drills for new material so that these old learnings are periodically exercised."
-Saphier, *The Skillful Teacher*

THE SKILLFUL TEACHER
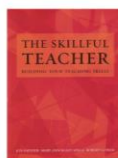
ASSIGNMENT: Number off 1-4. When you get your number, please find that corner in the room. In your groups, try to connect each of these visuals from the previous session. What do they have in common? Each group will need to select a representative to share what you discuss.
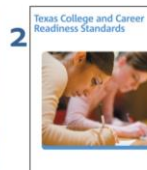
1

2 Texas College and Career Readiness Standards

3

4 COMMON CORE
STATE STANDARDS INITIATIVE
PREPARING AMERICA'S STUDENTS FOR COLLEGE & CAREER

Goals

Scenario: Consider a school attempting to achieve these goals.

| 1 | By the end of 9th grade, 82% of all students who received a D or F in 8th grade Math will earn an A, B, or C in Math and successfully pass the end of course assessment with a passing rate of 70% or higher. |
| 2 | By the end of 12th grade, 65% of students labeled Economically Disadvantaged will have completed one or more advanced course and register for an Advanced Placement test. |

[QUIZ]

Of all the phrases below that teachers could say to their students, which ones do you think best lead the school to their academic goals? Which (if any) might get in the way? Why do you think that?

A. You're awesome!

B. [Point to the 3rd step in the math problem] Tell me more about why you took this step.

C. You disappointed me, buddy.

D. You're such a good reader!

E. It looks like you took your time on that assignment.

[DO + DON'T]

You're so smart!	You took your time and answered every question!
You're such a great kid.	I watched you ask 3 people for help during group time on that problem, and I can tell it helped you learn.
Man oh man, you must be a *math person*. I was never very good at math.	So it looks like that didn't work. What else can you try?

[DO + DON'T]

You're so smart!	**EFFORT**
You're such a great kid.	**ASKING FOR HELP**
Man oh man, you must be a *math person*. I was never very good at math.	**TRYING NEW STRATEGIES**

[THINK-INK-PAIR-SHARE]

Reflect on a moment in your own career when you doubted yourself and your abilities – particularly if something was hard for you. Maybe you thought you weren't good enough or weren't born for that role. Knowing what you know now, describe in writing the type of advice you'd give yourself.

SCENARIO 1

You taught your heart out for a week. You planned as carefully as you've ever planned before, and you were really trying to make sure the students were doing as much work as possible, rather than you doing the talking. You checked for understanding several times during each lesson. Yet on your final assessment, only 1 kid got an A. You see him later in the day.

What's the first thing you say?

SCENARIO 2

It's the middle of the independent practice portion of your math lesson. Kids are doing a difficult math problem that requires several sequential steps to get it right. The problem is hard for almost everyone in the class (which you're okay with and was part of the plan). You see a child in the back of the classroom who seems to have stalled, though. She's quiet, looking at her paper, but you noticed she's been staring at it for a while. You walk up behind her, and over her shoulder you notice that she did the first step right, the second step wrong, and the third step right.

What do you say to her?

[HOMEWORK]

- Make a list of 5 students who are struggling in your classroom and 5 students who are not struggling in your classroom
- Attempt to provide 3 pieces of process feedback to each of them between now and the next session
- Write down what you said to each of them, as specifically as you can

[3-2-1 summarizer]	[HOMEWORK]
In your notes, please write down... • **3** take-aways from today's session • **2** big questions you're asking right now • **1** specific next step you intend to take between now and our last session	• Make a list of 5 students who are struggling in your classroom and 5 students who are not struggling in your classroom • Attempt to provide 3 pieces of process feedback to each of them between now and the next session • Write down what you said to each of them, as specifically as you can

Mindset session three. Between session two and three, the instructor will send at least two emails ended to serve as nudges (Thaler & Sunstein, 2009). The nudge will be a friendly note reminding participants to ensure they take the specific next step they listed in the 3-2-1 Summarizer. This connection between sessions will set a precedent for subsequent follow-up after the third session, should there be a need or desire to stay connected.

The final session intends to leverage that increasing participant self-awareness by integrating a stealthy intervention adapted from self-persuasion research. After the introduction to the session, participants will be challenged far more than the previous session to understand the perspective of individual students about mindset while connecting their learning about the positive role they can play. The questions they will be asked during the reflection relate to how struggling students think and feel as well as students who are not struggling yet. Children who struggle do not necessarily have fixed mindsets, and children who do not struggle may not have growth mindsets. Helping the participants understand that is critical to this discussion. The instructor will ask probing questions of small groups or even the whole group if this realization is not obvious to everyone after their homework.

After this cumulative review, the bulk of the remaining time will challenge

participants to think more deeply about what they have learned as well as how they might transfer what they have learned to others. The performance task intends to challenge participants to move past what they know and instead change how they know (Kegan, 2000). By placing them in the shoes of the instructional designer – designing for other teachers – the hope is that they will achieve transformative learning, or learning that helps to make meaning of one's own experience (Mezirow, 1991).

In addition, it is intended to leverage the research suggesting that when we make the argument for something that we may or may not believe, we are likelier to adopt those beliefs over time. Even if a participant has not reflected on their practice and started to adopt new practices, this stealthy intervention – which will be monitored through surveys – may help a teacher to adopt a growth mindset about their students. The hope is that by developing teacher training to help others understand and believe in growth mindsets, teachers who do not yet will do so over time.

Participants will close the training with another reflection. In that reflection, they will be asked to share how they typically approach and overcome challenges. Adapted in part from a task focused on recursive processes of self-affirmation (Cohen et al., 2009) as well as the intervention done at the University of Texas-Austin during freshmen orientation (Yeager et al., 2013) this writing exercise is intended to further affect a participant's willingness to cultivate growth mindsets in their students.

MINDSET THREE

STRENGTHENING POST-SECONDARY
READINESS BY
CULTIVATING MINDSETS

[SESSION OBJECTIVES]

- Continue analyzing the relationship between adult actions and student mindsets
  - Process vs. Person Praise
- Synthesize your learning about mindset by creating a performance task

[AGENDA]

I. Welcome & Framing
II. Homework Sharing
III. Cumulative Review
IV. Person vs. Process Feedback & Sharing
V. Performance Task & Worktime
VI. Summarizer
VII. Closing

[HOMEWORK: Person vs. Process]

EFFORT

ASKING FOR HELP

TRYING NEW STRATEGIES

Guiding Questions for Small Group Discussion
- When did you praise Effort?
- When did you praise Asking for Help?
- When did you praise Trying New Strategies?
- How did you say what you said?
- Did you notice any effects? Were they positive or negative?

[CUMULATIVE REVIEW]

"If learners spread out their study of a topic, returning to it periodically over time, they remember it better."
-Brown, Roediger, & McDaniel, *Make It Stick*

"Any information or skill one doesn't actively use tends to be forgotten. Therefore, old learnings should be included in practice and drills for new material so that these old learnings are periodically exercised."
-Saphier, *The Skillful Teacher*

THE SKILLFUL TEACHER
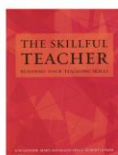
[NEW SCENARIO]

Today, you are hoping to elevate the rigor for every child in the room to see how it goes. You've diagnosed learning levels on this particular skill and you know every student's level. Although there's minor variation, you have 4 levels in the room. You've done your best to create 4 different tasks for the class to do in groups that will challenge every group to stretch. The task, by design, is just a little bit harder than the kids are used to.

5 minutes after the students begin, you notice Anna – who usually does well in your class – mutter under her breath, "Ugh, this is too hard. You guys do it." On the other side of the room you hear Calvin – who struggled earlier in the year – stand up and lean against the desk with a smile on his face saying "Guys, we can do this! If that strategy isn't working, we can just try a new one."

When the time is right, specifically what would
you say to Anna & Calvin?
Why?

[The "I Need Help" Performance Task]

\\Context
We're having a difficult time with teachers who are stuck believing that students are **born** one way or the other. For whatever reason, these teachers just don't believe we **earn** it through effort, asking for help, and trying new strategies. As we plan for new teacher orientation next year, we need to leverage your professional expertise to help us build training modules that would help future teachers.
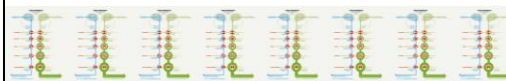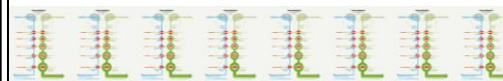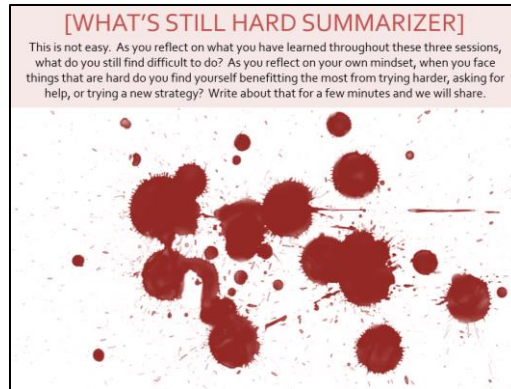
The "I Need Help" Performance Task

\\Performance Task

At your tables, please work in groups or 3-4 for the next 45 minutes to design the lesson plan and as many materials as you can in the time allotted for a training that could be used to help these teachers.

You may use any digital or paper tools you can access, and the format can be anything you think might be effective.

[WHAT'S STILL HARD SUMMARIZER]
This is not easy. As you reflect on what you have learned throughout these three sessions, what do you still find difficult to do? As you reflect on your own mindset, when you face things that are hard do you find yourself benefitting the most from trying harder, asking for help, or trying a new strategy? Write about that for a few minutes and we will share.

New Metrics

There is an adage that new work measured with old metrics yields old work. New metrics are selected in hopes that these new metrics will encourage new work that endures and fosters stronger growth mindsets in students. The intent is also to create formative feedback loops that enable course corrections in the moment while providing the type of summative data that can be used to inform subsequent iterations and revisions the plans in the future. All of the following data will be gathered as part of the plan: surveys after professional development to gauge the quality and effectiveness of the delivery; rubric scores to evaluate the quality of the professional learning; mindset surveys for teachers administered three times throughout the year; mindset surveys for students administered three times throughout the year; correlation between teacher training and teacher mindsets; correlation between teacher practice and student mindsets; correlation between teacher mindsets and student mindsets; correlation between student mindsets and student performance in math.

Survey for Professional Development Modules

1. Please enter your first and last name.

2a. Overall, I understand everything I need to understand about growth and fixed mindsets.
○ Strongly disagree (1)

❍ Disagree (2)
❍ Mostly disagree (3)
❍ Mostly agree (4)
❍ Agree (5)
❍ Strongly agree (6)

2b. What, if any, questions remain for you? (Open)

3a. Overall, I feel equipped with everything I need professionally to cultivate stronger growth mindsets in my students.
❍ Strongly disagree (1)
❍ Disagree (2)
❍ Mostly disagree (3)
❍ Mostly agree (4)
❍ Agree (5)
❍ Strongly agree (6)

3b. What other knowledge, skills, or resources would be helpful to you in subsequent trainings? (Open)

4a. As a learner, the time spent in this session could not have better used.
❍ Strongly disagree (1)
❍ Disagree (2)
❍ Mostly disagree (3)
❍ Mostly agree (4)
❍ Agree (5)
❍ Strongly agree (6)

4b. What suggestions do you have for the instructor to improve session quality? (Open)

Rubric for Professional Development Modules

	3	2	1
	Exemplary	**Proficient**	**Inadequate**
Universal Design for Learning (UDL) Representation	All material used during the session was represented in enough ways or with enough time that every learner was able to perceive and comprehend the information.	Most material used during the session was represented in a way that could be perceived and comprehended by every learner.	Several learners struggled to master objectives for the session because of the way the material was represented.

Universal Design for Learning (UDL) Action & Expression	Ample opportunities were given to learners to choose how best to take action during a session or express their learning (e.g. written, spoken, or visual representation given as options).	Some opportunities were given to learners to choose how best to take action and express their learning, with some missed opportunities or unnecessary constraints.	Not enough opportunities were given to learners to choose how best to take action and express their learning. Plenty of unnecessary constraints were placed on the learners.
Universal Design for Learning (UDL) Guidelines Engagement	Interest and motivation for learning was fostered for every learner. Instructor used at least 10 different strategies to engage learners (Tate, 2004). Ample choices and opportunities are offered.	Interest and motivation for learning were fostered for most learners most of the time. Instructor used 6-10 strategies to engage learners. Some choice is integrated into the training, with some missed opportunities.	There were many missed opportunities to foster interest and motivation in the learners. The instructor used 5 of fewer strategies to engage learners. Very few choices were offered to learners.
Framing the Session	**Clarity** Framing was clear. **Relevance** Participants not only knew why they were learning. Beyond that, the framing encouraged deep engagement and even investment in the sessions.	**Clarity** Framing was clear. **Relevance** It was made evident to the participants why they were learning the material during the session.	**Clarity** Framing was unclear. Instructor was unclear about what participants were going to learn today. **Relevance** It was also not clear why today's session mattered.
Ratio	Participants were at their learning edge throughout the session; nobody could have learned more.	The ratio of the instructor and participants doing the heavy lifting provided a balance that allowed students to learn, not just listen. There were some	The instructor did too much of the work and heavy lifting for students.

		missed opportunities for students to do more work.	
Use of Technology	The use of technology was appropriate and effective at driving stronger adult learning outcomes.	Technology played a meaningful role in achieving the learning outcomes, but there were times that it could have aided learning but was missing or was present but distracting.	There was either no technology used or the technology was distracting to the overall learning.
Homework	Between-session work is meaningful, relevant, and builds on the learning during the sessions. Self-directed learning (particularly on-the-job) is integrated into the plan.	Between-session work is somewhat meaningful and relevant or meaningful and relevant for some of the participants. There are missed opportunities. Some self-directed learning on the job is a part of the plan.	Between-session work is largely unnecessary, meaningless, or irrelevant.

Teacher Mindset Survey and Interview Strategy

Teachers will complete a Teacher Mindset Survey three times during the academic year – during the window of time that students are completing their mindset intervention; after first semester grades have been entered; and, after second semester grades have been entered. The Survey will be used to gather information about teacher perceptions of student intelligence and mindsets and will help to inform ongoing professional training and coaching.

In addition, teachers will engage in a brief one-legged interview (Hall & Hord, 2011). This interview will be conducted at least three times during the year to mirror the

Survey frequency. Teachers who are at lower stages of concern or who are not progressing through the stages will receive additional conversation time. This interview will consist of an in-person conversation in which an interviewer will ask a small number of open-ended questions and follow-up probing questions that can be used to diagnose the relative levels of concern teachers have about the growth mindset innovations being attempted in the school. Like the Survey, the information gathered from these conversations will inform ongoing training and coaching.

Teacher Mindset Survey

General fixed mindset
(Adapted from an edited version of Dweck, 2000)

How much do you agree or disagree with these statements?

My students have a certain amount of intelligence, and I can't do much to change it.
- ❍ Strongly disagree (1)
- ❍ Disagree (2)
- ❍ Mostly disagree (3)
- ❍ Mostly agree (4)
- ❍ Agree (5)
- ❍ Strongly agree (6)

The intelligence of each of my students is something they can't change very much.
- ❍ Strongly disagree (1)
- ❍ Disagree (2)
- ❍ Mostly disagree (3)
- ❍ Mostly agree (4)
- ❍ Agree (5)
- ❍ Strongly agree (6)

"Math person" fixed mindset
(Yeager, Bryk, Muhich, Hausman, & Morales, unpublished)

How much do you agree or disagree with this statement?

Being a "math person" or not is something students really can't change. Some of my students are good at math and others aren't.

❍ Strongly disagree (1)
❍ Disagree (2)
❍ Mostly disagree (3)
❍ Mostly agree (4)
❍ Agree (5)
❍ Strongly agree (6)

Student Mindset Survey

General fixed mindset
(Adapted from an edited version of Dweck, 2000)

How much do you agree or disagree with these statements?

I have a certain amount of intelligence, and I can't do much to change it.
❍ Strongly disagree (1)
❍ Disagree (2)
❍ Mostly disagree (3)
❍ Mostly agree (4)
❍ Agree (5)
❍ Strongly agree (6)

My intelligence is something about myself that I can't change very much.
❍ Strongly disagree (1)
❍ Disagree (2)
❍ Mostly disagree (3)
❍ Mostly agree (4)
❍ Agree (5)
❍ Strongly agree (6)

"Math person" fixed mindset
(Yeager, Bryk, Muhich, Hausman, & Morales, unpublished)

How much do you agree or disagree with this statement?

Being a "math person" or not is something I really can't change. Some students are good at math and others aren't.
❍ Strongly disagree (1)
❍ Disagree (2)
❍ Mostly disagree (3)
❍ Mostly agree (4)

○ Agree (5)
○ Strongly agree (6)

Stages of Concern One-Legged Interview (Hall & Hord, 2011)

What do you think about the school trying to increase and retain the number of students taking advanced math classes this year?

Sample probing questions to diagnose stages of concern:
- *Awareness*: How much do you know about mindsets and how important they are to kids who are taking harder math classes this year?
- *Informational*: What role do you think you're going to play in keeping more kids in these classrooms? Describe the role you think you could play?
- *Personal*: As a result of this change, how different do you think your job is going to be this year compared to other school years?
- *Management*: How are you planning to go about this? What changes are you making to your organization systems? What are you planning to do differently? Can you think of any changes that will happen related to how you spend your time?
- *Consequence*: What kind of impact do you think this will have on student grades? When you think about the students who haven't taken advanced coursework before, how do you think they're going to benefit from this? What concerns you?
- *Collaboration*: What sorts of help do you think you'll need from others on your grade level or in your department? How could the district support you in this work?
- *Refocusing*: If you had a magic wand, what changes would you make to the way this is rolling out this year?

Plan for Evaluation

The action plan proposed is holistic and intends to improve student performance and the willingness of students to persist when academic work intensifies by focusing both on student mindsets as well as teacher behaviors. Some aspects of the evaluation will be formative, and others will be summative. The evaluation of this approach to adult learning is divided into two discrete but related categories that evaluate students and teachers.

Student evaluation. The first is a student-focused quantitative evaluation that seeks to understand the effects on academic performance in math grades, student

mindsets, and a willingness to seek out new challenges and persist in difficult coursework when the difficulty of work increases. In addition to these quantitative aspects, the evaluation will include supplemental qualitative information that will help to understand in more depth the effects of a holistic strategy to cultivate growth mindsets on students during the school day.

The second is a teacher-focused, mostly qualitative evaluation of teacher behaviors. As teachers develop a deeper understanding of the importance of mindsets and how best to foster them in school, the effects on teacher mindsets and the way they work with students when those students encounter difficulty.

Student mindsets. Data from student surveys, administered three times during the year, will reveal the effects on the mindset interventions in students. This data will be disaggregated by teacher to determine differences. It will be used formatively – gathered and used in subsequent trainings to inform teachers of what is working and not working in the classrooms. The rest of the data will be used in a summative way at the conclusion of the year to evaluate the growth over time of mindsets.

Academic performance. Core subject grades at the semester and end of school year will be evaluated first by averaging them together and then disaggregating academic performance by FARM and prior achievement. This data will contribute to a summative evaluation and subsequent, targeted interventions in the future.

Challenge-seeking behavior. Student enrollment in advanced math coursework will be monitored throughout the year as a formative measure of student resilience. Data will be gathered related to the numbers of students who enroll in advanced coursework, those who remain in the course during the first semester, those who continue in that

course in the second semester, and those who complete the whole year. This information will be evaluated to determine if there are differences in persistence for students who start with a growth mindset, those who develop a growth mindset throughout the year, and those who have a fixed mindset the entire year. This information will help to inform an understanding of the effects that mindsets have on a child's willingness to persist in difficult coursework. As part of the summative evaluation, retention rates and trends by groups of students will be analyzed.

In addition, surveys will be administered to students three times during the year to evaluate a student's willingness to seek new challenges. These will be used for formative purposes, presented as part of professional learning sessions. These surveys will be brief and will supplement the analysis conducted about student persistence in tough coursework. It is expected that students who are willing to seek new challenges are likelier to remain in advanced coursework throughout the year. The summative evaluation will include analysis of the trends by group.

Teacher evaluation. An evaluation of teachers will include an ongoing analysis of the effects of the three in-person trainings focused on mindset. In addition, some qualitative efforts will be made to determine the effects of the training on practices in the classroom. The summative evaluation will include analysis of the trends and growth of teacher mindsets.

Evaluating professional development. At the conclusion of each professional development module, surveys will be administered to solicit formative feedback about the overall effectiveness of the professional learning. This will be used to improve the next training. In addition, the formative feedback will provide opportunities to support

campuses or teachers differently.

Qualitative supplemental. Three times during the school year, teacher coaches will videotape a whole lesson cycle in each classroom, with the camera focused on interactions between the teacher and students. Those videos will be evaluated to determine what actions are changing, if any, as a result of the professional learning experiences. This will mostly inform the summative evaluation only, as teacher coaching is handled entirely by the campus. If there are obvious opportunities to share effective strategies in trainings, video clips will be gathered and used in training to provide examples.

In addition, the summative evaluation will include an analysis of which teachers showed the most and least growth in mindsets and academic performance; the evaluation will attempt to identify trends in teacher behavior that either fosters or inhibits the development of growth mindsets in students.

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