THE RELATIONS AMONG ACADEMIC GRIT, GROWTH MINDSET, SCHOOL ENGAGEMENT, AND ACADEMIC ACHIEVEMENT IN MIDDLE SCHOOL STUDENTS

Rachel Younger

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THE RELATIONS AMONG ACADEMIC GRIT, GROWTH MINDSET, SCHOOL ENGAGEMENT, AND ACADEMIC ACHIEVEMENT IN MIDDLE SCHOOL STUDENTS

by

Rachel Leigh Younger

A Dissertation
Submitted in Partial Fulfillment of the
Requirements for the Degree of
Doctor of Philosophy
Major: Psychology

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Abstract

The purpose of this study was to examine the relations among three psychosocial factors (i.e., Academic Grit, School Engagement, and Growth Mindset) and Academic Achievement among a cross-sectional sample of middle school students (N = 141). Participants were administered the Academic Grit Scale, Multi-Dimensional School Engagement Scale, and Implicit Theories of Intelligence Scale via an online survey, and i-Ready Reading and Math benchmarks and student’s GPA assessed academic achievement. Factor analysis was used to confirm the measurement of these constructs, which resulted in a post-hoc measurement model combining indicators of Academic Grit with two indicators of School Engagement. Structural equation modeling was used to examine psychosocial factors as predictors of academic achievement, as well as a competing model depicting academic achievement as a predictor of the psychosocial factors. Together, the psychosocial factors were found to explain 21% of the variance in Academic Achievement, although none of these factors contributed significantly to achievement as indicated by the direct paths. In contrast, Academic Achievement explained little to no variance in psychosocial factors when modeled as a predictor. Ultimately, the results demonstrated the distinctiveness of psychosocial factors and their potential contribution to academic achievement, but also suggest the need for additional research.
The Relations among Academic Grit, Growth Mindset, School Engagement, and Academic Achievement in Middle School Students.

Academic Achievement is a complex student outcome that is influenced by a variety of factors including an interplay between cognitive and psychosocial factors. Cognitive factors refer to a student’s ability to comprehend what is learned in schools and attaining academic skills such as problem solving and are often measured by cognitive or academic tests (Farrington et al., 2012). In school settings, psychosocial or attitudinal factors include academic behaviors, academic perseverance, academic mindsets and attitudes about learning, learning strategies and social skills. In the recent literature, short-term interventions have aimed to improve these psychosocial factors such as changing student’s beliefs about their intelligence, promoting social belonging, and connecting academic performance to future academic goals (Blackwell et al., 2007; Good et al., 2003; Oyserman et al., 2002). Notably, these factors have had substantial effects on academic performance during early and late adolescence (Crede et al., 2017; Clark & Malecki, 2019; Lam & Zhou, 2019).

During early adolescence, students transition from one school context to another (i.e., elementary to middle school). Research has pointed to declines during middle school in academic performance, students’ attitudes toward school, engagement in school activities, effort completing difficult tasks, and school attendance (Eccles et al., 1991; Farrington et al., 2012; Hagborg, 1992; Harter et al., 1992; Wang & Eccles, 2012). However, students in early adolescence also have the increased capacity to define and establish goals, strengthen self-regulation strategies, view challenges as an opportunity of growth, and engage in learning strategies that promote persistence (Dweck & Leggett 2000; Farrington et al., 2012; Yeager & Dweck, 2012). Given the important role of student’s attitudes and beliefs in academic achievement, the aim of this paper is to examine the relations among academic grit, growth
mindset, school engagement, and academic achievement in middle school students. Therefore, grit and academic grit will be reviewed, followed by growth mindset and school engagement. Lastly, the relations among grit, growth mindset, and school engagement will be examined in the context of academic achievement among adolescents.

**Theoretical Components of Grit**

Of all the student’s attitudinal factors, much of the recent research has focused on grit. Introduced by Duckworth and colleagues (2007), grit has been defined as the perseverance and passion for long-term goals and is comprised of two underlying constructs: perseverance of effort and consistency of interest. The impact of grit on achievement has been examined cross-sectionally (i.e., Duckworth et al., 2007; Duckworth et al., 2011) and longitudinally (Duckworth et al., 2007; Duckworth & Quinn, 2009) among undergraduates, adolescent competitors in the National Spelling Bee, teachers, and high school students. Despite this breadth of participants, grit’s consistency, increase, and relation to academic achievement across the life span are mixed. In meta-analysis, overall grit was found to predict little to none of the variance in high school and college academics when other traits such as conscientiousness are controlled ($\Delta R^2=.004$), and grit did not vary across grade levels or gender (Crede et al., 2017). Among elementary and middle school students, studies found that the relation of grit to academic achievement was partially mediated by self-efficacy, and test score gains in English and Math were relatively weak or dissipated when grade level, gender, SES, and prior achievement were controlled (Usher et al., 2018). However, across studies conducted with participants in grades 7th through 12th grade, grit provided small to medium incremental predictive validity for achievement outcomes, including achievement test scores and concurrent GPA, compared to personality factors including self-control, conscientiousness, agreeableness, extraversion, neuroticism, openness to
experience, and goals of personal significance (Duckworth et al., 2007; Duckworth & Quinn, 2009; Eskreis-Winkler et al., 2014; Muenks et al., 2018; West et al., 2016).

Notably, these differences in incremental validity have been attributed to the different facets of grit. The perseverance of effort facet of grit has been found to explain more unique variance in academic achievement than overall grit and the consistency facet of grit (Crede et al., 2017; Duckworth & Quinn, 2009; Lam & Zhou, 2019). After controlling for age, the perseverance of effort subscale contributed 12.4% of variance to GPA in grades 7-12, whereas consistency of interested contributed only 2.7%. Meta-analytic and findings have provided additional evidence of the persistence of effort subscale due to its strong associations among high school, college, and post graduate GPA (Muenks et al., 2018; Crede et al., 2017) and academic achievement in grade levels kindergarten through 12\textsuperscript{th} grade (O’Neal et al., 2018; 2019; Lam & Zhou, 2019). Overall, grit’s contribution to academic achievement is unclear. Further research is needed among the relations between the perseverance of effort facet of grit, other personality factors, and academic achievement.

**Academic Grit**

Although grit as a general construct has been researched thoroughly, little attention has been placed on examining the role of grit in a school context, or on developing a measure that encompasses a student’s persistence in attaining an educational goal. After surveying the literature, Clark and Malecki (2019) created the Academic Grit Scale (AGS) to provide a psychometrically sound instrument to capture the achievement of academic goals among youth while retaining Duckworth’s original definition of grit. The AGS emphasizes the persistence of effort facet of Duckworth’s grit based on findings from prior literature (i.e., Crede et al., 2017; Duckworth & Quinn, 2009; Lam & Zhou, 2019). The authors defined academic grit as a single
latent variable with three components encompassing determination, resilience, and focus during the pursuit of challenging goals within the domain of education. The AGS was validated and examined with self-reported academic achievement and GPA among 757 middle school students in 6th through 8th grade. Overall, The AGS accounted for greater variance in academic achievement (29%), GPA (19%), and school satisfaction (27%), compared to the Child Adapted Grit Scale (CAGS; Duckworth & Quinn, 2009). Additionally, academic grit uniquely predicted self-reported academic achievement and GPA. Notably, female adolescents and sixth graders reported significantly higher academic grit than male adolescents and eighth graders, though the effect size was small. Furthermore, Clark and Melecki (2014) called for future research to examine academic grit among specific educational outcomes, and how academic grit overlaps with similar psychosocial constructs such as school engagement and academic mindsets.

**Growth Mindset**

Among the factors being examined in this study, mindset has the longest history among psychological research (Farrington et al., 2012). The theory of mindset, also known as implicit theories of intelligence, was introduced by Dweck (1988) as the belief an individual has towards the development of intelligence. Based on Dweck’s “incremental theory”, an individual with a growth mindset views intelligence as malleable and has the potential to be improved through practice and effort. In contrast, the “entity theory” defines a fixed mindset as the belief that an individual’s intelligence is a determined ability that is static and cannot be improved or changed over time (Dweck & Leggett, 1988; 2000). The current literature has demonstrated how these mindsets affect students’ view of academic challenges and achievement differences (Blackwell et al., 2007; Costa & Faira, 2018; Gunderson et al., 2017; Henderson & Dweck, 1990; West et al., 2016).
Meta-analytic findings provide robust support for Dweck’s incremental theory of intelligence and its relation to academic outcomes (Burnette et al., 2013; Costa & Faira, 2018; Sisk et al., 2018). Though overall the relation between growth mindset is positive among these studies, the magnitude was relatively weak with effect sizes ranging from .095 to .10 (Burnette et al., 2013, Costa & Faira, 2018; Sisk et al., 2018). However, when compared to the Big Five conscientiousness and self-control, growth mindset was the most strongly related to eighth-grade state Math ($r=.32$) and English test score ($r=.36$; West et al., 2016). Importantly, developmental stage (i.e., children, adolescents, and adults) was found to be a significant moderator (Sisk et al., 2018; Gunderson et al., 2017), such that a stronger relation between GPA and growth mindset was found in adolescents (i.e., middle school and high school) compared to children (i.e., elementary school students) and adults (i.e., postsecondary students). Notably, growth mindset was found to have stronger influence on academic achievement in middle school than in high school and college (Costa & Faira, 2018). Even in longitudinal studies, students with a growth mindset had higher grades by the end of seventh and eighth grade (Romero, et al., 2014; Henderson & Dweck, 1990) and growth mindset had a significant effect on change in grades across time (Blackwell et al., 2007). In sum, research has established that growth mindset can make important contributions to academic achievement during early adolescence, but more research is needed to examine its role in comparison to other attitudinal factors.

**School Engagement**

Another important factor pertaining to academic achievement is school engagement. School engagement, also known as student engagement, encompasses students’ direct and continuous participation in school as well as the observable and unobservable qualities of student interactions with learning activities, teachers and peers (Skinner & Pitzer, 2011). Prior research
has expanded school engagement into a multidimensional construct encompassing three factors: behavioral, emotional, and cognitive engagement (Bae & Debusk Lane, 2018; Lei et al., 2018; Skinner et al., 2009; Wang & Holcomb, 2010). Behavioral engagement represents positive classroom conduct, and the productive and proactive participation during class, such staying on task and exerting effort on academic and nonacademic activities (Fredricks et al., 2004; Wang et al., 2019). Second, emotional engagement represents overall student affective response including the value, enjoyment, and interest in school activities, and positively identifying with their school (Finn, 1989; Wang & Holcomb, 2010; Wang et al., 2019). Third, cognitive engagement represents the student’s ability to exert the effort needed for comprehending complex ideas and to produce high-quality academic work, as well as using learning strategies such as strategic planning or self-regulation (Fredericks et al., 2004; Wang et al., 2019).

Recent theoretical frameworks of school engagement have added social engagement as a fourth factor. Social engagement encompasses students’ social interactions in the classroom including participation with classmates and the quality of their social relationships (Linnenbrink-Garcia et al., 2011; Wang & Holcomb, 2010; Wang et al., 2019). In middle school, social engagement has been shown to be an area of focus by school personnel and been associated with higher achievement (Ryan & Patrick, 2001; Farrington et al., 2012; Shin & Ryan, 2012; Wang et al., 2018; Wang et al., 2019). Notably, Wang and colleagues (2019) were the first to integrate all four specific of school engagement (i.e., social, behavioral, emotional, and cognitive) into a single bifactor scale known as the Multidimensional School Engagement Scale (MSES). Indeed, when examining the predictive validity of the MSES, social engagement was found to be a stronger predictor of GPA compared to behavioral and cognitive engagement, but not as strong as emotional engagement. However, the researchers found that behavioral, cognitive, and
emotional engagement explained more variance in the global school engagement factor compared to social engagement, suggesting that the social dimensions of school engagement are distinct from the academic dimensions. Even so, school engagement and its facets have been shown to explain unique variance in academic achievement and been positively correlated with academic achievement, including GPA and specific academic pursuits, in across a variety of studies (Bae & Debunsk-Lane, Lei et al., 2018; Wang et al., 2010; Wang et al., 2019). In a meta-analysis of 69 studies conducted in the US and China, overall school engagement had moderate effects (average weighted effect size: \( r_{OE} = .269 \)) on academic achievement, as well as behavioral engagement (\( r_{BE} = .350 \)), emotional engagement (\( r_{EE} = .216 \)), and cognitive engagement (\( r_{CE} = .245 \)) (Lei et al., 2018). Overall, students with higher general school engagement have been found to have higher GPA’s, fewer school absences, higher educational aspirations, fewer detentions, and fewer suspensions compared to those who scored lower on general school engagement (Wang et al., 2019).

Among the four factors of school engagement, behavioral and emotional engagement have been most commonly examined among specific academic pursuits in middle school (Bae & Debusk Lane, 2018; Lee et al., 2016). In the fall and spring of one academic year, school engagement had a significant, moderate, and positive effect on middle school science achievement (Lee et al., 2016). Additionally, when compared to gender and race/ethnic group membership, grade level was shown to be a significant predictor of membership among 5 latent profiles (Moderately Engaged, Moderately Disengaged, Disengaged, Behaviorally Engaged, and Behaviorally Disengaged). Specifically, eighth grade students were 60-70% more likely to be in the Moderately Engaged profile and associated with the highest science achievement scores compared to students in sixth and seventh grade (Bae & Debusk Lane, 2018). Indeed, Wang and
colleagues (2010) found school identification and students’ perceptions of school environment in seventh-grade directly and indirectly impacted their eighth-grade academic achievement through three facets of school engagement (i.e., behavioral, cognitive and emotion). Despite these findings, the relations between school engagement and achievement for middle school students has rarely been examined, and no study to date has examined a multidimensional measure of school engagement as it relates to middle students’ achievement.

**Relations Among these Factors**

The majority of studies have examined two of these psychosocial factors together (Cho et al., 2018; O’Neal et al., 2018; O’Neal et al., 2019; Steinmeyer et al., 2018, Zeng et al., 2016). Notably, growth mindset has been studied as a predictor of behavioral engagement, but it is often mediated by other factors such as resilience (Zeng et al., 2016). Growth mindset has also been studied and discussed as a predictor (Tang et al., 2019), an improver (Dweck et al., 2014; Polirstok, 2017), and an antecedent of grit (Duckworth & Eskreis-Winkler, 2015; Farrington et al., 2012; West et al., 2016). Additionally, both growth mindset and grit have been examined as reciprocal predictors of one another across time (Park et al., 2020). In contrast, behavioral school engagement has been examined as a covariate (e.g., Muenks et al., 2017; Steinmayr et al., 2018) and as having a reciprocal relation with grit (e.g., O’ Neal et al., 2019). Theorists and researchers have proposed that grit conceptually and operationally overlaps with school engagement (Clark & Malecki, 2019; Muenks et al., 2017; Skinner et al., 2009; Zimmerman et al. 2011). In examining latent factors, grit-PE was found to cross load and moderately correlate with behavioral engagement (Muenks et al., 2017). Additionally, a few researchers have examined the relation between academic achievement and psychosocial factors. Either research has included prior GPA as a predictor of psychosocial factors (e.g., Muenks et al., 2017; Steinmayr
et al., 2018, Tang et al., 2019) or found a reciprocal relation between specific areas of achievement such as reading and emotional engagement. Still, none of these studies have examined all three factors (i.e., growth mindset, academic grit, and multi-dimensional school engagement) with academic achievement and the possible relations among them, despite the increased need to understand how to promote them during early adolescence (Farrington et al., 2012; Dweck et al., 2014; Yeager & Dweck, 2012).

Notably, Farrington and colleagues (2012) proposed a conceptual model encompassing the relation between academic mindsets, academic perseverance, academic behaviors, and academic performance within a classroom/school and larger socio-cultural context. Though not a focus in this study, Farrington’s model notes the effects of sociocultural context on the classroom environment. For example, the sociocultural context can impact these psychosocial factors through social stress, and race-related stressors such as the presence of stereotype threat among minoritized students (Austin et al., 2022; Walton & Cohen, 2007; Wang et al., 2022; Yeager & Dweck, 2012). They suggest that academic mindsets may lead to academic perseverance (i.e., academic grit), and that this mediation effect leads students to engage in more pro-academic behaviors, such as the ones that constitute school engagement, resulting ultimately in higher academic achievement. Additionally, they suggest that the resulting academic achievement would have a reciprocal effect on the development of academic perseverance, academic mindsets, and pro academic behaviors. This model has yet to be empirically validated but it has been used to guide researchers in examining the many factors that impact academic achievement (Duckworth & Yeager, 2015; Steinmeyer et al., 2018; Tang et al., 2019; West et al., 2016). To my knowledge, only one study has examined all three factors (i.e., grit, growth mindset, and school engagement), a longitudinal study among students from sixth through ninth-grade from
Finland (Tang et al., 2019). Using Duckworth and Quinn’s (2009) short grit scale and Schoolwork Engagement Inventory (2012), initial perseverance of effort (grit-PE) was significantly predictive of both GPA and academic engagement (i.e., energy, dedication, and absorption) by the end of ninth grade. Additionally, growth mindset was positively related with grit-PE, but the effect disappeared when school engagement and prior GPA were included in the model. In a similar way, grit-PE mediated the pathway between growth mindset and GPA, but the effect dissipated after school engagement and prior GPA were included as covariates. However, grit-PE did mediate the relationship between goal commitment and engagement even when prior GPA was included as a covariate. Results from this study demonstrate the need for more research to explore the different pathways between these factors and academic achievement.

When considered together in a comprehensive model, the nature of the relations among academic grit, mindset, school engagement, and academic achievement is unclear. Many studies have examined grit’s relation with academic achievement, but no study to date has examined the recent Academic Grit Scale among other psychosocial factors such as growth mindset or multidimensional school engagement among middle school students (Clark & Malecki, 2019). Additionally, studies have examined growth mindset (Burnette et al., 2013; Costa & Faira, 2018; Sisk et al., 2018), grit (Clark & Malecki, 2019; Crede et al., 2017; Duckworth & Quinn, 2009) and school engagement (Bae & Debusk Lane, 2018; Lam & Zhou, 2019; Lei et al., 2018) in regard to their individual contributions to academic achievement. Research has examined each factor with one other psychosocial factor serving as a mediator or covariates (Cho et al., 2018; Muenks et al., 2017; O’Neal et al., 2018; O’Neal et al., 2019; Steinmeyer et al., 2018; Zeng et al., 2016) or precursor to academic achievement (Duckworth & Eskreis-Winkler, 2015; West et
al., 2016; Tang et al., 2019). To my knowledge, only one study (Tang et al., 2019) has examined the association between grit, mindset, school engagement and academic achievement, few who have examined academic achievement as a precursor to these factors (O’Neal et al., 2018; Jiang et al., 2019; Tang et al., 2019), and none have examined school engagement multidimensionally.

**Purpose of the Study**

The purpose of this study was to examine the nature of the relations among three psychosocial factors (i.e., Academic Grit, School Engagement, and Growth Mindset) and Academic Achievement in middle school students. Using Clark & Malecki’s (2019) initial research and measure of academic grit, Wang and colleagues’ (2019) recent multidimensional measure of school engagement, and the academic performance framework developed by Farrington et al. (2012) as a theoretical basis, the role of these psychosocial factors and academic achievement was examined among a cross-sectional sample of sixth- through eighth- grade students. The following research questions guided this study: (1) Does academic grit, growth mindset, and school engagement contribute to academic achievement? and (2) Does academic achievement contribute to academic grit, growth mindset and school engagement?
Confirmatory factor analysis (CFA) was used to verify the factor structure of the four latent variables of interest (see Figure 1).

![Proposed Four-Factor Measurement Model](Image)

*Figure 1. Proposed Four-Factor Measurement Model*

*Note.* Indicators are labeled as amount, identity, ability, focus, determination, resilience, behavioral, emotional, cognitive, social, GPA, i-Ready ELA, and i-Ready Math. Latent variables are identified as Academic Grit, School Engagement, Growth Mindset, and Academic Achievement.

Then, structural equation modeling (SEM) was used to examine two competing models depicting the relation between Academic Grit, Growth Mindset, School Engagement, and Academic Achievement. Based on the limited prior research it was hypothesized that all three psychosocial factors would significantly contribute to academic outcomes (Bae & Debunk-Lane, 2018; Cho et al., 2018; Lei et al., 2018; O’Neal et al., 2018; O’Neal et al., 2019; Wang et al., 2010; Wang et al., 2019; Steinmeyer et al., 2018; Zeng et al., 2016), as depicted in the Psychosocial Predictor model (see Figure 2).
It was expected that growth mindset, academic grit, and school engagement would be positively associated with academic achievement. However, previous research (i.e., Duckworth & Eskreis-Winkler, 2015; West et al., 2016; Tang et al., 2019) has focused primarily on psychosocial factors relation to academic achievement and is unclear if, reversely, academic achievement additionally contributes to academic grit, growth mindset, and school engagement. To explore that possibility, the Academic Achievement Predictor model depicting academic achievement as a predictor of the three psychosocial factors was also examined (see Figure 3).
Figure 3. Academic Achievement Predictor Model of Relations Among Latent Variables

Note. Indicators are labeled as amount, identity, ability, focus, determination, resilience, behavioral, emotional, cognitive, social, GPA, i-Ready ELA, and i-Ready Math k. Latent variables are identified as Academic Grit, School Engagement, Growth Mindset, and Academic Achievement.

Method

Participants

A total of 141 students from a public middle school located in the mid-south region of the United States consented to participate in this study. All students participating in the regular education curriculum were invited to participate. Participants were in sixth grade ($n=65$), seventh grade ($n=26$), or eighth grade ($n=50$). Students identified as 32.1% African American or Black, 4.4% Asian or Pacific Islander, 4.4% Biracial, 43.1% European American or White, 2.2% Latinx or Hispanic, 0.7% North African or Middle Eastern, 8.8% Other, and 7.1% preferred not to answer. Students who identified as “Other” self-reported as “White” ($n=7$), “brown” ($n=1$), “half Indigenous American and half Italian” ($n=1$), “a mix of Caucasian and
Latinx” \((n=1)\), “Mediterranean” \((n=1)\), and “Native American” \((n=1)\). Students identified as male \((n=64)\), female \((n=74)\), gender fluid \((n=1)\), or preferred not to answer \((n=5)\).

**Measures**

*The Academic Grit Scale (AGS; Clark & Malecki, 2019)*

The AGS is a new self-report measures that assesses a student’s overall academic grit or determination, resilience, and focus on the pursuit of challenging long-term goals within the domain of education. The AGS has 10 items with four items underscoring determination, four items underscoring resilience, and two items underscoring focus (see Appendix for items) which are averaged to produce the Academic Grit score. The AGS is scored using a Likert Scale with responses from \(1 = \text{not at all like me}\) to \(5 = \text{very much like me}\) with higher mean scores indicating higher academic grit. Each set of items will be combined to produce three mean scale scores (i.e., Determination, Resilience, and Focus). These scales will serve as indicators in a measurement model to load onto the latent variable of Academic Grit. The internal consistency reliability coefficient for the AGS is .92 (Clark & Malecki, 2019). Our study found a comparable reliability coefficient \((\alpha=.91)\). The AGS includes on global factor that accounted for 50% of the variance in an EFA. The standardized factor loadings of the 10 items on the single academic grit factor were reported all above .60.

*Multidimensional School Engagement Scale (MSES; Wang et al., 2019)*

The Multidimensional School Engagement Scale is a self-report test that measures various aspects of school engagement and disengagement including behavioral, emotional, cognitive, and social dimensions. The MSES consists of 37 items scored on a Likert Scale with responses from \(1 = \text{not at all like me}\) to \(5 = \text{very much like me}\). The scale results in two constructs based on a bifactorial model: Global School Engagement and Global School Disengagement.
However, only the nineteen questions that comprise school engagement will be included in this study. School engagement items included four behavioral, five cognitive, five emotional, and five social questions (see Appendix for items). Each set of dimension questions will be combined to produce four mean scale scores (i.e., Behavioral, Cognitive, Emotional, and Social). These scales will serve as indicators in a measurement model to load onto the latent variable of School Engagement. The reliability reported by the original authors are McDonald’s ω and ωH which are more appropriate constructs for bifactorial models. The standardized coefficient for school engagement was reported to .81. Our study found a comparable coefficient alpha (α = .88). The Global School Engagement factor loadings were reported to be all statistically significant with loadings above >.30 (M = 0.58, range = .40–.79). Specific dimension factor loadings are reported lower than the global school engagement factor. However, the variances were split among the global and individual dimension factors and all variances of the specific factors (i.e., behavioral, emotional, social, and cognitive) are reported to be significant (Wang et al. 2019).

Implicit Theories of Intelligence Scale (ITI; Dweck, 2000)

The Implicit Theories of Intelligence Scale measures the incremental (i.e., growth mindset) and entity (i.e., fixed mindset) theories of intelligence (Dweck, 2000). The scale recommended for adolescents consists of a six-item subset (i.e., three entity theory statements and three incremental theory statements) of the original eight-item scale that consists of four entity theory statements and four incremental theory statements. Only the three statements regarding the incremental theory of intelligence will be used for this study (see Appendix). The six-item scale was recently revalidated against the eight-item scale in a sample of 237 students in fifth through eighth-grade (Park et al., 2016). The standardized factor loadings are reported to be .92, .79, and .81 for the three items utilized in this study. The three questions were adapted from
Liker scale with responses from 1 = not at all like me to 5 = very much like me to a sliding scale ranging from 1 to 10 to make the measurement continuous. Our study found coefficient alpha to be acceptable ($\alpha = .88$).

**Academic Data**

The participating school provided two types of data regarding students’ academic achievement. Information from school records will be used to report current grades in all subject areas and benchmark data in all subject areas (i.e., English and Math) will be provided. Grades will be converted to a GPA score. The benchmark scores and GPA were used as indicators for the latent variable of Academic Achievement.

**Grades**

The participating school provided second quarter report cards that consisted of grades either A (cumulative score ranging 93-100), B (cumulative score ranging 85-92), C (cumulative score ranging 75-84), D (cumulative score ranging 70-74), and/or F (cumulative score ranging 0-69) for participating sixth, seventh-grade, and eighth grade students. Report cards included grades for English Language Arts, Mathematics, Science, and Social Studies. Grades were re-coded on a four-point scale when transferred to the data file by researchers. Once recoded, grades were added and averaged to calculate a grade point average.

**i-Ready Diagnostic (Curriculum Associates, 2016; 2020)**

The participating school provided winter diagnostic benchmark scores in reading and math. i-Ready is a web-based adaptive screening assessment for reading and mathematics. Reading diagnostics include skills assessed in vocabulary and comprehension (i.e., informational and literary text). Math diagnostics include skills assessed in numbers and operations, algebra and algebraic thinking, geometry, and measurement and data. All test questions were multiple
choice with some reading questions grouped as a set with a single reading passage. Scale scores (100-800) were calculated by i-Ready to indicate that a student has mastered skills up to level. These scores were standardized into z scores when transferred to the data file. Spring reading and math diagnostic scores were highly correlated ($r \geq .80$) with 2018 Common Core state testing scores (i.e., TN Ready).

**Procedure**

Following the approval of the University of Memphis Institutional Board (#PRO-FY2020-559) data were collected in December 2021. Parental consent was delivered electronically via email from the school’s administration approximately two weeks prior to the survey administration. All participants whose parents provided electronic consent via email were assigned an ID number by the school’s research administrator corresponding with their survey. All measures were administered electronically using a secure password protected online survey program called Qualtrics that required students to have a link to access the survey. The survey encompassed student assent, the Academic Grit Scale, Multi-Dimensional School Engagement Scale, and Implicit Theories of Intelligence Scale, a statement of confidentiality, and demographic information including age, racial identity, gender identity, format of learning (i.e., virtual or in-person), and grade. Teachers were provided with a sheet of paper with each participant’s name and ID #, and with the link to the survey. During a homeroom meeting designated by school administration, the computer-based survey was completed online. Students had approximately 30 minutes to complete the survey. The school provided participants’ winter benchmark data for English and Math content areas as well as grades (i.e., English Language Arts, Math, Science, and Social Studies) across their courses as reported on the most recent
report card. Names in the data files were replaced with the identification number, and then shared with the primary investigator via secured OneDrive folder.

Results

Data Processing and Screening

Data were screened for accuracy of input, out-of-range values, skewness, kurtosis, univariate and multivariate outliers, missing data, and multivariate normality. No univariate outliers were identified in the data set (z-scores > 3.29), skewness and kurtosis statistics fell within acceptable limits (< |2.0|; Tabachnick & Fidell, 2019), and there was a total of five multivariate outliers (p <.001) based on Mahalanobis Distance. Instances of missing data were due to four participants’ absence during i-Ready testing and were coded as missing data (-999). Little’s MCAR test was not significant, $\chi^2$ (35, N = 141) = 44.44, $p = .132$, suggesting that data were missing completely at random. Pairwise plots were visually inspected for nonlinearity and heteroscedasticity appeared to be within normal limits. To detect multicollinearity, correlations among the indicators (> .80), the variance inflation factor (VIF, > 5.0), and tolerance values (< .10) were examined (Kline, 2016). One indicator, resilience, was found to demonstrate borderline multicollinearity with cognitive engagement ($r = .82$, VIF= 5.2, tolerance = 0.19). Its notable that two indicators of School Engagement, behavioral and cognitive engagement, showed stronger correlations with the three Academic Grit indicators (.62 to .82) than with the emotional and social engagement indicators (.40 to .57) (see Table 1).
<table>
<thead>
<tr>
<th>Indicators</th>
<th>M</th>
<th>SD</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Focus</td>
<td>3.73</td>
<td>.89</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Determination</td>
<td>4.26</td>
<td>.56</td>
<td>.59*</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Resilience</td>
<td>3.89</td>
<td>.74</td>
<td>.74*</td>
<td>.78*</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Behavioral Engagement</td>
<td>3.89</td>
<td>.70</td>
<td>.64*</td>
<td>.62*</td>
<td>.69*</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Cognitive Engagement</td>
<td>3.77</td>
<td>.69</td>
<td>.69*</td>
<td>.74*</td>
<td>.82*</td>
<td>.64*</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>6. Emotional Engagement</td>
<td>3.86</td>
<td>.66</td>
<td>.48*</td>
<td>.48*</td>
<td>.60*</td>
<td>.52*</td>
<td>.57*</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Social Engagement</td>
<td>3.96</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Amount</td>
<td>1.14</td>
<td>.32*</td>
<td>.43*</td>
<td>.40*</td>
<td>.38*</td>
<td>.32*</td>
<td>.33*</td>
<td>.20*</td>
<td>--</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Identity</td>
<td>1.12</td>
<td>.25*</td>
<td>.30*</td>
<td>.30*</td>
<td>.23*</td>
<td>.22*</td>
<td>.24*</td>
<td>.16</td>
<td>.75*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Ability</td>
<td>1.03</td>
<td>.44*</td>
<td>.47*</td>
<td>.41*</td>
<td>.39*</td>
<td>.36*</td>
<td>.36*</td>
<td>.33*</td>
<td>.69*</td>
<td>.70*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. GPA Q2</td>
<td>3.56</td>
<td>.34</td>
<td>.07</td>
<td>.10</td>
<td>.10</td>
<td>.14</td>
<td>.06</td>
<td>.04</td>
<td>.02</td>
<td>.10</td>
<td>.15</td>
<td>.17</td>
</tr>
<tr>
<td>12. i-Ready Reading</td>
<td>1.00</td>
<td>.03</td>
<td>-.03</td>
<td>.13</td>
<td>.08</td>
<td>.03</td>
<td>.02</td>
<td>-.14</td>
<td>.01</td>
<td>.09</td>
<td>.03</td>
<td>.65*</td>
</tr>
<tr>
<td>13. i-Ready Math</td>
<td>1.00</td>
<td>-.05</td>
<td>-.07</td>
<td>.03</td>
<td>-.04</td>
<td>-.06</td>
<td>.02</td>
<td>-.2*</td>
<td>-.04</td>
<td>.08</td>
<td>-.07</td>
<td>.67*</td>
</tr>
</tbody>
</table>

*Note. *p<.001
Measurement Models

This study utilized Mplus 8 (Muthen & Muthen, 2014) to conduct a confirmatory analysis to validate the measurement of the latent factors and to examine the structural models. A total of 13 indicators and four factors were examined. Based on the prior literature, a four-factor solution was expected with mean subscale scores loading on the Academic Grit (i.e., focus, resilience and determination) and School Engagement (i.e., behavioral, cognitive, social, and emotional engagement) factors and three item scores loading onto Growth Mindset (i.e., amount, identity, ability) and Academic Achievement factors (i.e., i-Ready Math z score, i-Ready Reading z score, and quarter 2 GPA). The available sample size ($N = 141$) was determined to be adequate for the analyses (e.g., 13 indicators * 5 = 65; Tabachnick & Fidell, 2019). Maximum likelihood estimation with robust standard errors (MLR) was used to handle missing data and to account for multivariate outliers. Standardized values were reported to facilitate interpretation, but the unstandardized coefficients were used for determining statistical significance. The factor loadings of the indicators were analyzed using an asymptotic factor covariance matrix of the polychoric correlations and error covariance matrix with reported standardized coefficient estimates. An average standardized factor loading $.30$ and significant $p$ value ($<.001$) was be considered reasonable (Kline, 2016).

As advised by Kline (2016), a variety of fit indices were used to interpret the adequacy of the models. The model $\chi^2$tests the null hypothesis which indicates if the model is an appropriate fit for the data. Additionally, the model $\chi^2$ is a badness of fit test and therefore a significant chi square test identifies a lack of model fit. RMSEA measures the fit between the model and the population covariance matrix, with values $\leq .05$ indicating a close approximate fit, values between $.05$ and $.08$ suggesting reasonable error of approximation, and values $\geq .10$ indicating
poor fit (Browne & Cudeck, 1993). RMSEA also provides a 90% confidence interval. If the lower bound of the CI ≤ .05, we would fail to reject the null hypothesis that the researcher’s model has a close approximate fit to the population, and if the upper bound of the CI ≤ .10, we would reject the null hypothesis that the model has a poor fit to the population. The Comparative Fit Index (CFI) represents the extent to which the target model is better than the independent model that assumes all variables to be uncorrelated, and values of > .95 indicates good model fit. The SRMR is a measure of the mean of absolute correlation residual and the overall difference between the observed and predicted correlations, with values less than .10 indicating adequate fit (Hu & Bentler, 1999). Additionally, two goodness-of-fit measures, the Akaike Information Criteria (AIC; Akaike, 1998), and the Bayesian Information Criterion (BIC; Schwarz, 1978), were used to compare fit between non-nested models. Lower values indicate a better fit for both AIC and BIC, and a difference of 10 or more points provides evidence for superior fit of one model over another (Kass & Raftery, 1995).

For the proposed grit four-factor measurement model, all the factor loading reached statistical significance (p < .001). With the exception of the moderate factor loading of social engagement (.45) and emotional engagement (.64) on School Engagement, the factor loadings were consistently strong across the four latent variables with values ranging from .75 to .94 (see Table 2).
<table>
<thead>
<tr>
<th>Factor Loading</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor 1: Grit</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A1. Focus</td>
<td>.78*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A2. Determination</td>
<td>.83*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A3. Resilience</td>
<td>.94*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Factor 2: Multidimensional School Engagement</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S1. Behavioral Engagement</td>
<td>.75*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S2. Cognitive Engagement</td>
<td>.88*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S3. Emotional Engagement</td>
<td>.65*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S4. Social Engagement</td>
<td>.45*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Factor 3: Growth Mindset</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M1. Amount</td>
<td>.86*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M2. Identity</td>
<td>.85*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M3. Ability</td>
<td>.82*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Factor 4: Academic Achievement</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G1. GPA</td>
<td>.75*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G2. i-Ready ELA Benchmark</td>
<td>.87*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G3. i-Ready Math Benchmark</td>
<td>.90*</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. *p < .001

Modification indices were examined to determine if the model required re-specification and revealed an association between the Academic Grit latent factor and one indicator of the School Engagement latent factor, cognitive engagement. This was consistent with the multicollinearity statistics found for resilience and cognitive engagement, as well as the patterns observed in the correlation matrix with cognitive and behavioral engagement showing more robust correlations with the indicators of the Academic Grit factor than with social and emotional engagement (see
Indeed, the prior literature indicates a potential conceptual overlap between grit with cognitive and behavioral engagement (Clark & Malecki, 2019; Muenks et al., 2017; Skinner et al., 2009; Zimmerman et al., 2011). Therefore, an expanded grit four-factor model was examined post-hoc, where the cognitive and behavioral engagement indicators were loaded onto the Academic Grit rather than School Engagement factor. Additionally, the cognitive and behavioral engagement indicators had higher loadings onto the Academic Grit factor as seen in Table 3.

### Table 3
Factor Loadings for the Expanded Grit Measurement Model

<table>
<thead>
<tr>
<th>Factor Loadings for the Expanded Grit Measurement Model</th>
<th>Factor loading</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1   2   3   4</td>
</tr>
<tr>
<td>Factor 1: Grit</td>
<td></td>
</tr>
<tr>
<td>A1. Focus</td>
<td>.78*</td>
</tr>
<tr>
<td>A2. Determination</td>
<td>.83*</td>
</tr>
<tr>
<td>A3. Resilience</td>
<td>.94*</td>
</tr>
<tr>
<td>S1. Behavioral Engagement</td>
<td>.75*</td>
</tr>
<tr>
<td>S2. Cognitive Engagement</td>
<td>.87*</td>
</tr>
<tr>
<td>Factor 2: Multidimensional School Engagement</td>
<td></td>
</tr>
<tr>
<td>S3. Emotional Engagement</td>
<td>.87*</td>
</tr>
<tr>
<td>S4. Social Engagement</td>
<td>.59*</td>
</tr>
<tr>
<td>Factor 3: Growth Mindset</td>
<td></td>
</tr>
<tr>
<td>M1. Amount</td>
<td>.86*</td>
</tr>
<tr>
<td>M2. Identity</td>
<td>.85*</td>
</tr>
<tr>
<td>M3. Ability</td>
<td>.82*</td>
</tr>
<tr>
<td>Factor 4: Academic Achievement</td>
<td></td>
</tr>
<tr>
<td>G1. GPA</td>
<td>.75*</td>
</tr>
<tr>
<td>G2. i-Ready ELA Benchmark</td>
<td>.87*</td>
</tr>
<tr>
<td>G3. i-Ready Math Benchmark</td>
<td>.90*</td>
</tr>
</tbody>
</table>

Note. *p < .001
As may be seen in Table 4, the fit indices suggested that the proposed grit four-factor model adequately fit the observed data and that the expanded grit four-factor models also adequately fit the observed data.

### Table 4

**Model Fit Indices**

<table>
<thead>
<tr>
<th>Model</th>
<th>$X^2$ (df, p-value)</th>
<th>CFI</th>
<th>RMSEA (90% CI)</th>
<th>SRMR</th>
<th>AIC</th>
<th>BIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expanded Grit**</td>
<td>89.38 (59, .006)</td>
<td>.96</td>
<td>.06(.03, .09)</td>
<td>.06</td>
<td>3238.69</td>
<td>3371.34</td>
</tr>
<tr>
<td>Proposed Grit</td>
<td>101.31 (59,.000)</td>
<td>.95</td>
<td>.07 (.05, .09)</td>
<td>.06</td>
<td>3253.98</td>
<td>3386.66</td>
</tr>
</tbody>
</table>

*Note. *$p < .000$*

**Cognitive and Behavioral Engagement were loaded onto Academic Grit instead of Multidimensional Student Engagement.**

However, the expanded grit four-factor model demonstrated slightly better fit across all indices than the proposed grit four-factor model and exceeded the 10-point difference threshold on both the AIC and BIC.

### Structural Models

Once the measurement model in SEM was examined, the nature of the relations among academic grit, school engagement, growth mindset, and academic achievement were explored by comparing two separate structural models. The psychosocial predictor model depicted academic grit, school engagement, and growth mindset as contributors to academic achievement while controlling for each other (see Figure 2). In contrast, the academic achievement predictor model reversed the direction of these relations, with academic achievement serving as a predictor of growth mindset, academic grit, and school engagement (see Figure 3). These two structural models were applied to both the proposed and the expanded grit four-factor measurement
models. Given the conceptual and statistical overlap among the cognitive and behavior engagement variables with academic grit, it seemed important to present the results across both the proposed and expanded measurement models. It should be noted that the measurement and structural models are equivalent models (i.e., they have the same number of parameters and fit the data equally well). In the measurement models, the three psychosocial latent variables were allowed to covary with academic achievement, whereas they were specified as direct paths in the structural model while controlling for the remaining psychosocial factors. Therefore, the fit indices for the proposed and expanded grit measurement and structural models are identical, respectively (see Table 4). Standardized path coefficients were reported for each structural model. Similar to beta weights from regression analyses, these path coefficients specify the proportion of the standard deviation unit that the dependent variable changes as a function of a one standard deviation change in the independent variable (Kline, 2016). Standardized coefficient effect sizes above .05 are considered small, values above .15 are considered moderate, and those above .25 are considered large (Kline, 2016).

Importantly, the standardized path coefficients in the proposed grit model exceeded the threshold of 1 due to extremely high correlations among the psychosocial latent variables (see Table 5). Therefore, it was not possible to interpret the results based on the proposed grit measurement model.
<table>
<thead>
<tr>
<th></th>
<th>Psychosocial Predictor Model</th>
<th>Achievement Predictor Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proposed Grit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Academic Grit</td>
<td>2.655</td>
<td>0.08</td>
</tr>
<tr>
<td>Multidimensional</td>
<td>-2.578</td>
<td>-0.00</td>
</tr>
<tr>
<td>School Engagement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Growth Mindset</td>
<td>-0.08</td>
<td>.047</td>
</tr>
<tr>
<td>Grit Expanded</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Academic Grit</td>
<td>0.13</td>
<td>0.06</td>
</tr>
<tr>
<td>School Engagement</td>
<td>-0.12</td>
<td>-0.01</td>
</tr>
<tr>
<td>Growth Mindset</td>
<td>0.04</td>
<td>.048</td>
</tr>
</tbody>
</table>

*Note.* All path coefficients were nonsignificant (*p* > .05)

Only the results based on the expanded measurement model are described in what follows. Across the psychosocial predictor and academic achievement predictor models, all the path coefficients were nonsignificant and are presented in Table 5. As individual variables the psychosocial latent variables were not related to academic achievement, regardless of whether achievement was conceptualized as a predictor versus as outcome. In the psychosocial predictor
model, the three psychosocial factors together explained only 1.1% of the variance in academic achievement \( (R^2 = .011, SE = .024) \). Similar results were obtained for the academic achievement predictor structural model. Academic achievement explained approximately 0.4% of the variance in academic grit \( (R^2 = .004, SE = .016) \), 0% of the variance in school engagement \( (R^2 = .000, SE = .003) \), and 0.2% of the variance in growth mindset \( (R^2 = .002, SE = .010) \). However, the psychosocial latent variables were significantly \( (p < .001) \) and positively related to one another across both models. Growth mindset moderately covaried with school engagement \( (.42) \) and academic grit \( (.47) \), and academic grit strongly covaried with school engagement when social and emotional engagement were the only indicators loading onto the School Engagement factor \( (.73) \).

**Discussion**

To my knowledge, this is the first cross-sectional study to examine academic grit, multidimensional school engagement, and growth mindset among middle school students. Additionally, this is one of the first studies to use the Multidimensional School Engagement Scale (Wang et al., 2019) and The Academic Grit Scale (Clark & Malecki, 2019) together. The purpose of this work was to examine the nature of the relations among these three psychosocial factors and academic achievement when considered together in a comprehensive model. Notably, standardized path coefficients exceeded the appropriate range within the proposed grit model due to high multicollinearity, suggesting a potential overlap in psychosocial latent factors. The factor analytic results lead to the exploration of a post hoc expanded grit measurement model, reflecting the conceptual ambiguity present in the literature. Interestingly, analyses using this expanded grit measurement model found that the contributions of each psychosocial factor to academic achievement did not reach statistical significance, which is inconsistent with much
of the extant literature. When the relations were reversed, academics made little to no contribution to the psychosocial factors. Results from this study suggest that further research is needed to examine if these three psychosocial factors together play a role in supporting academic achievement. However, methodological limitations and conceptual overlap among psychosocial factors may have influenced these results.

Two competing models were examined in this study, one depicting Academic Grit, Growth Mindset, and Multidimensional School Engagement factors as predictors of achievement (Figure 2), and another where the paths were reversed such that achievement predicted the psychosocial factors (Figure 3). Results based on the proposed measurement model, which upheld the factor structure purported by the AGS and MSES, were not. Based on the literature, it was hypothesized that the psychosocial factors would have positive and significant contributions to Academic Achievement among middle school students. When considered together in the model, there was significant multicollinearity between multidimensional school engagement and academic grit. Therefore, the relations between the psychosocial factors and academic achievement could not be interpreted within the proposed grit measurement structure. However, within the expanded grit measurement model, the psychosocial factors contributed little to academic achievement. It’s notable that among the correlations between the 14 psychosocial indicators and the three academic achievement indicators used to create the latent variables, the only significant association was found between Social Engagement and i-Ready Math, and it was weak and negative ($r = -.20$). On the surface, these results seem inconsistent with prior literature examining one or two of the psychosocial factors. However, Tang and colleagues (2019) found when growth mindset, school engagement, and grit were modeled all together, their unique contributions to academic achievement largely dissipated. Our results support the notion that
these psychosocial factors may not uniquely contribute to academic achievement when examined together at a single timepoint. More research is needed to examine whether these psychosocial factors significantly and uniquely contribute to academic achievement when modeled together longitudinally.

Academic achievement was examined as a predictor of academic grit, growth mindset, and school engagement given that a majority of studies have only examined the prediction of academic achievement through psychosocial factors. Model results from the expanded grit model revealed that academic achievement explained virtually none of the variance (0% to 0.4%) in the three psychosocial factors, which was surprising given recent theoretical models indicating a reciprocal effect between achievement and psychosocial factors (Farrington et al., 2012). Very few studies have examined academic achievement’s contribution to these psychosocial factors. O’Neal and colleagues (2018) found that reading achievement did not directly affect emotional engagement and grit but there was a reciprocal effect among these psychosocial factors and literary achievement among elementary dual language learners. Indeed, most studies have examined the impact of psychosocial factors on specific areas of learning. In past studies that examined Grit, School Engagement, and Growth mindset found these psychosocial factors significantly impacted subject grades including reading (Costa & Faira, 2018; Gunderson et al., 2017; Marchand & Furrer, 2014; O’Neal et al., 2018), math (Blackwell et al., 2007; Costa & Faira, 2018; Gunderson et al., 2017), and science (Bae & Debusk Lane, 2018; Lee et al., 2016). Given these results across specific subject areas, it seemed reasonable to hypothesize that there would be a relation among these psychosocial factors and global achievement, but that was not supported by the results of this study.
Divergent to past literature, the current study used GPA and standardized benchmark test as indicators for the overall latent variable of academic achievement, in order to provide a full view of what is measured to determine a student’s academic progress. Additionally, the use of z-scores may have restricted the variation among the i-Ready test scores and therefore attenuated the relations between academic achievement and the psychosocial factors. Research has found that prior GPA predicted grit at a second time point among 5th and 6th graders (Jiang et al., 2019) and 7th grade GPA predicted 8th grade grit-perseverance of effort in 8th grade and engagement in 9th grade (Tang et al., 2019). Farrington et al. (2012) also hypothesized previous GPA, test scores, and academic mindsets were likely to mediate the relations between student’s psychosocial skills and their academic achievement. There is limited research on the effects of concurrent academic achievement on psychosocial factors as most research has focused on how psychosocial factors predict academic achievement. Our results suggest that concurrent academic achievement provides little effect on concurrent psychosocial factors. Thus, future studies can further examine the role of psychosocial factors on specific subject areas and further test Farrington’s hypothesis that prior academic achievement and mindsets affect psychosocial skills and academic achievement across time.

The use of a cross-sectional rather than longitudinal design may have impacted the results of this study. Past researchers have highlighted that the theoretical nature of grit focuses on long term goals (Duckworth et al., 2007; Duckworth & Quinn, 2009; Muenks et al., 2018), and so it follows that academic grit may focus on long-term academic goals (Clark & Malecki, 2019). Indeed, only one study has examined all three psychosocial factors longitudinally where grit mediated the relationship between growth mindset and GPA and mediated the relation between goal commitment and engagement (Tang et al., 2019). It is possible that these psychosocial...
factors may mediate or moderate one another’s predictive impact on academic achievement longitudinally across time (Farrington et al., 2012; Tang et al., 2019). This study provides a valuable snapshot of how these factors relate to one another concurrently, but more research is needed to elucidate the various potential pathways among these variables across development.

Factor analytic results from the proposed model led to the exploration of a post hoc expanded grit measurement model. Consistent with the data analytic pan, a confirmatory factor analysis was conducted to verify the structure of the latent factors before proceeding to the structural models. The proposed measurement model presented each factor in a manner that was consistent with the structure purported by the instrument developers (e.g., four indicators for the MSES, three for AGS). All psychological factors and their indicators were found to significantly correlate with one another consistent with prior literature (Burnette et al., 2013; Costa & Faira, 2018; Muenks et al., 2018; Sisk et al., 2018; Tang et al., 2019; West et al., 2016). However, correlational patterns among the indicators, elevated multicollinearity statistics, and results from the modification indices pointed to overlap between the Multidimensional School Engagement factor and the Academic Grit factor. Indeed, the psychosocial predictor structural model was not able to be interpreted due to these results as path coefficients were out of interpretable range.

Prior literature has noted that there is potential conceptual overlap among these psychosocial factors, specifically, behavioral engagement and grit, and some researchers have pointed to similarity in the language used among these measures (Muenks et al., 2017; Steimayr et al., 2018). The AGS resilience subscale questions often overlapped with the MSES cognitive engagement questions. For example, a resilience question on the AGS (Clark & Malecki, 2019) is “I complete my schoolwork no matter how difficult it is.”, whereas a cognitive engagement question on the MSES (Wang et al., 2019) is “I work hard in the face of challenges/difficulties at
Indeed, when examining the different factors of school engagement in creating the MSES, Wang and colleagues (2017) found that the social engagement factor was distinct from the academic engagement domain (i.e., behavioral, emotional and cognitive engagement). Interestingly, social engagement had the lowest factor loading of any indicator in this study consistent with Wang’s conclusions. Due to this conceptual overlap noted in the literature and the high correlations between academic grit & school engagement observed in this study, an alternative CFA was examined. In the expanded grit measurement model, the two school engagement indicators, cognitive and behavioral engagement, were allowed to load on the Academic Girt latent factor, and the emotional and social engagement indicators loaded on one factor retaining the named School Engagement.

The expanded grit measurement model was found to fit the data slightly better than the proposed model, although both demonstrated adequate fit. Factor loadings for the behavioral and cognitive engagement indicators on Grit were comparable to those found in the proposed model for multidimensional school engagement, but resulted in higher factor loadings for social and emotional engagement indicators on School Engagement. Even so, when academic achievement was examined as a predictor of psychosocial factors, the results indicated little to no variance was explained by academic achievement. In contrast, when the psychosocial factors were examined as predictors of achievement they accounted for only 1% of the variance. In other words, when the purported factor structure of the AGS and MSES measures was maintained, the relations among psychosocial factors were not able to be examined due to multicollinearity and high correlations among academic grit and multi-school engagement; Indeed, when cognitive and behavioral engagement were added to the Academic Grit latent factor their combined contributions dissipated. These results are consistent with the theorists who acknowledge there is
empirical overlap between academic grit and school engagement and claim further distinctions among these variables are needed to be examined (Clark & Malecki, 2019; Muenks et al., 2017; Steimayr et al., 2018; West et al., 2016). Further research needs to further examine the theoretical implications and empirical overlap of these psychosocial factors.

Results from this study give rise to uncertainties about the extent to which these psychosocial constructs are separate and uniquely contribute to achievement. Few studies have included all three constructs and none have included new AGS or the MSES in measuring academic grit and multidimensional school engagement. In particular, the inclusion of social engagement with other forms of engagement has been somewhat controversial, as noted in this study and previous studies (Wang et al., 2010; Wang et al., 2019). Notably, academic grit and multidimensional school engagement were so highly correlated, the proposed grit structural models were unable to be interpreted and a post hoc model was conducted to examine the relations among the factors. However, when cognitive and behavioral engagement were loaded onto Academic Grit, the contribution of the psychosocial factors to achievement was a nonexistent effect. These results suggest conceptual distinctions between academic grit and school engagement need to be further explored and distinguished from one another.

Of note, research on grit and school engagement have been examined and measured from different theoretical perspectives including personality and educational psychology (Muenks et al., 2017; Zimmerman et al., 2011), which makes the conceptual understanding of these factors difficult to differentiate. However, limitations associated with the design of this study, such as use of cross-sectional data and inability to incorporate demographic variables of interest, also make it difficult to draw firm conclusions from these results. Indeed, student demographics and developmental trajectories have been shown to significantly contribute to academic achievement.
(Bae & Debusk Lane, 2018; Clark & Malecki, 2016; Gunderson et al., 2017; Henderson &
Dweck, 1990; Romero et al., 2014; Sisk et al., 2018; Usher et al., 2018; Wang et al., 2010). Even
so, one of the most comprehensive models (Farrington et al., 2012) that includes student
demographic variables and socio-cultural context factors has yet to be empirically validated.
This study is a first step in mapping these relations among middle schoolers, but more research is
needed to develop a coherent integration of these factors and how they influence one another
over time.

**Limitations and Future Directions**

Several limitations of this study merit discussion. As previously addressed, the size of
the sample did not allow for the analysis of students in subgroups such as grade-level, gender, or
race or ethnic identity, which constrained further examination of developmental trends and
demographic factors that could be impacting the results. Past studies have found correlations
among grit scores and a student’s gender identity and grade level (Clark & Malecki, 2016; Usher
et al., 2018). One study found that positive relations disappeared and reversed when grade levels
were combined (West et al., 2016). Indeed, most studies have noted grade level as a significant
predictor or covariate when examining school engagement and growth mindset’s relation to
academic achievement (Bae & Debusk Lane, 2018; Gunderson et al., 2017; Henderson &
Dweck, 1990; Romero et al., 2014; Sisk et al., 2018; Wang et al., 2010). Future studies should
examine academic grit’s effect on academic achievement across time, and explore the impact of
developmental and demographic factors.

Importantly, researchers have noted that the sociocultural context, community, school,
and classroom context all impact students’ achievement (Austin et al., 2022; Farrington et al.,
2012; Walton & Cohen, 2007; Wang et al., 2022; Yeager & Dweck, 2012). It seems quite
reasonable that the psychosocial factors investigated in this study could be impacted by current psychosocial stressors and sociocultural context including social stress, parental stress, and racial stress and trauma (Austin et al., 2022; Bartle-Haring et al., 2012; Raufelder et al., 2014; Shernoff & Schmidt, 2008; Wang et al., 2021; West et al., 2016). Notably, this study was conducted during a heightened time of stress including the COVID-19 pandemic and exposed systemic racism, both of which may have negatively impacted the students in our diverse sample.

Participants in this study identified as African American or Black, Asian or Pacific Islander, Biracial, White, Latinx or Hispanic, and as North African or Middle Eastern. Researchers have noted racial stereotypes (Pennington et al., 2016; Walton & Cohen, 2007; Wang et al., 2019; Wang et al., 2022; Yeager & Dweck, 2012) and ongoing racial stress pronounced during COVID-19 has been linked to lower school engagement, lower academic achievement, and lower mental health outcomes (Samela-Aro et al., 2021; Liu & Modir, 2020). In-person instruction resumed for participating students in fall 2021, following a more than year long period of primarily virtual instruction. Data collection for this project was postponed till December 2021 to allow student to reacclimate to in-person instruction. However, the influence of the COVID-19 and racial pandemic in the US on these results is not known and may impact the generalizability of these results to future samples. Future research should examine how the broader social context, including factors related to facets of diversity and COVID-19 related experiences, impact these psychosocial factors and achievement. This continued research is needed in order to develop interventions to mitigate the impact of these stressors by improving student’s psychosocial skills and enhancing protective factors.
Conclusion

The purpose of this study was to investigate the relations among academic grit, growth mindset, school engagement, and academic achievement in a cross-sectional sample of middle school students. Study results corroborated previous research that these psychosocial factors are important to academic achievement, and demonstrated the need of future research to explore the distinctiveness of each psychosocial factor from both an empirical and theoretical lens. This study adds to the emerging literature as it is the first to examine the relations among all three psychosocial factors and academic achievement in a sample of middle school students. Research regarding the development of these psychosocial skills is needed to build a solid theoretical framework in order to inform intervention efforts that promote academic achievement among all students. Future research should aim at determining whether the relations among psychosocial factors and academic achievement vary longitudinally across development and are influenced by sociocultural and demographic factors.
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Appendix

1. Academic Grit Scale (Clark & Malecki, 2019)
Please respond to the following items by reading each statement and then selecting on the response that best describes you on a scale of 1= Not at All like me and 5= Very Much Like Me. There are no right or wrong answers, so please be honest.

1) I push myself to do my personal best in school
2) I work toward my academic goals no matter how long they take to reach.
3) Even when I could do something more fun, I give schoolwork my best effort.
4) I complete my schoolwork no matter how difficult it is.
5) I am determined to give my best effort in schoolwork.
6) Once I set a goal in school, I try to overcome any challenges that arise.
7) I am able to balance working hard in school with my other hobbies and interests.
8) Even if I am struggling in school, I keep trying my best.
9) When it comes to completing work in school, I always try my hardest.
10) In school, I work hard to achieve challenging goals.

2. Implicit Theories of Intelligence Scale (Dweck, 2000)
Please respond to the following items by reading each statement and then selecting on the response that best describes you on a scale of 1= Not at All like me and 5= Very Much Like Me. There are no right or wrong answers, so please be honest.

1) No matter who you are, you can change your intelligence a lot.
2) You can always greatly change how intelligent you are.
3) No matter how much intelligence you have, you can always change it a good amount.

3. Multidimensional School Engagement Scale (Wang et al., 2019)
Please respond to the following items by reading each statement and then selecting on the response that best describes you on a scale of 1= Not at All like me and 5= Very Much Like Me. There are no right or wrong answers, so please be honest.

1) I always try my best in school
2) I contribute to what we are doing in class
3) I asked questions when I don’t understand.
4) I get involved in school activities (e.g., clubs, sports, school events).
5) I plan out how to finish my schoolwork.
6) I look over my schoolwork and make sure it is done well.
7) I keep trying even when I get stuck on my schoolwork.
8) I work hard in the face of challenges/difficulties at school.
9) I figure out what I did wrong when I make mistakes on my schoolwork.
10) Doing well in school is important to my future.
11) I have fun at school.
12) I am happy at school.
13) I am proud of my school.
14) I am interested in what we are learning at school.
15) I help my peers when they are struggling.
16) I enjoy working with peers at school.
17) I work with other students and we learn from each other.
18) I am open to making new friends at school.
19) I enjoy spending time with peers at school.
Institutional Review Board  
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April 23, 2021

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Submission Type: Initial  
Title: Academic Grit and its Influence on Academic Achievement in Middle School Students IRB ID: #PRO-FY2020-559

Expedited Approval: April 23, 2021

The University of Memphis Institutional Review Board, FWA00006815, has reviewed your submission in accordance with all applicable statuses and regulations as well as ethical principles.

Approval of this project is given with the following obligations:

1. When the project is finished a completion submission is required  
2. Any changes to the approved protocol requires board approval prior to implementation  
3. When necessary submit an incident/adverse events for board review  
4. Human subjects training is required every 2 years and is to be kept current at citiprogram.org.

For additional questions or concerns please contact us at irb@memphis.edu or 901.6783.2705

Thank you,

James P. Whelan, Ph.D.  
Institutional Review Board Chair  
The University of Memphis.