ABSTRACT

Title of Thesis: STRESS AND ACHIEVEMENT IN ELEMENTARY SCHOOL STUDENTS: THE MEDIATING ROLE OF GROWTH MINDSET

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The achievement gap is one of the most pernicious education problems in the United States, and stress has a negative impact on achievement. Growth mindset may explain how stress impacts achievement. This study used a short-term longitudinal design (*n* = 251; 36% DLL) to evaluate growth mindset as a mediator of the negative impact of stress on literacy achievement in 3rd - 5th grade students. Results confirmed that perceived stress was negative related to achievement. The present study also explored whether mediation model results differ between dual-language learning (DLL) and English-native students. Although growth mindset did not act as a mediator in the full sample, growth-minded attributions mediated the negative effect of stress on achievement for non-DLL students only. These results hold implications for understanding how to help students with the consequences of stress on their mindsets and academic performance.

Stress and Achievement in Elementary School Students: The Mediating Role of Growth Mindset

by

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Chapter 1: Introduction

The achievement gap is a pervasive issue that may be maintained, in part, by stress (Levy, Heissel, Richeson, & Adam, 2016). This study focuses on the perceived stress of students, defined as the perceived, internal experience of stress-related feelings (e.g., anxiety, anger, hopelessness) and feeling overwhelmed in reaction to distressing life experiences (e.g., Suldo, Shaunessy, & Hardesty, 2008). Although limited, some research has demonstrated that children who report high levels of perceived stress are at increased risk for negative outcomes, such as academic underachievement (e.g., Schmeelk-Cone & Zimmerman, 2003). Stress has significant implications for students later in life, too, such as earning lower salaries, increased risk of incarceration, and being less likely to graduate from high school or college (McKinsey, 2009).

Despite its negative relation with achievement, stress is an understudied contributor to the achievement gap (Levy, Heissel, Richeson, & Adam, 2016). The stress literature is largely cross-sectional and does not analyze the negative effects of stress over time. Only two longitudinal studies (described in detail in the literature review below) examine the relation between perceived, general life stress and achievement (O'Neal, 2018; Schmeelk-Cone & Zimmerman, 2003). More importantly, the majority of existing stress research does not explore the relationship between stress and achievement among elementary aged children, when the achievement gap begins to widen (Burchinal et al., 2011). In addition, both cross-sectional and longitudinal studies often explore the relationship between stress and broad measures of achievement, such as GPA in core academic subjects or standardized test scores. More narrow measures of achievement,

such as the Test of Silent Reading Efficiency and Comprehension (TOSREC), may better assess students' level of literacy achievement, which is important for success in many subject areas in elementary school. In sum, longitudinal studies that link stress and achievement in samples of elementary students are needed to better understand the effect of stress on the future achievement of students.

Dual-language learning (DLL) students, in particular, face a significant amount of stress and may be at elevated academic risk throughout elementary school (National Academy of Sciences, Engineering, and Medicine, 2017); dual language learners are defined as children with at least one parent who speaks a language other than English in the home (Migration Policy Institute, 2017). DLL students often do not receive the quality instruction or social-emotional support needed to achieve at the appropriate grade level (National Academy of Sciences, Engineering, and Medicine, 2017). DLL students also face other barriers to success, including learning the English language, acculturative stress, and/or parent immigration status (Alva & de Los Reyes, 1999; National Academy of Sciences, Engineering, and Medicine, 2017). A recent national demographic profile revealed that DLLs comprise nearly half (45%) of school aged children in the nation (Migration Policy Institute, 2017), and that children within this unique population are becoming increasingly diverse. DLL students come from families that identify with many different races and ethnicities, speak many different languages, and have widely varied countries of origin and socioeconomic statuses (Migration Policy Institute, 2018). The heterogeneity of this group makes it difficult to conclude that aforementioned barriers contributing to the achievement gap reflect the entire DLL experience; however, stress

may be a common factor contributing to the achievement gap for DLL and non-DLL students, alike (National Academy of Sciences, Engineering, and Medicine, 2017).

Not only does the link between stress and achievement need to be established in elementary school, but how stress impacts achievement is also important to identify. In theory, stress may impact learning processes which, as a mediator, in turn, impacts achievement. Yet, only one study examines how stress impacts achievement via learning processes (O'Neal, 2018). These mechanisms are important to identify in order to explain how learning plays a role in achievement in the face of risk factors, like stress (Masten, 2003). Understanding risk processes can lead to better research and interventions preventing the impact of risks, like stress, on learning processes and academic outcomes. Stress is likely to impact learning processes, like motivation, engagement, self-regulation, or growth mindset, but all of these have not been tested as outcomes of stress.

Socioemotional skills are an important part of the learning processes which relate to academic outcomes (Domitrovich, Durlak, Staley, & Weissberg, 2017). Understanding the process by which socioemotional skills impact achievement, therefore, merits further research (Masten, 2003). Initial risk models have tested motivation and engagement as an outcome of stress, with one study examining how stress impacts achievement via the mediators of grit and emotional engagement (O'Neal, 2018). However, mindset is one factor that has not been either examined as an outcome of stress or as a mediator of stress' impact on achievement. Mindset should be examined as a mediating socioemotional learning process partly because studies have indicated that students' mindsets play an essential role in learning and often lead to better achievement outcomes (e.g., Blackwell, Trzeniewski, & Dweck, 2007). The link between stress and growth

mindset is also supported by Masten's (2003) risk model, which posits that risks (e.g., stress) may negatively affect child development by weakening adaptive systems, including socioemotional factors like mastery motivation or mindset, over time.

Growth mindset (which first arose as a construct from research on mastery motivation) is defined as individuals' implicit beliefs that their abilities can develop with effort (Blackwell et al., 2007). Mindset occurs on a continuum, with individuals differing in their implicit views of intelligence as fixed or malleable (Dweck, 1999). In the face of academic difficulty, having a growth mindset contributes to fewer feelings of helplessness (Blackwell et al., 2007) and more positive beliefs about effort (Jones, Wilkins, Long & Wang, 2012). Researchers have implemented interventions that have shown that growth mindset is malleable and capable of changing, even across a short time period of one to four weeks (e.g., Blackwell et al., 2007; Yeager at al., 2016). These interventions have demonstrated that children can increase their beliefs about intelligence being expandable, which in turn, leads to higher levels of achievement (Blackwell et al., 2007; Yeager at al., 2016). An improved growth mindset may, therefore, act as a catalyst for improvements in achievement.

This thesis aims to understand the relationships among stress, growth mindset, and achievement in elementary school students. Using a sample of students attending two schools in a Maryland suburb, I examined the relationship between stress and achievement, and the mediating effects of growth mindset. This study was the first to assess growth mindset as a mediator of the negative impact of stress on literacy achievement, thereby addressing identified gaps in the literature. I am particularly interested in literacy achievement because reading is a fundamental skill that is important

for success in many other subject areas. The present study also explored whether patterns in the relation among stress, growth mindset, and literacy achievement differ between DLL and English-native students.

Chapter 2: Literature Review

The following literature review will explore the relations among stress, growth mindset, and achievement. I will review research regarding the achievement gap in elementary school-aged children and summarize the current literature on stress and growth mindset. Additionally, theory relevant to risk and resilience processes that lead to achievement will be addressed. Rationale for the present study, which was the first to evaluate growth mindset as a mediator of the negative impact of stress on achievement, will be discussed. In addition, I will explore potential implications of growth mindset for DLL students.

Theoretical Framework

The study relies on Masten's (2001) risk and resilience framework to test a model of how stress and growth mindset are related to literacy achievement over a short-term longitudinal design in a population of elementary school students. Masten's (2001) risk and resilience framework has been used to examine how environmental factors in a child's family, school, and community interact to either exacerbate problems and place children at risk or ameliorate problems as an opportunity for resilience (Bryan, 2003). The following section will focus solely on the risk aspect, rather than the resilience component, of Masten's framework.

Masten's (2001) model posits that risks may negatively affect a child's development by weakening adaptive systems over time, like learning processes, attachment relationships, mastery motivation and reward systems, or biological systems within the child. Child development is dynamic and arises from the interaction of these

adaptive systems (Masten, 2003). Processes underlying risks to development require explicit identification in order to understand how adaptive systems become weakened. Risk factors in Masten's model are often environmental and include stressful events, low parental education, divorce, and child maltreatment, which have the potential to negatively influence a child's development and academic functioning (Masten, 2003). The model also explores how ordinary resilience factors may help lessen the impact of adverse environmental effects by serving as a buffer for the child (Masten, 2001); however, the resilience component of Masten's framework is beyond the scope of this study.

The current study proposes that, using Masten's (2001) risk and resilience model as its theoretical basis, the link between the risk factor of stress with an outcome of achievement can be examined by investigating growth mindset as a mediation process. Stress is a pervasive source of risk that may weaken a child's ability to achieve over time (e.g., LePine, LePine, & Jackson, 2004). Stress may be especially relevant as a risk factor for DLL students given factors like parent immigration status (Alva & de Los Reyes, 1999), learning the English language, or the tendency to receive inadequate instruction and socioemotional supports in school (National Academy of Sciences, Engineering, and Medicine, 2017). The proposed study is therefore connected to Masten's (2001) framework, which posits that most risk factors to developmental and academic functioning arise from prolonged exposure to environmental threats. Similarly, Masten (2003) posits that a child's mastery motivation system may be weakened over time by risks, like stress. Growth mindset has been conceptualized as a socioemotional construct that is similar to mastery motivation, which has been defined as the inherent drive that

leads children to explore and master challenging tasks (Morgan, Harmon, & Maslin-Cole, 1990). Since growth mindset first arose as a construct from research on mastery motivation (e.g., Dweck & Leggett, 1988), it is possible that perceived stress may also negatively impact a student's mindset system. It is therefore worth examining how stress from the environment affects adaptive processes, and for whom stress has an impact with outcomes in academic functioning.

Risk processes need to be identified via a malleable mediator in order to establish how the outcome of achievement is affected by risk. A key element of a risk process model is having a malleable mediator, which is responsive to a risk predictor, like stress, and would explain the impact of the risk factor on the outcome. Therefore, I focus part of my justification for using a risk process model on the importance of a malleable mediator.

Growth mindset is a socioemotional construct and potential malleable mediator that may help explain the relation between a risk like stress with achievement. It is important to note that growth mindset can be viewed as a risk or protective factor, however, it will be examined as a risk process in this proposed study. Based on theory related to risk, growth mindset would need to diminish in response to risks, like stress. Since growth mindset is capable of change and helps students overcome academic challenges (e.g., Blackwell et al., 2012), it may also be capable of changing in response to stress. The malleability of growth mindset in students has been demonstrated by an abundance of research focused on implementing growth mindset interventions (e.g., Blackwell et al., 2007; Paunesku et al., 2015; Yeager et al., 2016). The ability of human adaptive systems to change is key to Masten's theory, and growth mindset is also

mutable. Given that growth mindset is capable of change, it may be an important part of an adaptive learning process with outcomes for achievement. Additionally, growth mindset first arose as a construct from research on mastery motivation (i.e., the inherent drive that leads children to explore and attempt to master challenging tasks; e.g., Dweck & Leggett, 1988), which is another adaptive system that Masten (2003) posits is weakened over time by risks, like stress. The relation between these constructs will be reviewed in further detail in the operationalization of growth mindset section of this proposal. In sum, growth mindset may act as a mediator that explains the risk effects of stress on academic achievement.

The current study model relies on the importance of identifying processes underlying risks to child development, namely malleable mediators, to explain how risks are threatening adaptive systems, such as learning. I offer a novel risk process model to examine the effects of perceived stress on academic achievement with growth mindset as a mediator. Appendix C shows the mediational model that was tested to answer the question: Does growth mindset mediate the relation between stress and academic achievement?

Achievement Gap in Elementary School

The academic achievement gap continues to be a pervasive issue within the American education system (Hemphill & Vanneman, 2011; Vanneman, Hamilton, Baldwin Anderson, & Rahman, 2009), partly due to its early emergence in a child's schooling. An achievement gap emerged as early as kindergarten in the Early Childhood Longitudinal Study (ECLS), where White and Asian students scored higher than Black and Hispanic students on reading and math tests (Lee & Burkam, 2002). The

achievement gap is also significant at kindergarten entry for Latino DLL children, and it can persist throughout their schooling, with unequal high school completion and college enrollment outcomes compared to non-DLL peers (Espinosa, 2013). Another study detected an achievement gap in standardized reading and math performance between Black and White children from low-income families at age 3 and again in grades 1, 3, and 5 (Burchinal et al., 2011). These studies demonstrate that the achievement gap originates before school-age and that certain ethnic and language minority groups are often entering elementary school with lower levels of readiness than their peers. Given that early achievement significantly predicts later academic success (e.g., Gormley, 2005*),* these students may even be at elevated academic risk as they enter school.

The largest continuing and nationally representative assessment of achievement demonstrates that the achievement gap has not changed significantly since the 1990's. According to the National Assessment of Educational Progress (NAEP), there was a steady 21 to 26-point difference in reading and math scores between Hispanic and White students from 1990 to 2009 (Hemphill & Vanneman, 2011). In some states, the achievement gap has shown more noticeable growth compared to national statistics. For example, in Maryland, scores of White students have increased at a higher rate on test scores than Hispanic students, causing the achievement gap to widen (Hemphill & Vanneman, 2011). Achievement gaps between DLL and native-English students are also evident on the NAEP, with striking differences in the literacy domain. In 2015, 4th grade scores differed by dual language learning status by 25 points in math and by 37 points in reading (Migration Policy Institute, 2017).

The literacy achievement gap. The achievement gap is influenced by a literacy gap, which has significant implications. Research has established the importance of mastering reading by the end of third grade (e.g., Hernandez, 2011), where the shift from *learning to read* to *reading to learn* occurs. Students who have not mastered reading by this pivotal point face barriers to success in later grades, as reading becomes fundamental to the process of learning. Students who fail to reach this milestone are also at-risk for other negative outcomes, such as unemployment and high school drop-out (Hernandez, 2011). In one longitudinal study, children who were not reading proficiently in third grade, as indicated by the reading recognition subtest of the Peabody Individual Achievement Test (PIAT), were four times more likely to drop out of high school (Hernandez, 2011). Ultimately, the literacy gap disproportionately affects certain minority groups, including students of color and DLL students (Murphy, 2014), and has lifelong negative implications.

In this study, I therefore focused on literacy achievement, using two separate measures of literacy achievement to evaluate achievement in a broad (standardized test scores in reading) and narrow (TOSREC) manner. In sum, this study focuses on literacy achievement because reading is a crucial skill that underlies achievement in other content areas. Reading also predicts future achievement and is widely a requisite for success in Western society (Hernandez, 2011).

Dual-language learning students and the achievement gap. The achievement gap is especially relevant for DLL students. Over the past 18 years, the DLL population has risen by 24% in the United States from 25.8% to 32% (Migration Policy Institute, 2017). Currently, Maryland is one of the top states for the DLL population, with 28.1%

of DLL children in the U.S. residing in the state (Migration Policy Institute, 2018). In recent years, the term "superdiversity" has been used to describe DLL, denoting the considerable differences and increased diversity within the population itself. DLL children are becoming increasingly heterogenous with regard to race and ethnicity, languages spoken, country of origin, family income, immigration status, and parental educational attainment (Migration Policy Institute, 2018).

DLL students face a considerable amount of stress and have unique learning strengths and needs. They often do not receive adequate instruction, or the socioemotional support needed to achieve at the appropriate grade level (National Academy of Sciences, Engineering, and Medicine, 2017). In addition to support and instruction, DLL students face other barriers to success, including learning the English language, acculturative stress, and/or parent immigration status (Alva & de Los Reyes, 1999; National Academy of Sciences, Engineering, and Medicine, 2017). The increasing "superdiversity" of this group makes it difficult to conclude that barriers contributing to the achievement gap reflect the entire experience of DLL students. Since DLL students are often faced with more potential stressors relative to non-DLL students (National Academy of Sciences, Engineering, and Medicine, 2017), stress is one commonality that may be a relevant cause of the achievement gap for all DLL students. Overall, stress likely contributes to the achievement gap, which has significant implications for students later in life, such as being less likely to graduate from high school or college, earning lower salaries, and a higher chance of being incarcerated (McKinsey, 2009).

Operationalization of Stress

The present study uses a psychological framework (Suldo, Shaunessy, & Hardesty, 2008), and defines stress as the perceived, internal experience of stress-related feelings (e.g. anxiety, anger, and hopelessness) in reaction to distressing life experiences (e.g., Suldo, Shaunessy, & Hardesty, 2008). Specifically, general life stress is the focus of this thesis and is operationalized as the degree to which situations in one's life are judged as uncontrollable, emotionally upsetting, or overwhelming. This perception of stress was chosen instead of a counting of stressful life events because it is better able to capture students' ability to cope and the perception of challenges in their lives (Cohen et al., 1983). Additionally, this operationalization of stress removes the assumption that an increase in the number of stressful life events leads to increased levels of perceived stress. Children who report high levels of perceived stress (as measured in this proposed thesis) have negative outcomes, such as academic underachievement (e.g. Schmeelk-Cone & Zimmerman, 2003).

As previously mentioned, the DLL population is becoming increasingly diverse, with many communities experiencing "superdiversity" in their classrooms (Migration Policy Institute, 2018). Furthermore, general life stress was chosen because it may be better able to capture the unique experience of stress for DLL students across their lives (Levy, Heissel, Richeson, & Adam, 2016; O'Neal, 2018), instead of a measure that focuses on one specific life stressor (e.g., school). This operationalization of general life stress is closely related to our stress measure. Despite the importance of establishing temporal precedence in mediation studies, few researchers have examined longitudinal effects of perceived life stress on outcomes over time among children. In the following

section, I will discuss the existing literature examining the relation between stress and academic achievement.

Stress and Achievement (C Path)

Stress has a negative effect on academic performance (LePine, LePine, & Jackson, 2004) and is an understudied contributor to the achievement gap (Levy et al., 2016). The stress literature is limited in that it focuses mainly on the effect of academic stress on achievement (e.g., Lui & Lu, 2010) and does not explore the relationship between stress and achievement among elementary aged children, when the achievement gap begins to widen (Burchinal et al., 2011). By focusing primarily on academic stress, the literature does not capture the overall experience of stress for students across their lives. Rather, there is a need for achievement research to move beyond the focus on academic-related stressors to reflect the overall impact of stress on the achievement of students, which may be especially relevant for "superdiverse" DLLs. Only two studies (Schmeelk-Cone & Zimmerman, 2003; O'Neal, 2018) examine the relationship between perceived stress and achievement. A small number of other studies focus on general life stress by measuring exposure to stressful life events (Alva & de Los Reyes, 1999; Gillock & Reyes, 1999).

Alva & de Los Reyes (1999), for example, found that perceived exposure to stressful life events was associated with decreased academic achievement in a sample of 9th grade students attending a predominantly Hispanic public high school in Los Angeles, California. Specifically, adolescents who self-reported higher levels of stressful life events were more likely to have a lower GPA composite obtained from school records on their six major classes and to perceive themselves as less competent. Similarly, stressful

life events were negatively correlated with academic achievement (i.e. cumulative GPA) in a cross-sectional study of urban, low-income, Latinx high school students (Gillock & Reyes, 1999). In essence, students who reported frequent experiences of personal stressors tended to have lower academic achievement. Although cross-sectional and limited in diversity (all participants in both studies identified as Latinx), these studies indicate that general life stress has a negative effect on the achievement of students.

Longitudinal studies provide the opportunity to better understand the effect of stress on the future achievement of students, yet there are few studies that have examined patterns of perceived, general life stress over time. Schmeelk-Cone & Zimmerman (2003) used the Perceived Stress Scale (PSS) to measure stress in a large sample of African American high school students who were selected to participate on the basis of having low GPAs ($\leq$3.0) in 9th grade, when the study began. Researchers found that adolescents with high levels of perceived stress received lower grades and were less likely to graduate from high school than those with lower stress levels over time. More recently, short-term longitudinal research done by our lab at the University of Maryland found that stress, measured using the PSS, has a negative impact on the achievement of elementary students (O'Neal, 2018). This study was unique in that literacy achievement was measured using the TOSREC, rather than a broad measure of achievement. More narrow measures, such as the TOSREC, may better assess students' level of literacy achievement, compared to broad achievement measures (e.g., GPA in core academic subjects) that are not specific to literacy. Results indicated that stress negatively influenced literacy achievement by impacting the mediator of emotional engagement among low-income, DLL students in the 3rd through 5th grades (O'Neal, 2018). Further

longitudinal research that links stress and achievement in diverse samples of elementary students is needed to understand patterns and effects over time.

Although environmental indicators of stress, such as poverty, neighborhood stress, and family transitions are often studied in elementary-aged children (e.g., Morales & Guerra, 2006), the only research studying the effects of perceived life stress on the achievement of elementary students has been done by our lab. This proposed thesis will build on the existing literature by exploring the relationship between perceived stress and literacy achievement. In the following section, I will define and discuss stress' relation to growth mindset, as it is also necessary to explore what skills may mediate the relation between stress and achievement.

Operationalization of Growth Mindset

Growth mindset, often referred to as incremental theory of intelligence, captures individuals' implicit belief that their abilities can develop with effort (Blackwell et al., 2007). For the purposes of this study, growth mindset will be defined in line with the Blackwell et al. (2007) definition of the construct, stated above. In contrast, those with a fixed mindset believe that they possess a certain amount of intellectual ability that cannot be changed, which is consistent with an entity theory of intelligence. Mindset occurs on a continuum, with individuals differing in their implicit views of intelligence as fixed or able to change (Dweck, 1999). Additionally, these theories of intelligence provide information about attitudes toward achievement or failure, and they shape responses to academic challenges (Blackwell et al., 2007).

Growth mindset first arose as a construct from research on children's attitudes toward learning (Dweck & Leggett, 1988) and mastery motivation, or the inherent drive

that leads children to explore and master a skill or tasks independently (Morgan et al., 1990). Since then, research has demonstrated that growth minded individuals respond to challenges with determination, perseverance, and confidence (King, McInerney, & Watkins, 2012). They are more likely to set goals that focus on increasing their own abilities and attribute challenges that arise to a lack of learning or effort, rather than a reflection of their own intrinsic ability (Blackwell, 2002; Dweck 2012). Fixed-minded individuals, on the other hand, are more likely to attribute failure to a lack of ability. Students with a fixed mindset are often concerned with their performance, rather than learning and mastering concepts. They are more likely to perceive that success is uncontrollable (King et al., 2012), and may feel threatened by failure because they view it as a reflection of their own intelligence (Bandura, 1997). These response patterns prevail in the face of difficulty, even when students show equal intellectual ability to one another (Blackwell et al., 2007).

Researchers have implemented growth mindset interventions that demonstrate that growth mindset is a malleable, changing state (Blackwell et al., 2007; Yeager et al., 2016). In one landmark study, half of a large sample of 7th grade students were taught that intelligence is expandable and can be developed. Three weeks after participating in the intervention, these students endorsed more of a growth mindset overall compared to the mindset of students in the control group, which did not change significantly (Blackwell et al., 2007). In another study of students transitioning to high school, an intervention that taught students about the expandability of the brain and the development of intelligence was effective in reducing reports of a fixed mindset, compared to the control group (Yeager at al., 2016). Additionally, the researchers controlled for previous

achievement, which could suggest that growth mindset interventions are effective in changing mindsets across all levels of achievement. These intervention studies have demonstrated that growth mindset is a malleable trait, in addition to predicting higher achievement.

Socioemotional skills, like growth mindset, present an opportunity to narrow the achievement gap. Growth mindset has been speculated to be a protective, moderating factor in the face of stressors, such as stereotype threat (Good, Aronson, & Inzlicht, 2003) and family income (Claro, Paunesku, & Dweck, 2016). Since growth mindset may be a changing state that is responsive to external pressures, it could potentially be dependent on levels of stress. However, to my knowledge, no observational study (i.e., without an intervention involved) has been conducted with an independent variable of stress and a dependent variable of growth mindset; I will review one study below that implements a growth mindset intervention and a subsequent social-stress task to investigate the relationship between growth mindset and later stress (Yeager, Lee & Jaimeson, 2016). In the following section, I will primarily review research in which stress had an influence on constructs that are similar to growth mindset.

Stress and Growth Mindset (A Path)

To my knowledge, no study has examined how stress predicts growth mindset. The only study that directly investigates the relationship between stress and growth mindset is one that tests the effect of growth mindset on stress. Students who learned about growth mindset had reduced HPA-axis activation after a social-stress task, measured through cortisol activity. Seven months afterwards, these students had stronger

improvements in grade point averages over students who did not learn about growth mindset (Yeager, Lee & Jaimeson, 2016). Building upon this study, the present study will be able to rule out reciprocal, or reverse, effects in examining the relation between stress and growth mindset by controlling for initial growth mindset (Time 1) when stress predicts growth mindset (Time 2). In sum, no observational study to date has been conducted with an independent variable of stress and a dependent variable of growth mindset.

Although no studies have tested stress' potential effect on growth mindset, the link between these variables is supported by Masten's (2001) risk and resilience model (as described in the theoretical framework section of this thesis) and studies that utilize similar socioemotional variables. Scant research has directly examined how stress affects socioemotional factors. One study, however, exemplified that stress can undermine socioemotional factors, specifically emotional engagement, over a short period of time (O'Neal, 2018). In a low-income DLL sample, perceived stress was found to have a negative association with both emotional engagement and literacy achievement, with engagement mediating the impact of stress on later literacy (O'Neal, 2018). The same may be true for stress undermining growth mindset, since it first arose as a construct from research on the effect of engagement and mastery motivation on students' learning behaviors (Dweck & Leggett, 1988). It is therefore worth examining whether this socioemotional factor is similarly affected by stress. In sum, the proposed thesis will build on this study by examining the potential mediating role of another socioemotional construct, growth mindset, in the relation between stress and literacy achievement.

Growth mindset has been responsive to intervention (e.g., Blackwell, 2007; Paunesku et al., 2015; Yeager et al., 2016), and its malleability may help students overcome challenges, such as stress or negative emotions. In a sample of Filipino elementary students, holding a fixed mindset had a positive relation with negative emotions, such as anger, anxiety, and hopelessness (King, McInerney, & Watkins, 2012). Due to the cross-sectional nature of this study, logically, the opposite relation (that negative emotions may predict a fixed mindset) may also hold true. Stress in this proposed thesis is similar to the negative emotions studied by King et al. (2012) in that the stress measure reflects students' perceptions of frustration, anger, and nervousness, although my stress measure is different by also capturing overwhelming or uncontrollable feelings in response to situations in one's life. This similarity acts as preliminary evidence that stress may impact growth mindset. Thus, it is worth examining stress' impact on growth mindset to determine whether higher levels of perceived stress will predict a more fixed mindset.

Growth Mindset and Achievement (B Path)

A growth mindset has been linked to greater academic achievement on standardized tests and the grades that students earn (Blackwell et al., 2007). When students are faced with academic challenges, having a growth mindset contributes to fewer feelings of helplessness (Blackwell et al., 2007) and more positive judgments about effort (Jones et al., 2012). Students show greater motivation to learn when they view learning as a situation in which they have the potential to develop their abilities (Dweck, 1999; 2006). The link between mindset and achievement has been found in students at different developmental levels, from middle school (Blackwell et al., 2007) to college

(Good et al., 2012). However, the relation has only been examined among elementary school students in two studies (Stipek & Gralinski, 1996; Park, Gunderson, Tsykayama, Levine, & Beilock, 2016). These short-term longitudinal studies investigated growth mindsets' relation with achievement over the course of one school year and will be discussed below.

Stipek & Gralinski (1996) collected surveys on ability- and effort-related beliefs in 3rd to 6th grade students attending several schools that largely served poor and working class ethnically diverse families. Over the school year, the belief that intelligence cannot be changed, similar to a fixed mindset, was negatively associated with math and social studies achievement (Stipek & Gralinski, 1996). More recently, research has longitudinally tested growth mindsets' relation with standardized achievement in an ethnically and socioeconomically diverse sample of 1st and 2nd graders (Park et al., 2016). Growth mindset was measured using an ability-performance belief versus effort-related belief scale that asked students about the stability of intelligence and academic ability in addition to their preference for easy tasks, in addition to collecting school records on standardized test performance. Children with a growth mindset performed better on standardized math tests compared to children with more of a fixed mindset (Park at al., 2016). Overall, attributing success to effort through a growth mindset improves academic outcomes (Park at al., 2016) and fosters positive academic behaviors, such as higher levels of persistence and motivation in school (Dweck, 2002). Nonetheless, growth mindset has been studied mainly in relation to math or science achievement and in older students (e.g., Good et al., 2012). No studies explicitly examine reading achievement as

an outcome, while three studies (Romero et al., 2014; Yeager et al., 2016; Paunesku et al., 2015) incorporate English grades into their average GPA as an outcome.

Given that research on growth mindset in elementary students is limited, I will also review studies that found a positive relation between growth mindset and achievement with older samples of students. In an ethnically diverse sample of 7th grade students who attended a rural school district, female students who were growth minded earned significantly higher standardized math test scores than females in the control group (Good, Aronson, & Inzlicht, 2003). In a landmark study of 7th grade students who varied widely in ethnicity, socioeconomic status, and achievement, a growth mindset predicted higher grades while a fixed mindset predicted stagnant math grades over the remainder of middle school (Blackwell et al., 2007). Similarly, a longitudinal study found that students who believed that intelligence was malleable in 6th grade earned higher grades throughout 7th and 8th grade, compared to those who believed that intelligence was fixed (Romero et al., 2014). The belief that intelligence can be developed also predicted more advanced math courses over time, suggesting that growth mindset may also influence longer term academic trajectories (Romero et al., 2014). Teaching students about the brain's ability to grow as a result of hard work and effort on challenging tasks (i.e., a growth mindset) has also led to higher GPA's for students at-risk of dropping out of high school compared to the control group, while controlling for race, gender, school type, and prior GPA (Paunesku et al., 2015). In another study of college students, growth minded women received higher calculus grades and were more likely to continue to pursue their math studies compared to women with more of a fixed mindset regarding their math ability (Good, Rattan, & Dweck, 2012). These studies further

demonstrate the positive effects of growth mindset on achievement across diverse samples of students.

Growth mindset and achievement among DLL students. Researchers have proposed that growth mindset may help lessen the achievement gap (Dweck, 2015). Growth mindset may therefore hold important implications for DLL students, who often have lower achievement compared to their non-DLL peers (Murphey, 2014). More specifically, growth mindset may help decrease risk for the negative effects of stress for students affected by the achievement gap. No studies to date have explored growth mindset in DLL students; however, the abundance of research reviewed above indicates the utility of growth mindset for learning in general.

For example, those with a growth mindset are more likely to adapt in response to difficulty and put forth effort to overcome challenges (Blackwell et al., 2007), like underachievement relative to peers. Individuals with a growth mindset feel more empowered to work towards a goal and view failure as due to causes within their control, such as a lack of effort. As a result, failure is less threatening to growth minded individuals because setbacks are seen as an opportunity to improve (Aronson et al., 2002). This mindset may be especially useful for DLL students who face unique stressors that exceed academics, like language barriers or acculturative stress (e.g., Alva & de Los Reyes, 1999). The environmental challenges that DLL students often face might make it difficult to persist and put forth effort to achieve. A growth mindset may help DLL students reframe challenges, such as learning the English language, as something that can be overcome with increased effort.

It is important to note that the focus of the exploratory analysis is not to uncover potential deficits (i.e., I will not compare mean levels of growth mindset among DLL and non-DLL students), but to determine if the relation between growth mindset and achievement is similar among DLL and non-DLL students. The relation between growth mindset and literacy achievement may differ by DLL status, thus, the present study will explore growth mindset and literacy achievement among DLL and native English-speaking students.

Growth Mindset as a Mediator

There is a need to identify mediation processes underlying the relation between stress and achievement. As reviewed earlier, one short-term longitudinal study examined the impact of stress on achievement, as mediated by grit and engagement, in a sample of elementary-aged DLL students (O'Neal, 2018). Stress reduced student's academic engagement, which, in turn, had a negative effect on literacy achievement over the course of a four month study (O'Neal, 2018). This study demonstrated the link between stress, socioemotional factors like engagement, and achievement, such that higher levels of perceived stress lead to lower levels of engagement and subsequently, lower levels of achievement over time. The proposed thesis will build on this study by examining the potential mediating role of a similar socioemotional construct, growth mindset, in the relation between stress and literacy achievement, in a different sample.

Compared to more static traits, malleable socioemotional skills are often thought of as "resilience factors" that help students overcome challenges (Green et al., 2008). Intervention research on growth mindset has shown that students' mindsets are capable of changing, even across a short time period of one to four weeks (Blackwell et al., 2007;

Yeager et al., 2016). Thus, growth mindset is a changing, malleable state that occurs on a continuum and may serve as a mediator that is capable of changing in response to stress. Having more of a growth mindset, or increasing beliefs about one's intelligence being expandable, may in turn, lead to higher levels of achievement.

While studies have indicated that students' mindsets play an essential role in learning (e.g., Blackwell et al., 2007*)*, research on mediation models involving the effects of stress on achievement are needed. The proposed study will build on the literature by directly examining the mediational processes involved in the relation between stress and academic achievement. Although DLL students face unique stressors (National Academy of Sciences, Engineering, and Medicine, 2017), evidence does not inform whether growth mindset will differ as a mediator by DLL group. The proposed study will therefore explore growth mindset as a mediator for DLL students, with no firm hypothesis about the strength of growth mindset for DLL students compared to non-DLL students. By investigating growth mindset as a mediator, research can move towards identifying risk processes, which will help us better understand how to support students with the negative consequences of stress on academic performance.

The Present Study

The present study aims to understand the relationships among stress, growth mindset, and achievement in elementary school students. The present study was the first to evaluate growth mindset as a mediator of the negative impact of stress on achievement. This study also explored whether mediation patterns in the relations among stress, growth mindset, and literacy achievement differ between DLL and English-native students.

Research Questions and Hypotheses

I propose the following research questions and hypotheses to explore the relationship between stress, growth mindset, and achievement in a short-term longitudinal study:

1. How does perceived stress impact literacy achievement?
    a. *Hypothesis:* Perceived stress will have a negative effect on literacy achievement among students.
2. Does growth mindset mediate the relation between perceived stress and literacy achievement?
    a. *Hypothesis:* Growth mindset will mediate the relation between perceived stress and literacy achievement. Specifically, perceived stress will be negatively related to growth mindset (Path A), growth mindset will be positively related to achievement (Path B), and perceived stress will be negatively related to achievement (Path C).
3. Is the mediation process the same or different for DLL and non-DLL students?
    a. *Exploratory:* I will explore whether growth mindset will be an equally strong mediator for DLL students who are facing stress as it is for non-DLL students.

Chapter 3: Method

This study used a short-term longitudinal design with data that was collected at three time points from March to June of 2015. Researchers obtained parent consent and student assent before administering measures that assessed students' perceived stress and growth mindset. Time 1 measures were administered in March, Time 2 measures were administered from April to May, and Time 3 measures were administered in June. The data in this study was initially collected as part of a larger study, which includes other variables such as grit, peer and teacher support, emotional engagement, and anger regulation. Further information about the study design is detailed below.

Participants

Two hundred and fifty-one students participated in the study (M_{age} = 9.71, 56% female; 61% White; 12% Multiracial; 10% African American, 6% Latinx, 5% Asian, 6% other). Participants were recruited from two suburban elementary schools in Maryland and fell evenly across the third, fourth and fifth grades. Students were further identified as DLL if they or their parents reported that a parent spoke a language other than English at home (Child Trends, 2014). In cases where the child and parent reported ethnicity and/or DLL status differed, researchers used the parent report as the correct indicator of ethnicity and/or DLL status. Of the 251 students in the sample, 36% were identified as DLL (n = 81). DLL participants were more ethnically diverse than non-DLL participants (see Table 1), with 65% being ethnic minority compared to 25% in the non-DLL group. Overall, participating students' gender and ethnic demographics were proportional to that

of the schools' total student body (62% White, 12% Multi-racial, 10% African American, 6% Latinx, 5% Asian American, and 6% other; see Table 1), detailed further below.

Students were recruited from 27 classrooms across the two elementary schools. In both schools, approximately 57% of students are White non-Hispanic, 9-16% are Hispanic, 12-15% are Black non-Hispanic, 5% are Asian American, 7% are multi-ethnic, and <5% are American Indian (see Table 1). School-level statistics revealed that the two schools were comparable on other demographics too, including English as a Second Language (ESOL) (approximately 6% of students) and Free and Reduced Meals (FARMS) (14% of students). Across the two elementary schools, FARMS students were evenly divided among ethnic minority groups. Note that the school district did not permit researchers to ask students or parents about their socioeconomic or immigrant generational status. However, it is probable that differences in achievement between DLL and non-DLL participants are not due to low-income status because ethnic minority (≤ 5.5) and White groups (≤ 5) received FARMS at similar rates.

All recruitment and study procedures were conducted according to the school district's Office of Shared Accountability and the University of Maryland's IRB. Our Emotions, Equity, and Education lab recruited participants by visiting with teachers during team meetings to discuss participation in the study. Consent forms were handed out for students to bring home, and parents were asked to provide written consent for students to participate in the study. Thirty six percent of the students across the two schools in the third through fifth grades agreed to participate in the study. This recruitment rate ranged from 12% to 67% per class. As a result of being interested in our research, some teachers may have provided more reminders to students to return consent

forms. Analysis adjusted for class cluster to adjust for potential cluster effects on the model testing.

Procedure

The research was approved by the University of Maryland Institutional Review Board (IRB) and the public schools' district IRB. Students were interviewed at 3 time points (March, April to May, and June of 2015). Stress, growth mindset, and literacy achievement were assessed at all three time points. The proposed study will include perceived stress at Time 1, growth mindset at Time 2, and literacy achievement (TOSREC and MAP-R scores) at Time 3, in addition to controlling for gender, age, school type, interview format (individual vs. group interviews), gifted center participation, ethnicity (white vs. non-white), and both previous Time 1 achievement and growth mindset. See measures section for more information about these controls.

On average, there was approximately three months between students' Time 1 and Time 3 interviews. At each time point, researchers read the surveys aloud one-on-one to each student and answer options were presented on a printed scale. Students had the opportunity to point out their answer on the printed sheet. Additionally, students completed a three-minute standardized literacy test at each time point. Due to time constraints, 21% of students' data were collected in a small group setting. As a result, analyses will control for interview format to ensure that it does not influence the relation between the variables of interest.

Measures

Perceived stress. Perceived stress was assessed using a modified version of the 10-item Perceived Stress Scale (PSS-10; Cohen & Williamson, 1988) that was adapted for use with younger children. Students rated how often their lives felt uncontrollable, emotionally upsetting, or overwhelming within the last week (1= Never, 5 = Very Often). Questions focused on generalized perceived life stress (e.g., "How often did you feel like you could not do anything to change the way things were going?"). The PSS-10 scale demonstrates good internal consistency among adults (α = .89; Roberti, Harrington, & Storch, 2006).

Growth Mindset. Growth mindset was assessed using a subscale of a larger growth mindset measure titled Helplessness vs. Mastery-Oriented Responses to Failure scales (Blackwell et al., 2007). Students were read a vignette about failing a quiz in a preferred class. After, students rated how much they agree with sixteen statements about their attributions about failing and strategies for the future (1= Disagree a lot, 6 = Agree a lot). These statements represent a growth or fixed mindset. The growth mindset items based success on effort, presented failure as a challenge to work through and reflected feelings of perseverance (e.g., "I would work harder in the subject from now on"). Items reflecting the contrasting fixed mindset focused on attributions about ability or failure being out of the student's control (e.g., "I'm just not good at this subject"). Other fixed mindset items reflected avoidance as a future strategy (e.g., "I would try not to take this subject ever again"). The subscale has strong internal consistency among ethnically diverse middle school students (α = .76-.84; Blackwell et al., 2007) and adequate internal

consistency among primarily white, suburban 9th graders (α = .64-.76; Jones, Wilkins, Long, & Wang, 2012).

Given that the Helplessness vs. Mastery-Oriented Responses to Failure scale was originally standardized on middle and high school students, the scale developers provided the researchers with adapted questions tailored to a younger age group (L. Blackwell, personal communication, February 11, 2015). The original scale consisted of a helpless attributions subscale and a positive strategies subscale; the new items included responses to failure such as, "I didn't study enough," and "I would ask someone for help with the subject." There are no published psychometrics on these updated items.

Standardized test scores in reading. Students' scores on the Measures of Academic Progress in Reading (MAP-R), the district's standardized reading achievement test, were provided by the schools. The MAP-R is a computer-adaptive literacy achievement test that measures students' reading comprehension and vocabulary. The test typically takes 30 minutes to an hour to complete and requires students to answer multiple-choice questions in a variety of formats, including fill in the blank and comprehension questions about brief essays. The test is adaptive in that each test item is selected from a pool of possible items to match the student's estimated ability level, gauged from their performance on the previous item. Items in the pool are moderately to highly correlated (r = .68-.92) with generally high internal consistency (α = .61-.92).

The MAP-R is nationally normed for children in second grade through high school. The MAP-R is taken in the Fall and Spring of the third, fourth, and fifth grades at the participating schools. The Spring scores will be used as one of the standardized literacy outcome measures in the present study.

Standardized reading performance task. The Test of Silent Reading Efficiency and Comprehension (TOSREC; Wagner, Torgeson, Rashotte, & Pearson, 2010) tests students' silent reading decoding (accuracy), fluency (speed), and comprehension. At Time 3, each participant took the TOSREC. Students had three minutes to read as many sentences as they could to themselves and mark whether each sentence was true or false (e.g., "An apple is blue."). The TOSREC has strong reliability and convergent validity with other measures of literacy achievement, such as the Woodcock-Johnson Tests of Academic Achievement, 3rd ed. (WJ-III; Wagner et al., 2010).

Controls. Other studies have controlled for factors that may also play a role in the relationship between stress and achievement, such as gender, age, and previous achievement. I therefore entered covariates, including gender, age, ethnic minority status (white vs. non-white) school type, interview format (individual vs. group completion of measures) and both previous achievement and growth mindset to control for as many exogenous variables as possible, depending on power, that may affect the relationship between the variables of interest. It was important to control for ethnicity, in particular, to isolate it from DLL status and ensure that these variables are not confounding. Additionally, some students in the sample were enrolled at the gifted center, where they took advanced coursework. Since participation in more advanced courses could affect perceived stress, one's mindset, and achievement, gifted center participation was also entered as a control.

Analytic Procedure

A power analysis was conducted using G*Power to determine the likelihood that the sample size is sufficient to detect statistical significance, while controlling for as many relevant exogenous variables as possible. Descriptive statistics and psychometric analysis, including alpha coefficients, means, ranges, standard deviations of all studied variables were assessed using IBM SPSS Statistics version 23 to determine if they present normal distributions. Alpha coefficients of .65 or higher were considered to meet an acceptable internal reliability level (DeVellis, 2003). Correlations among the mediation model variables were calculated to determine if significant correlations occur between expected variables on the A, B, and C paths of the mediation model.

Using principle components analysis with oblimin rotation method in SPSS, an exploratory factor analysis was conducted on the perceived stress measure to determine if all items load positively onto one factor. This analysis was conducted because the PSS-10 has not yet been validated with school age children in any published studies. Items were considered to load sufficiently onto a factor when loadings measure ≥ .40 on the primary factor. An exploratory factor analysis of the growth mindset measure was also conducted (using principle components analysis with oblimin rotation method in SPSS) to evaluate the factor-structure of the measure when it included the child-adapted items, since those items were created by Blackwell et al. (2007) for clinical purposes and there are no published psychometrics on them.

Subsequent analysis was conducted using Mplus version 8.0 (Muthén & Muthén, 1998-2018). First, path analysis was conducted to examine the relation between perceived stress and literacy achievement. The analysis utilized bootstrapping with

10,000 sample replicates (Preacher & Hayes, 2008) as well as a maximum likelihood estimation with robust standard error, ML, to manage missing and potential non-normal data (Muthén & Muthén, 1998-2018).

Path analysis was also used to test the proposed mediation model (Figure 1a and 1b in Appendix C). In Figure 1a, path A is the relation between perceived stress and growth mindset. Path B is the relation of growth mindset with the academic achievement of students, as measured by the TOSREC. Path C is the direct relation of perceived stress on the continuous measure of TOSREC percentiles. Figure 1b depicts the path relations between stress, growth mindset, and achievement with the continuous measure of Spring MAP-R percentiles as the outcome variable. In path analysis, the two outcome variables (Time 3 TOSREC and Spring MAP-R) were tested within the same mediation model.

To explore whether the mediation process was statistically different between DLL and non-DLL students, path analysis was conducted in MPlus to examine mediation in each group. Then, a multiple group comparison test was used to determine if mediation (specifically the indirect effects) in the DLL group was significantly different from mediation in the non-DLL group. Since the present study used observed variables, measurement invariance was not formally testable (G. Handcock, personal communication, September 5, 2019).

Mediation was tested by running the INDIRECT command in MPlus with bootstrapping (Preacher & Hayes, 2008), which is a method that uses a regression procedure and tests the significance of mediation via bootstrapping. The analysis utilized bootstrapping with 10,000 sample replicates to test the significance of the indirect, direct, and total effects in each hypothesized mediation model (Preacher & Hayes, 2008).

Repeated bootstrapping of a sample can create a more normal distribution for significance testing and reduce Type I error rates (Preacher & Hayes, 2008). Additionally, in longitudinal studies, bootstrapping can uncover the complex effects of a mediator over time (Shrout & Bolger, 2002). A maximum likelihood estimation with robust standard error, ML, was used in MPlus to manage missing and potential non-normal data (Muthén & Muthén, 1998-2018).

In all models, fit indices were examined to evaluate model fit, including Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI), and Standardized Root Mean Squared Residual (SRMR). Model fit was assessed with cutoffs used in previous studies that have considered RMSEA values of less than 0.06, SRMR values of less than 0.08, and CFI values of greater than 0.95 as evidence of good model-data fit (e.g., Sass, 2011).

Chapter 4: Results

Descriptive Statistics

Table 2 and 3 presents the means, standard deviations, alpha coefficients, and ranges for stress, growth mindset, and achievement outcomes for the total group and by subgroup. Alpha coefficients and descriptive differences between the DLL and non-DLL groups will be discussed for each measure below.

The internal reliability coefficient of the perceived stress scale was in the excellent range (α = .82 for the overall sample, α = .84 for the DLL sample, α = .80 for the non-DLL sample). Mean perceived stress scores for DLL students (M = 26.09) were significantly higher than those of non-DLL students (M = 24.03); t(241) = -2.5, $p < .05$.

The full growth mindset scale demonstrated acceptable reliability across the full and subsamples (α = .65-.76). Although the strategies subscale did not meet an internal consistency level of .65 in the DLL sample (α = 0.52), it was acceptable in the total sample (α = .0.65) and the non-DLL sample (α = .68). This difference could be explained by lack of variability in sample size (n= 81) in the DLL group. In other words, lower internal reliability of the strategies subscale in this group may have been caused by higher variability in responses, and less consistency, in responses to items on the subscale, due to the small sample size. The attributions subscale did not meet the internal reliability threshold of .65 across the total sample (α = .61) or subsamples (α = .57-.63).

Growth mindset had the same mean across the total, DLL, and non-DLL samples (M = 4.94). The means of the growth mindset strategies subscale for the total, DLL, and

non-DLL samples (M = 5.36, 5.43, and 5.33, respectively) were higher than the means of the attributions subscales (M = 4.51, 4.47, and 4.53, respectively).

As detailed in Table 3, a literacy achievement gap emerged between DLL and non-DLL students: non-DLL students performed significantly higher than DLL students on both the TOSREC, t(188)=3.01, p<.05 and the MAP-R, t(233)=4.03, $p < .01$. The mean percentile for DLL students on the TOSREC was at the 66th percentile whereas the mean percentile for non-DLL students was at the 78th percentile. Similarly, the mean percentile for DLL students on the MAP-R was at the 74th percentile; the mean percentile for non-DLL students was at the 86th percentile. Overall, the mean percentile for the TOSREC was at the 74th percentile and the mean percentile on the MAP-R was at the 82nd percentile for the total sample.

Correlations

Correlations were examined between all of the variables of interest in the total sample and within the DLL and non-DLL subgroups. A correlation matrix for the observed variables of interest is displayed in Table 4.

Total sample. As expected, perceived stress was negatively correlated with all achievement outcomes, including MAP-R percentiles (r = -.17, $p < .01$), and TOSREC (r = -.16, $p < .05$) in the total sample. This significant correlation on the C path (see Appendix C for conceptual model) establishes that Time 1 perceived stress is negatively correlated with Time 3 achievement. Perceived stress also had a significant negative correlation with the mediator, Time 2 growth mindset (r = -.37, $p < .01$), as well as with the growth mindset attributes (r = -.35, $p < .01$) and strategies (r = -.31, $p < .01$)

subscales. Only the Time 2 growth mindset attributions subscale was significantly correlated with MAP-R percentiles (r = .16, < .05). Overall, significant correlations occur between the expected variables on the A, B, and C paths of the mediation model in the total sample.

DLL versus non-DLL groups. Correlations among stress, growth mindset, and achievement were similar in the DLL and non-DLL subsamples. In the DLL sample, perceived stress was significantly correlated with the full growth mindset (r = -.48, p <.01) scale, as well as with the attributes (r = -.44, p <.01) and strategies (r = -.35, p <.01) subscales. However, in the DLL sample, neither perceived stress nor growth mindset were significantly correlated with the achievement outcomes. In sum, significant correlations occur between expected variables on the A path, but not on the B or C paths in the DLL group.

In the non-DLL sample, perceived stress was negatively correlated with growth mindset and its subscales (r = -.30 – .33, p <.01). Additionally, perceived stress was negatively correlated with MAP-R (r = -.17, p <.05), but not TOSREC. The mediator, Time 2 growth mindset, was not significantly correlated with either achievement outcome. Thus, significant correlations occur between expected variables on the A and C paths, but not the B path in the non-DLL group.

Although significant correlations did not occur between all variables in the mediation models when the sample was split into DLL and non-DLL groups, mediation was still tested in exploratory analysis to compare the process between DLL and non-DLL students.

Model 1: Examining the Relationship between Stress and Achievement

To answer the question, "How does perceived stress impact literacy achievement?" the relationship between perceived stress at Time 1 and literacy achievement outcomes at Time 3 (TOSREC and MAP-R) was examined.

Exploratory factor analysis of stress. Using principle components analysis in SPSS, an exploratory factor analysis was conducted on the perceived stress measure. As proposed by Cohen and Williamson (1988) and seen in previous tests within this sample, it was anticipated that all items on the perceived stress scale would load positively onto one factor. Based on the cutoff eigenvalues of greater than 1, the data appeared to have one factor. The principle components analysis further revealed that all 10 items loaded positively onto the one factor at .54 or above, indicating that the perceived stress measure is unidimensional. The one factor explained 38.8% of the variance of the measure.

Path analysis. A model including perceived stress and both achievement outcomes was run and appeared saturated ($\chi^2 = 0$, df=0). As a result, fit indices were not examined to evaluate model fit (Kenny, 2015). However, parameter estimates were still examined, based on research that has suggested that the chi-square statistic is sensitive to sample size and can produce Type I error for models that do not have between 75 and 200 cases (Kenny, 2015). Analysis revealed that Time 1 perceived stress was negatively related to Time 3 TOSREC (Estimate = -.77(-2.96), $p < .01$, 95% CI = [-1.23, -0.27]) and Time 3 MAP-R (Estimate = -.57(-2.36), $p < .05$, 95% CI = [-1.07, -0.12]) for the total sample. This is consistent with the hypothesis for Model 1, which is that stress is negatively related to literacy achievement.

When previous achievement was added in as a control, the model fit was inadequate, RMSEA = 0.33, CFI = 0.90, SRMR = 0.10, $\chi^2 = 49.8$, df = 2. Additionally, there was no longer a significant negative relationship between perceived stress and the achievement outcomes; see Table 5 for estimates and *p*-values. It is likely that these findings are due to the fact that Time 1 and Time 3 TOSREC were administered so close together, with only 2-3 months in between them. Previous achievement (Time 1 TOSREC and Fall MAP-R) and literacy achievement outcomes (Time 3 TOSREC and Spring MAP-R) were also strongly correlated (see Table 4). Additionally, previous achievement explained the majority of the variance in literacy outcomes, which made it challenging to identify variance attributed to growth mindset in the mediation models.

As a result, a third variant of this model was run without Time 1 achievement variables. This variant controlled for gender, age, school type, ethnic minority status (white vs. non-white), interview format (group vs. individual interview), and gifted center participation (enrolled vs. not enrolled at the gifted center). The model appeared saturated ($\chi^2 = 0$, df=0), so fit indices were not examined to evaluate model fit (Kenny, 2015). Analysis revealed that Time 1 perceived stress was negatively related to Time 3 TOSREC (Estimate = -.57(-2.23), $p < .05$, CI[-1.11, -.12]) only. Overall, these results supported my hypothesis that stress is negatively related to literacy achievement.

Model 2: Examining Growth Mindset as a Mediator

To answer the question, "Does growth mindset mediate the relation between stress and achievement?" the relationship between perceived stress, growth mindset, and literacy achievement outcomes was examined.

Exploratory factor analysis of growth mindset. An exploratory factor analysis was conducted on the growth mindset measure using principle components analysis in SPSS. Based on the growth mindset literature, it was expected that the measure would load onto two factors.

First, I ran an EFA of the full growth mindset scale, including the additional child-adapted items that the scale developers provided to our lab to use with younger children (L. Blackwell, personal communication, February 11, 2015). Based on the cutoff eigenvalues of greater than 1, the data initially appeared to have a three-factor structure. Analysis revealed that the child-adapted items "I didn't study enough" and "I would complain to the teacher or my parents" did not load well onto any of the factors (i.e., did not have an estimate of at least .40). As a result, these items were dropped from analysis to increase reliability and ensure a better overall fit. Although the last remaining child-adapted item "I would ask for help with the subject" loaded onto the third factor at .49, it was also removed from analysis to maintain consistency and utilize the original 8-item growth mindset scale. It should be noted that these items were also dropped to increase reliability in the original study by Blackwell and colleagues (2007) that introduced Helpless vs. Mastery-Oriented Responses to Failure scale, and their psychometric properties have not been studied in any subsequent published research.

After re-running an EFA of the full growth mindset scale without the child-adapted items, the data loaded onto a single growth mindset factor, based on the cutoff eigenvalues of greater than 1. The factor explained 40.9% of the variance of the total growth mindset scale. Based on previous analysis with this sample conducted by our

research lab and to keep the model as simple as possible, the single factor of growth mindset will be used for mediation testing.

I also ran two separate EFAs for the attributions and strategies subscales. Based on the cutoff eigenvalues of greater than 1, one factor emerged from the data in both analyses. In the first EFA, the one factor explained 51.4% of the variance of the attributions subscale. Similarly, the one factor explained 51.1% of the variance of the strategies subscale in the second EFA.

Mediation analysis. Since the attributions subscale of the growth mindset measure was significantly correlated with MAP-R in the total sample, I first tested the attributions subscale as a separate mediator of the relation between perceived stress and achievement. This model included Time 2 attributions as a mediator between Time 1 perceived stress and Time 3 literacy achievement (MAP-R and TOSREC), while controlling for gender, age, school type, interview format (group vs. individual interview), gifted center participation (enrolled vs. not enrolled at the gifted center), and ethnic minority status (white vs. non-white).

Although Time 1 perceived stress was a significant predictor of Time 2 attributions ($\beta = -.05$), Time 2 attributions was not significantly related to Time 3 literacy achievement (MAP-R or TOSREC). Additionally, the direct effect of perceived stress to literacy achievement was not significant. As would be expected from these results, the indirect effect (of Time 1 perceived stress to Time 3 literacy achievement, as mediated by Time 2 attributions) was also nonsignificant. The full bootstrapped mediation model can be found in Table 6.

A second model included the full growth mindset measure at Time 2 as a mediator between Time 1 perceived stress and Time 3 literacy achievement (MAP-R and TOSREC), while controlling for gender, age, school type, interview format (individual vs. group interview), gifted center participation (enrolled vs. not enrolled at the gifted center), and ethnic minority status (white vs. non-white). Similarly, Time 1 perceived stress was a significant predictor of Time 2 growth mindset (β = -.04), but Time 2 growth mindset was not significantly related to Time 3 literacy achievement (MAP-R or TOSREC). Additionally, the direct effect of Time 1 perceived stress to Time 3 literacy achievement was not significant, nor was the indirect effect (of Time 1 perceived stress to Time 3 literacy achievement, as mediated by Time 2 growth mindset) significant. The full bootstrapped mediation model can be found in Table 7.

Model 3: Exploring the Mediation Process for DLL versus non-DLL students

Path analysis was conducted in the DLL and non-DLL subsamples, using a model that tested Time 2 attributions as a mediator between Time 1 perceived stress and Time 3 literacy achievement (MAP-R and TOSREC). Gender, age, school type, interview format (group vs. individual interview), gifted center participation (enrolled vs. not enrolled at the gifted center), and ethnic minority status (white vs. non-white) were entered as controls. Then, a multiple group comparison test was used to determine whether the indirect effects were significantly different between the DLL and non-DLL groups.

Path analysis: DLL subsample. Although, Time 1 perceived stress significantly predicted Time 2 attributions (β = -.07, CI[-0.12, -0.03]), Time 2 attributions did not significantly predict either literacy outcome at Time 3. Additionally, the direct effect (of

Time 1 perceived stress on Time 3 literacy achievement) and indirect effects (of Time 1 perceived stress on Time 3 literacy achievement, as mediated by Time 2 attributions) were non-significant. The full bootstrapped mediation model can be found in Table 6.

Path analysis: Non-DLL subsample. Analysis revealed that growth mindset attributions mediated the effect of perceived stress on literacy achievement, as measured by the TOSREC. Results indicated that Time 1 perceived stress was a significant predictor of Time 2 attributions (β = -.04, CI[-.06, -.02]), and that Time 2 attributions was a significant predictor of Time 3 TOSREC percentiles (β = 6.31, CI[.87, 11.62]). The indirect effect of Time 1 perceived stress on Time 3 TOSREC percentile scores, as mediated by Time 2 growth mindset attributions, was also significant (β = -.26, CI[-.58, -.07]). In this model, mediation was not significant with the achievement outcome of MAP-R percentiles. Taken together, these results support the model 2 hypothesis that growth mindset, specifically growth minded attributions, mediates the negative relation of perceived stress on achievement for non-DLL students.

Multiple group comparison. A comparison test was used to determine whether the indirect effects were significantly different between the DLL and non-DLL groups. Results indicated that the indirect effects of the DLL (β = .02, CI[-.69, .71], $p > .05$) and non-DLL groups (β = -.26, CI[-.58, -.04], $p > .05$), were not significantly different from one another, $p > .05$. Perhaps the magnitude of the indirect effect in the non-DLL group was not strong enough to be significantly different from the indirect effect of the DLL group. Additionally, this finding could be due to the inadequate power of .70 in the DLL subsample.

Chapter 5: Discussion

The main goal of this study was to examine growth mindset as a mediator of the relation between perceived stress and reading achievement for elementary school students. Initial results indicated that perceived stress was negatively related to literacy achievement (specifically TOSREC percentiles). Yet, growth mindset did not mediate the negative impact of perceived stress on literacy achievement in the full sample. Nevertheless, this study makes a unique contribution to the literature by suggesting that growth-minded attributions may be a significant mediator for non-DLL students in particular. In addition, results suggest that stress is a risk factor that may weaken an individual's growth mindset over time.

Across the full sample as well as the DLL and non-DLL subsamples, perceived stress significantly predicted growth mindset. This suggests that perceived stress may lead to a decreased ability to: (a) make adaptive attributions about failure and (b) engage in effort-based, positive strategies following a failure. For example, a student experiencing high perceived stress may be more likely to avoid taking a challenging subject, rather than working harder in the subject in the future. Additionally, times of high stress may lead students to adopt a "helpless" mentally and attribute their failures to external factors that they cannot control. The potential effect of stress on a student's mindset surrounding their intelligence should be considered by educators when individualizing instruction and adopting interventions for at-risk students.

This study also explored whether the mediation process differed based on DLL status. One interesting finding was that growth minded attributions (e.g., disagreeing with

the statement “I wasn’t smart enough” after failing a quiz in a preferred subject) mediated the negative effect of stress on TOSREC percentiles for the non-DLL sample only. For the DLL sample, growth mindset was not a significant mediator of the relation between stress and either reading achievement outcome. The following discussion will further explore these results in the context of existing literature on stress, growth mindset, and achievement, while also considering limitations of the current study. Implications and future directions will also be discussed throughout the discussion.

The Relationship between Stress and Reading Achievement

As predicted, perceived stress had a negative effect on reading achievement among students over time. These findings add to the small number of studies that have found that general life stress is negatively related to academic performance (e.g., Alva & de Los Reyes, 1999; Gillock & Reyes, 1999; Schmeelk-Cone & Zimmerman, 2003; O’Neal, 2018). In the present study, the link between stress and reading achievement was established using outcome measures that tap into multiple components of literacy (e.g., comprehension, decoding, fluency, vocabulary development), rather than focusing solely on GPA as an indicator of achievement. Using silent reading fluency and sentence completion measures, like the TOSREC, may be a better indicator of literacy. These types of domain-specific measures may also be more meaningful and relevant for elementary school students, compared to GPA. Future studies should therefore utilize similar outcomes to investigate other mechanisms to determine *how* stress negatively affects literacy achievement for elementary school students.

The findings of the present study are also unique in that they confirm the negative impact of perceived stress on reading achievement within elementary school, which is a

developmental period that only one other study has examined in reference to perceived stress (O'Neal, 2018). One explanation for stress' potential negative impact on achievement is that students who endorse high perceived stress may suffer from working memory limitations, which in turn, may impact their academic performance. For example, research has indicated that sustained unpleasant emotional states, such as anxiety, may occupy working memory and result in difficulty sustaining concentration on tasks (e.g., Shackman et al., 2006). This process may be similar for students who report high levels of perceived stress. On the PSS-10, those who endorse high perceived stress indicate feeling overwhelmed, emotionally upset, and out of control of situations in their lives. Additionally, students who endorse high perceived stress on the PSS-10 perceive that they do not have adequate resources to cope with stressful events. For these students, the regulation of negative thoughts and emotions related to life stress may take up too much working memory capacity, leading to underperformance in cognitively challenging tasks, like tests of reading achievement (Schmader et al., 2008). Moreover, this process is likely occurring during a vital period in schooling in which the achievement gap begins to widen (Burchinal et al., 2011). In sum, students high in perceived stress may suffer from working memory limitations that affect their academic performance, as demonstrated in previous studies with anxiety.

It is important to note that the inverse relation between stress and literacy achievement may also be true, specifically that reading achievement may have a negative impact on students' stress levels. Although no known published studies have examined the impact of literacy on the perceived stress of children, research has suggested that children could develop sustained negative emotions (e.g., anxiety) in response to

experiencing repeated failures in the classroom (Grills-Taquechel, Fletcher, Vaughn, & Stuebing, 2012). It is therefore possible that a lack of literacy skills may trigger stress and negative emotions in an elementary school student who is struggling to read in the classroom. It is likely that a bi-directional relation exists between stress and achievement, and future research should consider both pathways in examining the relation between stress and literacy in school-age children.

Growth Mindset as a Mediator

Perceived stress was theorized to be a risk factor that would reduce the growth mindset of students. This process, in turn, would help explain how perceived stress negatively affects literacy achievement. This framework was based upon the risk portion of Masten's risk and resilience theory (2003), which posits that risks (e.g., stress) may negatively affect a child's development by weakening adaptive systems over time. Yet, evidence was not found to support the growth mindset mediation model in the full sample. Although perceived stress significantly predicted mindset (such that those with high perceived stress at Time 1 had low growth mindset at Time 2), growth mindset did not fully mediate the negative effect of perceived stress on literacy achievement.

First, the relation between growth mindset and achievement was not significant in the full sample and in the DLL group. This was particularly surprising given the wealth of research that has focused specifically on the pathway from growth mindset to achievement. These studies have linked growth mindset to positive achievement outcomes across children (e.g., Stipek & Gralinksi, 1996; Park et al., 2016) and adolescents (e.g., Blackwell et al., 2007, Yeager et al., 2016; Jones et al., 2012; Good et al., 2003; Good et al., 2012; Romero et al., 2014; Paunesku et al., 2015). Perhaps the

short-term, longitudinal design of the present study contributed to these findings; it is possible that students' literacy achievement did not change considerably in the course of three months. It is also possible that growth mindset was not associated with achievement because the students in the sample were already relatively high achieving, with mean scores on the achievement outcomes that were at the 66th and 78th percentile on the TOSREC and the 74th and 86th percentile on the MAP-R for the DLL and non-DLL groups, respectively.

These findings may also be explained by the gap in the literature, given that growth mindset studies have not yet focused explicitly on the academic domain of reading as an indicator of achievement; indeed, they have not had an academic-specific domain outcome like English. While three of the above-mentioned studies (Paunesku et al., 2015; Romero et al., 2014; Yeager et al., 2016) factor English grades into average GPA as their outcome, the majority of research on the relation between growth mindset and achievement has focused on math grades (Stipek & Gralinki, 1996) or scores on standardized math tests (Blackwell et al., 2007; Jones et al., 2012; Park et al., 2016). The studies that incorporated English grades into their achievement outcome (Paunesku et al., 2015; Romero et al., 2014; Yeager et al., 2016) reported on the impact of growth mindset on overall GPA only, which was calculated by averaging grades in core academic subjects like math, social studies, science, and English. Thus, the potential impact of growth mindset on English achievement was not examined as a separate outcome in these studies. Moreover, the two studies of growth mindset with elementary-aged samples (Stipek & Gralinski, 1996; Park et al., 2016) did not include any indicators of literacy in their studies. Future studies that explicitly examine literacy in the relation between

growth mindset and achievement in elementary-aged samples are needed to draw conclusions about the relation between these variables, especially since reading becomes vital to the process of learning itself by the third grade.

Another explanation for these findings may be developmental. Perhaps the link between growth mindset and positive achievement outcomes does not emerge until adolescence. Only two published studies have examined growth mindset in elementary students. Although a link was found between mindset and achievement, these studies used measures that assessed ability- and effort-related beliefs, which are similar to a fixed versus growth mindset (Stipek & Gralinski, 1996; Park et al., 2016). Future studies using more common indicators of growth mindset (i.e., the Helplessness vs. Mastery-oriented Responses to Failure Scale; growth mindset interventions) in samples of younger children are needed in order to determine when the link between growth mindset and achievement fully emerges.

In the full sample and in the DLL group, the indirect effect of perceived stress on achievement as mediated by growth mindset was also non-significant. This could be due to issues with the measurement of growth mindset. It is possible that Helplessness vs. Mastery-Oriented Behavioral Responses to Failure scale is more similar to the construct of mastery motivation, when used on its own. An interesting gap in research on the related construct of mastery motivation is that it is largely unrelated to academic outcomes in younger students (e.g., Anderman & Midgley 1997; Elliot & Church, 1997). Researchers have suggested that the way academic performance has been measured in the mastery motivation literature likely contributes to these findings, as test scores and grades are not always accurate measures of a student's mastery of a content area (Meece,

Anderman, & Anderman, 2005). Although the present study utilized a more comprehensive measure of literacy achievement, one possible limitation is the construct validity of using only one indicator of growth mindset that focuses on responses to failure. Future studies should utilize the Helplessness vs. Mastery-oriented Responses to Failure Scale in conjunction with other measures of growth mindset that also explicitly tap into participant's beliefs about effort and whether intelligence is expandable (e.g., Blackwell et al., 2007).

Interestingly, growth mindset mediated the negative effect of perceived stress on literacy achievement for non-DLL students only. These findings can be understood in the context of the Yerkes-Dodson law, which suggests that there is a curvilinear relationship between stress and learning for complex tasks (Yerkes & Dodson, 1908). According to Yerkes and Dodson (1908), performance initially increases with stress in a linear fashion. There is an optimal level of stress that results in optimal performance, but there is a reversal point where performance eventually begins to decline under high stress. In the present study, non-DLL students had significantly lower perceived stress than DLL students. I therefore speculate that the non-DLL group had an adaptive amount of stress (e.g., Gassull et al., 2010). Perhaps growth minded attributions about failure mediated the negative effect of stress on achievement, as a result of lower and possibly adaptive or more optimal initial stress levels in the non-DLL group. At higher stress levels, perhaps one's mindset alone may not fully explain the negative link between stress and achievement. It is possible that the lack of mediation in the DLL group contributes to the lack of findings in the full sample, overall. Additional studies are needed to determine

whether growth mindset acts as a mediator of the impact of stress on literacy in times of low versus high stress.

It is also possible that growth mindset acts as a moderator. Previous literature has established growth mindset as a protective factor in the face of stressors, like poverty (Claro et al., 2016) and stereotype threat (Aronson, Fried, & Good, 2002). Additionally, a recent dissertation found that growth mindset was a protective factor for DLL students who faced low stress only (Goldthrite, 2019). As a result, future research should examine growth mindset as a buffer against general life stress, while focusing on literacy achievement in elementary school students.

Limitations

The main limitations of this study are related to the short-term longitudinal design of the study, sample size, and sample demographics. To build upon the present study, these limitations should be addressed in future research.

In the present study, measures were administered with only 1 to 2 months in between timepoints. This made it difficult to control for certain exogeneous variables, like previous growth mindset. For example, Time 1 and Time 2 growth mindset were administered very close together and were strongly correlated with one another. Specifically, Time 1 growth mindset explained a majority of the variance in Time 2 growth mindset, which made it difficult to identify variance attributed to perceived stress in the mediation models. Similarly, the Spring MAP-R (which was used as a Time 3 outcome in conjunction with Time 3 TOSREC) was administered by the schools from April to June of 2015, which meant that MAP-R testing began one month after data

collection began. As a result, MAP-R testing overlapped with the administration of Time 1 stress and Time 2 growth mindset for a portion of the sample. Future studies should consider allotting more time between data collection timepoints, so that previous growth mindset and achievement can be controlled for and temporal precedence can be fully established.

Additionally, the sample size limited the power that was available to conduct model-testing, especially when comparing mediation processes for DLL and non-DLL groups. Based on a desired power of .80, the power for the non-DLL subscale was acceptable to detect a small-sized effect (d = 0.10) at .96. However, the power to detect a small-sized effect (d = 0.10) for the DLL subsample was not acceptable at .70. It is possible that the present study was not able to identify growth mindset as a mediator for DLL students (n = 81), due to limitations in sample size. Since growth mindset had the same mean across the total, DLL, and non-DLL samples (M = 4.94), it can be concluded that differences in means was not a factor driving the significant mediation in the non-DLL group. Unfortunately, it is possible that differences in mediation between the DLL and non-DLL groups could be due to power, rather than a true difference in the mechanism by which perceived stress affects achievement. Future studies should utilize larger samples of DLL and non-DLL students in order to tease apart the mediation processes between these groups.

Another limitation regarding the sample was that it consisted primarily of students who were in public school in a suburb that housed middle-to-upper class families. It is possible that the DLL students in the sample experience stress differently in comparison to students who come from low-income, immigrant families and often experience chronic

stress from ecological factors, such as living in poverty, being exposed to neighborhood violence, or other family stressors. While some DLL students in the sample could have been members of low-income, immigrant families, the proportion of the sample that fits this demographic is not known because the schools did not allow us to explicitly collect data on immigrant status. It was found, however, that the DLL students in the study had significantly higher stress and lower achievement relative to their non-DLL peers. Future studies should consider sampling DLL students across multiple schools that serve families from diverse socioeconomic status' in order to fully generalize findings to the superdiverse DLL group, as a whole.

Improving upon the measurement of DLL-status could also help lead to more generalizable findings regarding DLL students in future research. For example, DLL-status could be assessed by examining what percentage of time the non-English language is spoken at home, rather than identifying if a parent speaks a language other than English with the child in the home. Examining DLL students in this way could lead to more meaningful conclusions about the effect of DLL-status on stress, mindset, and achievement.

Conclusions and Implications

The results of this study contribute to understanding how perceived stress affects academic outcomes for elementary students. This study adds to the dearth of literature that has examined social-emotional variables as an outcome of stress in elementary students (e.g., O'Neal, 2018). Moreover, the present study was the first to demonstrate a link between perceived stress and growth mindset. This finding aligns with Masten's (2003) risk theory and suggests that stress is a risk factor that can weaken an individual's

growth mindset over time. Furthermore, this study was the first to demonstrate significant mediation between stress and literacy achievement via the mediator of growth minded attributions for non-DLL students. Taken together, these findings have important implications for educators and clinicians. By understanding the consequence of stress on a students' mindset and academic performance, educators and clinicians may be better equipped to provide school-based prevention and intervention services for children.

The findings of the present study also contribute to a gap in the literature regarding the mechanisms by which stress affects achievement for diverse student groups. In the present study, an academic achievement gap emerged between DLL and non-DLL students. Additionally, DLL students reported significantly higher perceived stress compared to their non-DLL peers. These results justify future investigation into other social-emotional mediators of the relation between stress and achievement, especially for diverse student groups (e.g., DLL students) who may be affected by the achievement gap, in addition to experiencing higher stress levels compared to their peers.

In terms of school-based practices, these results hold important implications for educators and school psychologists. Understanding how stress affects literacy achievement for diverse populations, such as DLL students, is a necessary first step in implementing culturally responsive interventions. There is a need for schools to implement evidence-based social-emotional interventions to improve achievement outcomes and perhaps decrease stress, given the link between stress and growth mindset that was found in the present study. One recent national study demonstrated that an online, one-hour growth mindset intervention led to improved achievement for lower-achieving 9th grade students, specifically (Yeager et al., 2019). Moreover, the

intervention led to higher GPAs in core subjects when peer norms aligned with the messages of the intervention (i.e., that intelligence is expandable; Yeager et al., 2019). These recent findings warrant investigation into the culture surrounding mindset in schools and demonstrate the need for feasible, evidence-based interventions surrounding mindset for younger students. By promoting growth mindset in the culture of a school, social-emotional interventions may even work better to improve achievement outcomes and decrease stress.

Overall, the present study contributes to the literature on the effects of perceived stress on literacy achievement for elementary school students. Mediation was not significant in the full sample. Thus, additional studies should replicate these findings to truly determine whether growth mindset is a mediator of the negative impact of stress on literacy achievement. Future research should also investigate whether other social-emotional variables act as mediators that could explain how perceived stress affects literacy achievement for elementary students, and DLL students in particular. An increased understanding of these mechanisms could lead to preventative measures to reduce the negative impact of stress on achievement.

Appendix A

Table 1

Sample Demographics

	Total Sample		Dual Language		Non-Dual Language	
Demographic Variables	*N*	%	*N*	%	*N*	%
Child Sex						
Female	142	57	50	55	92	57
Age						
8 years	23	9	11	12	12	8
9 years	83	33	35	38	48	30
10 years	93	37	30	33	63	39
11 years	52	21	15	17	37	23
Grade Level						
3rd	74	30	27	31	47	30
4th	78	32	34	38	44	28
5th	93	38	27	31	66	42
Ethnicity						
Asian/Pacific Islander	13	5	9	10	4	3
Black, non-Hispanic	25	10	18	20	7	4
Latina/o	14	5	13	14	1	1
White, non-Hispanic	155	62	32	35	123	77
Multiethnic	29	12	14	15	15	9
Other	14	6	5	6	9	6

Note: Total n = 251, Dual Language n = 81, Non-Dual Language n = 170.

Table 2

Descriptive Statistics (Total Sample)

Measures	Number of Items	*M (SD)*	*α*	Range
1. Perceived Stress T1	10	24.69(6.10)	**0.82**	11.00 – 44.00
2. Growth Mindset T1	8	4.94(.64)	**0.73**	1.88 – 6.00
Attributions subscale	4	4.51(.83)	0.61	1.75 – 6.00
Strategies subscale	4	5.36 (0.64)	**0.65**	2.00 – 6.00
3. Growth Mindset T2	8	4.72(.52)	**0.77**	2.25 – 5.75
Attributions subscale	4	5.63(.72)	**0.67**	1.80 – 6.00
Strategies subscale	4	5.24(.55)	0.64	2.50 – 6.00
4. TOSREC percentiles T1	--	71.09(26.64)	--	1.0 – 99.00
5. TOSREC percentiles T3		73.98(26.79)	--	1.0 – 99.5
6. MAP-R Fall percentiles (T1)	--	81.46(21.90)	--	0.5 –1.00
7. MAP-R Spring percentiles (T3)	--	81.88 (20.95)	--	1.00 – 99.00

Note. Alpha coefficients in bold meet an acceptable internal reliability level of .65 or higher (DeVellis, 2003). TOSREC = Test of Silent Reading Efficiency and Comprehension (Wagner, Torgesen, Rashotte, & Pearson, 2010). MAP-R = Measures of Academic Progress – Reading. Listwise $N = 166$.

Table 3

Descriptive Statistics (DLL and non-DLL Sample)

Measures	*DLL M (SD)*	*DLL α*	*Non-DLL M (SD)*	*Non-DLL α*
1. Perceived Stress T1	26.09*(6.64)	**0.85**	24.02*(5.74)	**0.80**
2. Growth Mindset T1	4.94(0.59)	**0.65**	4.94(0.66)	**0.76**
Attributions subscale	4.47(0.85)	0.57	4.53(0.83)	0.63
Strategies subscale	5.43(0.56)	0.52	5.33(0.67)	**0.68**
3. Growth Mindset T2	5.05(0.61)	**0.71**	5.03(0.67)	**0.81**
Attributions subscale	4.66(0.91)	**0.68**	4.70(0.81)	**0.68**
Strategies subscale	5.44(0.51)	0.55	5.35(0.66)	**0.69**
4. TOSREC percentiles T1	64.89*(29.48)	--	74.11*(24.67)	--
5. TOSREC percentiles T3	65.66*(29.64)	--	77.92*(24.48)	--
6. MAP-R Fall percentiles (T1)	72.93*(26.06)	--	85.36*(18.54)	--
7. MAP-R Spring percentiles (T3)	73.83*(26.56)	--	85.48*(17.14)	--

Note. Alpha coefficients in bold meet an acceptable internal reliability level of .65 or higher (DeVellis, 2003). * = significant difference between means, $p < .05$; TOSREC = Test of Silent Reading Efficiency and Comprehension (Wagner, Torgesen, Rashotte, & Pearson, 2010). MAP-R = Measures of Academic Progress – Reading. DLL Listwise $N = 68$, Non-DLL Listwise $N = 168$.

Table 4

Correlation Matrix

Measure	1	2	3	4	5	6	7	8	9	10	11
					Total Sample						
1. Perceived Stress T1	--	-.43**	-.45**	-.27**	-.37**	-.35**	-.31**	-.18**	-.17*	-.17**	-.16*
2. GM full T1		--	.90**	.82**	.70**	.63**	.61**	.21**	.19**	.21**	.13
3. GM attributions T1			--	.50**	.57**	.58**	.41**	.16*	.15*	.20**	.12
4. GM strategies T1				--	.60**	.42**	.68**	.13*	.12	.11	.04
5. GM full T2					--	.92**	.85**	.12	.11	.13	.10
6. GM attributions T2						--	.58**	.16*	.16*	.16*	.12
7. GM strategies T2							--	.04	.03	.06	.05
8. MAP-R Fall Percentiles								--	.84**	.69**	.74**
9. MAP-R Spring Percentiles									--	.70**	.75**
10. TOSREC Percentiles T1										--	.835*
11. TOSREC Percentiles T3											--
					Dual Language Learners						
1. Perceived Stress T1	--	-.52**	-.53**	-.26*	-.48**	-.44*	-.35**	-.19	-.07	-.19	-.15
2. GM full T1		--	.90**	.75**	.61**	.54**	.53**	.28*	.26*	.26*	.28*
3. GM attributions T1			--	.40**	.56**	.52**	.42**	.20	.15	.23*	.25
4. GM strategies T1				--	.29*	.12	.48**	.14	.17	.10	.07
5. GM full T2					--	.92**	.74**	.06	.13	.15	.08
6. GM attributions T2						--	.42*	.14	.18	.18	.11
7. GM strategies T2							--	-.10	-.01	.04	.01
8. MAP-R Fall Percentiles								--	.81**	.75**	.71**
9. MAP-R Spring Percentiles									--	.76**	.77**
10. TOSREC Percentiles T1										--	.82*
11. TOSREC Percentiles T3											--
					Non-Dual Language Learners						
1. Perceived Stress T1	--	-.39**	-.39**	-.30**	-.33**	-.30**	-.31**	-.12	-.17*	-.12	-.12
2. GM full T1		--	.90**	.85**	.72**	.67**	.64**	.17*	.16*	.18*	.06
3. GM attributions T1			--	.55**	.57**	.61**	.41**	.12	.14	.18*	.04
4. GM strategies T1				--	.70**	.55**	.74**	.17*	.14	.13	.06

5. GM full T2	--	.93**	.89**	.16	.12	.12	.13
6. GM attributions T2		--	.66**	.15	.12	.14	.14
7. GM strategies T2			--	.15	.08	.08	.10
8. MAP-R Fall Percentiles				--	.84**	.62**	.75**
9. MAP-R Spring Percentiles					--	.63**	.71**
10. TOSREC Percentiles T1						--	.84**
11. TOSREC Percentiles T3							--

Note:

*** = significant at the .001 level
** = significant at the .01 level
* = significant at the .05 level

Table 5

Perceived Stress on Literacy Achievement

Paths	Controls	Unstandardized Estimates (Standard Error), Confidence Intervals (CI)
Stress → TOSREC & MAP-R	None	**-.77***(-2.96), [-1.23, -.27]** **-.57*(-2.36), [-1.07, -.12]**
Stress → TOSREC & MAP-R	Time 1 TOSREC Fall MAP-R	-.003(-.01), [-.39, .41] -.03(-.25), [-.31, .24]
Stress → TOSREC & MAP-R	Gender Age School type Ethnic minority status Interview format Gifted center participation	**-.57*(-2.23), [-1.11, -.12]** -.38(-1.64), [-.89, .02]

**p*<005; ***p*<.01, ****p*<.001

Table 6

Mediation Models for Growth Mindset Attributions Subscale

	Total Sample	**DLL**	**Non-DLL**
Paths	Unstandardized Estimates (SE), Confidence Intervals	Unstandardized Estimates (SE), Confidence Intervals	Unstandardized Estimates (SE), Confidence Intervals
Time 1 Perceived Stress →Time 2 Attribution	**-.05***(-4.96), [-.07, -.03]**	**-.07***(-3.30) [-.12, -.03]**	**-.04***(-3.98), [-.06, -.02]**
Time 2 Attribution → Time 3 TOSREC & MAP-R	3.85(1.62), [.94, 8.38] 3.47(1.54), [-1.05,7.74]	-.26(-.04), [-12.50, 11.05 4.41(.57); [-11.72, 16.52]	**6.31*(2.14), [.87, 11.62]** 3.09(1.49), [-.35, 7.89]
Indirect Effect: Time 1 Perceived Stress → Time 3 TOSREC & MAP-R	-.18(-1.50), [-.45, .03] -.16(-1.44), [-.41, .03]	.02(.04), [-.97, .81] -.29(-.53), [-1.38, .78]	**-.26(-2.07), [-.58, -.07]** -.13(-1.48), [-.35, .00]

**p*<005; ***p*<.01, ****p*<.001

Table 7

Mediation Model for Full Growth Mindset Variable

Paths	Unstandardized Estimates (Standard Error), Confidence Intervals (CI)
Time 1 Perceived Stress →Time 2 Attribution	**-.04*****(-5.70)** **[-.05, -.03]**
Time 2 Attribution → Time 3 TOSREC & MAP-R	3.39(1.11), [-2.50, 9.51] 2.78(1.17), [-.22, .15]
Indirect Effect: Time 1 Perceived Stress → Time 3 TOSREC & MAP-R	-.13(-1.09), [-.39, .08] -.12(-1.15), [-.30, .07]

*p<005; **p<.01, ***p<.001

Appendix B

Questionnaire Items

Perceived Stress: Modified version of the Perceived Stress Scale – 10 item version (Cohen & Williamson, 1988).

These next questions are about how you felt and what you thought during the last week: In the last week…

Think about a time when something unexpected happened.

1. How often did you get upset because something you did NOT expect happened?

Think of a time when you did NOT like something that was happening.

2. How often did you feel like you could NOT do anything to change the way things were going?
3. How often did you feel nervous and "stressed"? [*in general, when you're in school*]

Think about a problem you have had.

4. How often did you feel like you could make your problems better?
5. How often did you feel like things were going right for you?
6. How often were you too upset to do all the things you had to do?

Think about a time when you were frustrated

7. How often did you feel like you could deal with the things that frustrated you? [*or do something to feel better or fix the frustrating problem?*]
8. How often did you think about your schoolwork and think, "I can do all of this!"?
9. Think about a time there were things you could NOT change. How often did you get mad about that?
10. How often did you feel like there were so many hard things to do that you just could NOT do them all?

Growth Mindset: Helplessness versus Mastery-oriented Responses Failure Scale (Blackwell et al., 2007)

Instructions: When you read this story, pretend that it really happened to you and try to picture how you would feel and what you would do if it happened:

You start a new class at the beginning of the year and you really like the subject and the teacher. You think you know the subject pretty well. When you take the quiz, you think you did a good job. Then the class gets their quizzes back and you find out your grade: you got an F, a failing grade.

What would you think was the main reason that you failed the quiz?

1. I wasn't smart enough *(reverse coded).*
2. The quiz was unfair, too hard for the class *(reverse coded)*.
3. I'm just not good at this subject *(reverse coded).*
4. I didn't really like the subject that much *(reverse coded).*
5. **I didn't study enough.**

What would you do next?

6. I would try not to take this subject ever again *(reverse coded).*
7. If I could, I would try to cheat on the next test *(reverse coded).*
8. I would spend less time on this subject and just work on the subjects I'm good at *(reverse coded).*
9. **I would complain to the teacher or my parents *(reverse coded).***
10. I would work harder in the subject from now on.
11. **I would ask someone for help with the subject.**

Note: Perceived Stress Scale items were rated on a five-point Likert-style scale, with 1 = Never and 5 = Very Often. Growth mindset was rated on a six-point scale, with 1=Disagree a lot, and 6=Agree a lot.

The child-adapted items (shown in bold) were pilot items from the scale developers that were dropped from analysis to increase reliability and ensure a better overall fit. As a result, the original 8-item scale was used in analysis in the present study.

4th Grade TOSREC Sample

21.	yes	no	An astronaut is a man or woman whose job it is to catch fish.
22.	yes	no	Going to a store during a sale might result in a good bargain.
23.	yes	no	If you bump into a friend on purpose it would be an accident.
24.	yes	no	An anchor is used to keep a boat from floating away.
25.	yes	no	A telescope is commonly used to view the stars in the sky.
26.	yes	no	A mother may not approve of her daughter's boyfriend.
27.	yes	no	The correct place to wear a colorful hat is on your ankle.
28.	yes	no	Something that is easy for you to do is a challenge.
29.	yes	no	Giving your old clothes to charity is a way to help others.
30.	yes	no	A bashful person is someone who loves to talk to large groups.
31.	yes	no	A person who gets lost might try to use a compass to get home safely.
32.	yes	no	You might be anxious if you are about to take a spelling test.
33.	yes	no	Most modern women attempt to grow very long beards.
34.	yes	no	A teacher will be mad if one of her students wins a spelling contest.
35.	yes	no	Broccoli refers to a kind of dog that has been used for years to guard sheep.
36.	yes	no	Some kids eat peanut butter and jelly on crackers.
37.	yes	no	A buzzard might build a cabinet in a cafe.
38.	yes	no	Water balloons that kids throw at each other are made out of concrete.
39.	yes	no	A recipe tells the cook which ingredients to use for baking a cake.
40.	yes	no	A person who has been on a diet and has lost a lot of weight may be slender.
41.	yes	no	A leaky balloon will expand.

Number Correct [ ] − Number Incorrect [ ] = Raw Score Subtotal (p. 3) [ ]

Appendix C

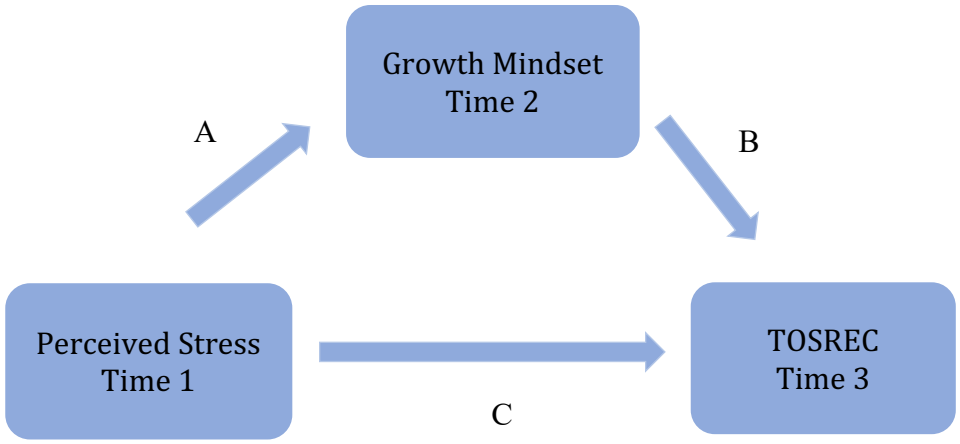

Figure 1: Hypothesized mediation model where the effect of perceived stress on the academic achievement of students is mediated by growth mindset.

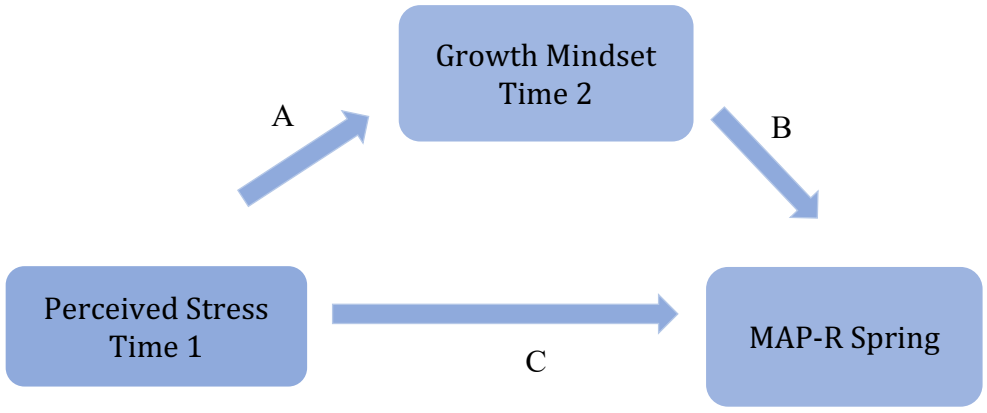

Figure 1b: Hypothesized mediation model where the effect of perceived stress on the academic achievement of students is mediated by growth mindset. Spring MAP-R was administered by the schools around Time 3 and was therefore used as a Time 3 achievement outcome in conjunction with Time 3 TOSREC.

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