ABSTRACT

Title of dissertation: THE CHICK OR THE EGG? MULTI-GROUP, SHORT-TERM LONGITUDINAL RELATIONS BETWEEN GRIT AND LITERACY ACHIEVEMENT

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The impact of grit on achievement is well established, but it is unclear whether achievement impacts grit. This short-term longitudinal study examined the direction of relations between grit and literacy among diverse elementary school student groups. Most grit research features a unidirectional design (e.g., grit affects achievement). Yet, recent research supports cross-lagged models in which socioemotional skills and achievement affect one another. In addition to testing cross-lagged effects, this study examined the direction of grit-literacy relations for different demographic groups (i.e., age, gender, and dual language status). **Method:** Participants included upper elementary students (N = 396; 3 schools; M_{age} = 9.61; 55% female; 59% dual language learners; 11% Black, 6% Asian, 29% Latino/a, 8% Multiracial; 39% White). Measures were student-reported grit, teacher-reported grit, and a student literacy achievement performance task (Test of Silent Reading Efficiency and Comprehension, TOSREC). **Analytic Approach:** An autoregressive cross-lagged design included two time points over 4 months.

A cross-lagged model was compared to unidirectional models (i.e., direct and reverse) for best fit. Multi-group analyses were then used to examine whether grit-literacy relations differed as a function of demographics. **Results:** The data fit the cross-lagged model better than the direct or reverse models. Within the context of a cross-lagged model – which contained both the direct and reverse effects – there was a significant relation between Time 1 literacy achievement and Time 2 student-reported Grit-PE, suggesting that literacy achievement can predict later Grit-PE. There were no demographic differences in the fit of the data with the cross-lagged model between gender, DLL status, and age groups. Findings of the current study support the examination of reciprocal effects in grit-literacy relations and its generalizability among students. Longer-term cross-lagged studies are needed to further understand the temporal sequence between grit and literacy.

THE CHICK OR THE EGG?
MULTI-GROUP, SHORT-TERM LONGITUDINAL RELATIONS BETWEEN GRIT AND LITERACY ACHIEVEMENT

by

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Dissertation submitted to the Faculty of the Graduate School of the
University of Maryland, College Park in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
2019

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Dedication

I thank Imma and Abba, Bubbie and Grandpa, my precious daughters Talia and Hannah – and above all – Chuck, for their unconditional support, encouragement, and love. I gratefully acknowledge my advisor, Colleen O'Neal, Ph.D., who has provided me with cherished support and advice (about research and otherwise) over the years. Lastly, I thank Lynsey Weston Riley, my student-mentor in research, who taught me how to love a construct and simultaneously think critically of it.

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Chapter 1: Introduction

Like career work in adulthood, children's schoolwork can be "boring but important" (Yeager et al., 2014, p. 559). This includes elementary literacy achievement, which is fundamental to success across school subjects (ACT, 2006). Acquiring literacy skills can be difficult. As William James aptly said in his Talks to Teachers, schoolwork that requires repeated practice like literacy can be "repulsive, and cannot be done without voluntarily jerking back the attention to it every now and then ... It flows from the inherent nature of the subjects and of the learning mind" (1983, pp. 108–109).

What factors prepare students for literacy achievement? There are many ways to answer this question, but one noteworthy approach is via "non-academic" skills (e.g., Every Student Succeeds Act, S.1177, 2015) such as grit (Tough, 2012). Before using grit as a non-academic indicator, however, its measurement and relation to academic achievement must be explored (e.g., Duckworth & Yeager, 2015). The field generally focuses on direct effects in socioemotional research (i.e., socioemotional skills impact achievement), potentially because achievement outcomes are prioritized. Yet theorists suggest that socioemotional processes may not only increase achievement, but achievement may also increase socioemotional skills (Shavelson, Hubner, & Stanton, 1976). Colloquially known as "reciprocal effects," these cross-lagged panel models suggest that socioemotional and academic development occur in a dynamic fashion over time; changes in socioemotional functioning affect later academic growth (e.g., Hughes, Luo, Kwok, & Loyd, 2008), just as prior academic growth affects later socioemotional functioning (Guo, Sun, Breit-Smith, Morrison, & Connor, 2015; Valentine & DuBois, 2005).

Accordingly, this dissertation has two aims. The first is to explore the direction of literacy's relation to grit and its sub-facets. In the current study, grit and literacy achievement may have cross-lagged (i.e., reciprocal) relations, similar to how grit and engagement were related to literacy achievement in a cross-lagged analysis of elementary-aged dual language learners (O'Neal, Goldthrite, Weston Riley, & Atapattu, 2018). Increasing research suggests that literacy and socioemotional skills affect one another (e.g., Guay, Marsh, & Boivin, 2003). It is possible that a positive record of overcoming achievement challenges may yield an enjoyment of such challenge and desire to persist; in turn, people may seek more achievement challenges and develop their grit (Duckworth, 2016). Examining whether these reciprocal patterns unfold with grit may provide a more nuanced understanding than unidirectional models offer. For school psychologists, results may also have implications for grit's usefulness in education and how intervention could alter children's school trajectories.

To advance psychologists' understanding of directionality, I examined grit's subscales separately. In theory, grit consists of two sub-facets, Perseverance of Effort (grit-PE) and Consistency of Interests (grit-CI), and each facet offers a similar contribution to achievement. In school-based research, however, they might not relate to achievement equally (Credé, Tynan, & Harms, 2016; Muenks, Wigfield, Yang, & O'Neal, 2017). As educators consider the role of grit in their classrooms, it is important to understand how grit's two facets relate to literacy.

The second aim is to examine grit-literacy relations by subgroup. Research must explore grit's functioning among young, diverse students (O'Neal, Boyars, & Riley, *under review*). It is easy to imagine that patterns between grit and literacy could vary for

dual language learners, a suspicion supported by nascent research (Boyars, *in preparation*). People from different cultures may also conceptualize grit differently (Datu, Valdez, & King, 2016). Furthermore, relations may vary by gender, as they do with similar socioemotional skills (Duckworth & Seligman, 2006). Such variation may be due, in part, to gender-related stereotypes or social pressures (Dweck, 2014). It is also possible that patterns vary by age, whether because young children are more encouraged to follow their passions, or because older children are more capable of following through on goals (Pintrich & Zusho, 2002; O'Neal, et al., *under review*). Children's understanding of competence develops over time (Wigfield & Karpathian, 1991), which may also have implications for the directionality between grit and literacy. A multi-group approach is congruent with school psychologists' focus on the whole child, as opposed to assuming monolithic processes. Rather than taking a "one size fits all" approach, it is essential to examine grit-literacy relations with a systematic approach across demographic groups.

Proposed Study

This short-term, cross-lagged study explored how grit and literacy relate to one another among upper elementary students. Using a diverse sample from three schools in Maryland, I examined how grit and literacy achievement affect one another at a later time point, and whether the directionality of relations differs by age, language status, and gender.

Hypotheses

1. There are cross-lagged (i.e., reciprocal) effects between grit and literacy for the full sample.
2. These effects will be driven by perseverance of effort (grit-PE), not consistency of interests (grit-CI), in all models tested (direct, reverse, cross-lagged).
3. Multi-group analyses will suggest similar cross-lagged relations for all subgroups (i.e., age, language status, and gender).

Chapter 2: Literature Review

"Energy and persistence conquer all things."

- Benjamin Franklin

Generations of parents and educators have aimed to inculcate in their children the virtues of persistence, hard work, and commitment to a greater cause. Researchers began measuring these qualities' relation to health and achievement outcomes half a century ago (for example, "hardiness" in Kobasa, 1979). This dissertation focuses on one such skill: grit. In the first part of this literature review, I provide background on grit theory, measurement, critiques, and relation to achievement. In the second part, I make the argument, and review related literature, that research needs to build on existing unidirectional grit-achievement models by examining cross-lagged relations between grit and literacy achievement. Finally, to establish how these relations differ across demographic groups, I review the literature on grit-achievement relations for students of different ages, genders, and dual-language learner status.

Part 1: Grit Definition and Theory

Grit is defined as sustained commitment to long-term goals (see Table 1 for items; Duckworth & Quinn, 2009). A gritty individual "approaches achievement as a marathon; his or her advantage is stamina" (2007, p. 1088). People high in grit persist despite "failure, adversity, and plateaus in progress" (Duckworth et al., 2007, p. 1088). Grit consists of two sub-factors: (a) perseverance of effort (grit-PE) and (b) consistency of interests (grit-CI; Duckworth et al., 2007; Duckworth & Quinn, 2009). Grit-PE captures effortful, consistent pursuit of goals despite setbacks. Grit-CI represents a passionate commitment to one goal.

Table 1

Short Grit Scale (Grit-S) Items and Adapted Grit-S Items in Current Study

Original Items	Current Study Adapted Items
1. New ideas and projects sometimes distract me from previous ones.[a,b]	Other things sometimes distract me from what I am already working on in school.[a,b]
2. Setbacks don't discourage me.	My schoolwork is difficult and makes me want to give up.[b]
3. I have been obsessed with a certain idea or project for a short time but later lost interest.[a,b]	I get very interested in a new topic in school, but then I quickly get bored with it.[a,b]
4. I am a hard worker.	I am a hard worker in school.
5. I often set a goal but later choose to pursue a different one.[a,b]	I often set a goal in school but later give up and choose a different goal.[a,b]
6. I have difficulty maintaining my focus on projects that take more than a few months to complete.[a,b]	It's hard to focus on schoolwork that takes a long time to complete.[a,b]
7. I finish whatever I begin.	I finish whatever I begin in school.
8. I am diligent.	I work steadily in school without giving up.

Note. Original items from Duckworth & Quinn, (2009). Items are rated on a 5-point Likert scale (1 = *Not at all like me*, 5 = *Very much like me*). Mean of item scores are used to summary score.
[a]Item from interests subscale.
[b]Item reverse-scored.

Grit theorists note that the pairing of these traits has been suggested for more than a century – the need to work "with zeal and with capacity for hard labour" (Galton, 1869, p. 33) and aphorisms like "energy and persistence is needed to conquer all things" (Franklin & Pierce, 1849, p. 32) abound (Duckworth, et al., 2007). The combined grit construct is therefore intended to capture the long-discussed synergy between the "energy and persistence" required to reach long-term goals (Franklin & Pierce, 1849, p. 32).

Grit's theoretical foundations are in the personality and goal commitment literature (Duckworth, 2016; Duckworth et al., 2007). This initial work distinguished grit from similar constructs (e.g., self-control, conscientiousness). Grit is unique in its intensity and longer duration of goal commitment and perseverance; Duckworth, Peterson, Matthews, & Kelly (2007) saw value in creating this new construct, believing it might have the power to distinguish unusually successful individuals from typical high achievers. Indeed, although related constructs like conscientiousness or self-control may help people achieve goals on a short-term basis (Duckworth & Gross, 2014), grit's emphasis on "long-term stamina" (Duckworth et al., 2007, pg. 1089) is tied to goal completion over months or years.

Grit has also been placed within a hierarchical goal framework (Duckworth, 2016; Duckworth & Gross, 2014). Lower-order goals are short-term, substitutable, and commitment to them is captured by domain-general measures like self-control. In contrast, grit entails the higher-order, superordinate goals that sit atop the goal hierarchy (Duckworth & Gross, 2014). In theory, commitment to these higher-order goals may explain between-person differences in achievement (e.g., Duckworth et al., 2007), over and above predictors like cognitive ability (Howe, 2001). People's abilities may vary,

but the long-term effort put forth for higher-order goals is essential to success (Duckworth, et al., 2007; James, 1907). The tendency to pursue long-term goals with grit is evident across various domains, including careers, school, and interpersonal relationships (Eskreis-Winkler, Shulman, Beal, & Duckworth, 2014).

Extension to children. The development of the grit construct was inspired by research among adults that reached their ambitions (Duckworth & Quinn, 2009). From the outset, however, grit's relevance was explored among children (Duckworth et al., 2007). For example, in early studies among young National Spelling Bee contestants, students who were considered high in grit labored for "what they love" through deliberate, effortful practice (Duckworth, Kirby, Tsukayama, Berstein, & Ericsson, 2011, p. 179). Yet as described below, the theory extending grit to children's schooling is less well established than it is for adults. The lack of research among children is important given that grit's functioning may vary by age (Muenks et al., 2017).

When studying grit in children, it is first important to note that grit is not just an isolated, stable trait (Duckworth, 2016). Having emerged from the personality literature, grit was initially framed as a personality trait (Duckworth et al., 2007). In initial research among adults and high-achieving youth, grit was examined under the framework of the "Big Five" personality traits, which represent five universal traits which all people express along a spectrum of intensity (Soto, John, Gosling, & Potter, 2011). Grit was posited as a facet of conscientiousness (Duckworth et al., 2007), a trait that increases slightly with maturation but is generally stable (Soto et al., 2011). This context implied that grit acts like a stable quality.

Over time, however, grit's potential malleability has been emphasized (Duckworth, 2016; Shechtman, DeBarger, Dornsife, Rosier, & Yarnall, 2013), along with its motivational correlates (Von Culin, Tsukayama, & Duckworth, 2014). In the field of education, grit has been placed under the umbrella construct of "academic perseverance," which also includes qualities like tenacity, self-control, and delayed gratification (Farrington et al., 2012). It is no surprise that grit's conceptualization has shifted in the education literature, such that it is embraced as a malleable skill among children (e.g., Shechtman, DeBarger, Dornsife, Rosier, & Yarnall, 2013). First, studying grit in an academic context makes the concept of malleability more pertinent. It is well established that in the school context, perseverance is malleable, even if behavioral changes at school do not generalize to other areas of life; this may include children's follow-through on big projects, task completion, and persisting on difficult classwork (Farrington et al., 2012), which are behaviors that may indicate grit. Second, trait-like tendencies are difficult to change, but the intensity, duration, and direction of those behaviors can be shaped (e.g., McCrae & Costa Jr, 1994). Thus, in extending grit to children, grit is considered less of a stable trait and more of a "state" to promote in academic settings like elementary school (Shechtman et al., 2013).

Relatedly, grit may be context-dependent among elementary school children. Research on instructional practices indicates that a child who demonstrates perseverance in one setting might appear unmotivated in another setting (Farrington et al., 2012). One study among low-income, ethnically diverse dual language learners found that the context of peers' grit was twice as strong in predicting individual elementary-school literacy compared to individuals' grit (O'Neal, 2017). It suggested that grit's predictive power

"does not lie solely in an individual's character" (O'Neal, 2017, pg. 9), but that children's environment helps shape it. Grit's malleability in the school setting is demonstrated by a study by West and colleagues (West et al., 2016). On an individual level, grit and related behaviors predicted school outcomes; when the authors aggregated the data to the school level, however, positive correlations between school-average achievement gains and socioemotional skills dissipated and even reversed. Ironically in charter schools, which tend to stress the importance of socioemotional skills and high achievement, students reported marked declines in grit, conscientiousness, and self-control over time. The authors suggest that these skills remain important for achievement, but that students "redefine upward" their definition of these skills at schools that emphasize achievement, and therefore rate themselves more critically (West et al., 2016, pg. 165). In other fields, this phenomenon has been dubbed the "Big Fish Little Pond" effect, such that students compare their own abilities with that of classmates, and they alter their self-ratings and behavior accordingly (Marsh, Martin, Yeung, & Craven, 2017). These trends illustrate how children may alter their socioemotional understandings based on educational context.

Context may take on a broader meaning than one's educational setting. From an ecological standpoint, micro-, meso-, and macro-level factors may all shape socioemotional skills (Bronfenbrenner & Morris, 2006; Yeager & Walton, 2011), and specifically grit-literacy relations. An ecological approach to context will be discussed in Parts 2 and 3 in a review of reciprocal models and cultural differences, but the approach suggests that grit studies should incorporate contextual and demographic factors.

Grit and achievement. Part of grit's allure is its ability to predict student outcomes (Shechtman et al., 2013). Of note, the research supporting this conclusion was designed to assess direct effects (e.g., grit affects achievement, rather than grit and achievement affecting each other); this critique will be discussed in depth in the second part of this literature review. Among adults, grit predicts outcomes such as retention of military cadets (Maddi, Matthews, Kelly, Villarreal, & White, 2012), fewer career changes (Duckworth & Quinn, 2009; Eskreis-Winkler et al., 2014), and even longevity of one's marriage (Eskreis-Winkler et al., 2014). It also relates to school-specific outcomes among young adults, including educational attainment (Duckworth & Quinn, 2009), completion of training courses in the military (Duckworth & Quinn, 2009; Eskreis-Winkler et al., 2014), college grades (Chang, 2014; Duckworth et al., 2007; Strayhorn, 2014), and doctoral program grades (Cross, 2014).

Grit is relatively less studied among children and youth. To first tie grit to similar socioemotional constructs in the educational literature, grit may be linked to self-regulation (Riley, 2016), whose relation to children's achievement has been studied extensively. Grit has been conceptualized as "sustained self-regulation in the service of superordinate goals" among youth (Eskreis-Winkler et al., 2016, pg. 380), which facilitates the achievement of academic milestones like high school graduation. Dovetailing with grit (Riley, 2016), self-regulation involves the "voluntary control of attentional, emotional, and behavioral impulses in the service of personally valued goals and standards" (Duckworth & Carlson, 2013, p. 209). Self-regulatory strategies are particularly useful for students when the benefits of their work are not immediate (Pintrich, 2000). They are taught in school and learned by students (Duckworth, Grant,

Loew, Oettingen, & Gollwitzer, 2011); such metacognitive strategies encourage grit-like behaviors including effort (e.g., Oettingen & Stephens, 2009) and goal setting (Pintrich, 2000), which ultimately support academic achievement.

The few studies on grit among children suggest that grit predicts children's performance at high levels of achievement. Duckworth and colleagues (2011) found that self-reported grit predicted the spelling round reached at the National Spelling Bee, after controlling for a related personality trait. The path between grit and spelling bee performance was mediated by students' use of tedious but effective study methods. However, these results did not hold after accounting for verbal IQ. One limitation of the study by Duckworth et al. (2011) was that it did not include demographic information aside from age and gender, nor did it test differences in its model by these demographic variables. It therefore is unknown whether the relation between grit and spelling bee performance occurs equally for all groups of students. This study also assumed the primacy of direct, rather than cross-lagged, effects between grit and exceptional spelling achievement.

Correlational studies also suggest grit's relation with achievement, too. Among a diverse sample of 4th-8th grade students, grit was correlated with math report card grades in a cross-sectional study (Rojas & Usher, 2012). Grit may predict achievement beyond other noncognitive variables common in educational research, although critiques have also been made that grit predicts achievement above and beyond other noncognitive variables only weakly or not at all (e.g., Credé et al., 2016; Rimfeld, Kovas, Dale, & Plomin, 2016). Eskreis-Winkler et al. (2014) administered an adapted version of the grit-PE subscale to high school juniors. Juniors with high grit-PE were more likely to

graduate from high school the following year; grit-PE's effect on retention held after controlling for motivation, related personality factors, standardized achievement test scores, and demographic variables. A relevant limitation of this study is the assumption that grit affects achievement, rather than achievement and grit affecting one another. Eskreis-Winkler and colleagues' study also only included grit-PE. This limitation is noteworthy because one critique of grit is that the subscales have different associations with predicted outcomes. Eskreis-Winkler et al.'s findings therefore might not extend to grit-CI. Equally important, the study results may not extend to all demographic groups. Although the study sample was both large and diverse, having drawn from the Chicago Public Schools, it is unclear how these findings extend to elementary-aged students or to dual-language learners specifically. This is highlighted in a short-term longitudinal study on stress and literacy among largely Latina/o, dual-language learners (O'Neal, 2018). It found that stress's negative impact on later literacy was mediated by engagement, but not grit. Specifically, stress negatively impacted engagement, and engagement positively impacted literacy. Although the failure of grit to mediate relations is striking, results might have differed for other largely White, monolingual groups, among whom most of the grit research has been conducted. The relative lack of research on grit among young, diverse students limits our ability to understand grit's relation to achievement in elementary school.

It is valuable to consider grit's relevance for literacy achievement in particular. Reading achievement requires both "the skill and will" to read (Cambria & Guthrie, 2010, p. 16); well-established constructs like motivation and engagement are related to literacy (Guthrie, Wigfield, & You, 2012), and reciprocal relations between engagement

and reading achievement (Hughes et al., 2008). Grit may also contribute to the "will" to read. To my knowledge, eight longitudinal studies of grit use literacy as an outcome, and they are highlighted throughout this literature review. Here, I focus specifically on longitudinal grit-literacy studies that control for prior literacy. Adjusting for the same measure of prior academic achievement is a more rigorous approach to predicting future achievement (O'Neal, et al., *under review*), and it has been successfully used with other motivational constructs (Blackwell, Trzesniewski, & Dweck, 2007; Meece, Wigfield, & Eccles, 1990).

One of these studies is a large-scale longitudinal study (West et al., 2016), cited earlier. Literacy was included as an outcome, in addition to math. The authors examined change in students' achievement between 4th and 8th grade, and whether students' 8th grade performance in these subject areas exceeded expected growth based on their performance four years earlier. At the student level, self-reported grit, conscientiousness, and growth mindset (but not self-control) predicted gains in school outcomes like attendance, behavior, and statewide standardized tests in English and math. As discussed above, these trends dissipated at the school-level because socioemotional survey responses may be influenced by the context in which they are administered. Thus, individual students who rated themselves higher in areas like grit tended to show larger gains in literacy and math.

Conversely, a recent dissertation explored grit's relation with literacy and its overlap with other noncognitive traits (Riley, 2016). It found that grit was distinct from other self-regulatory constructs like emotion regulation and growth mindset, but it was highly related to engagement. As a joint latent construct, grit and engagement predicted

literacy achievement later in the school quarter. However, these relations were only significant before accounting for prior literacy achievement. Importantly, effects between a combined grit-engagement and literacy were strongest for non-White dual-language learners (DLL). A later section of this literature review describes the need for grit research among diverse students.

In a similar vein, an unpublished study suggests that grit loses its predictive relation with literacy after controlling for prior literacy (O'Neal et al., *under review*). The study tested grit's prediction of literacy among DLL students, after adjusting for the same measure of prior achievement. Teacher-reported engagement – but not grit – predicted literacy when controlling for prior literacy among a largely low-income, DLL sample. For young, diverse students, grit may therefore be a less valuable predictor than established constructs like engagement. However, grit's promise may have been diminished in the short-term studies above; West and colleagues' approach suggests that over a longer period of time, grit can predict academic gains beyond prior measures of achievement. Overall, a handful of published studies link grit and literacy achievement, described here and throughout this literature review. Of note, these studies examine direct, rather than cross-lagged, effects between socioemotional skills and literacy.

Grit measurement. Thus far, I have introduced the grit construct and its relations with achievement. Below, I review psychometrics of the scale used to measure grit. The review first describes the factor structure of grit to demonstrate the need to analyze grit's subscales separately to properly examine the predictive power of grit on literacy achievement. It then summarizes research on the measure's validity and reliability.

Grit's "perseverance and passion" are captured in two related factors: Perseverance of Effort and Consistency of Interests (i.e., the Grit-S in Duckworth & Quinn, 2009; see Table 1 for full scale and items mapping onto each subscale). Perseverance of Effort (hereafter called grit-PE) is defined as effortful pursuit of goals despite setbacks, repeated failure, or a lack of positive feedback. Consistency of Interests (hereafter called grit-CI) is defined as unwavering commitment to a single goal, rather than sporadic engagement in different areas. Duckworth and Quinn (2009) and Wolters and Hussain (2015) found support for this hypothesized two-factor model in their confirmatory factor analyses of samples of National Spelling Bee contestants *(M* age = 13.20, *SD* = 1.23*)* and ethnically diverse college students, respectively. Emerging research also supports grit's correlated two-factor structure among children who are dual-language learners (O'Neal et al., under review). In another study, however, the factor structure differed between high school and college students, raising questions about whether the model structure varies based on developmental stage (Muenks et al., 2016). Muenks and colleagues speculated that younger students may have difficulty differentiating between the effort and interests subscales, and age differences are reviewed in detail at the end of this chapter.

Theoretically, grit's two subscales are both considered important for high levels of achievement. Empirically, the subscales have shown different associations with predicted outcomes (Duckworth & Quinn, 2009), leading some to suggest that the subscales should be examined separately (e.g., Credé et al., 2016). For example, grit-PE was a better predictor of GPA and extracurricular activities (Chang, 2014; Credé et al., 2016; Duckworth & Quinn, 2009), but grit-CI was a better predictor of adults' number of

career changes or achievement in elite academic events (i.e., advancement to the final round of the National Spelling Bee; Duckworth & Quinn, 2009).

The self-reported grit measure (Grit-S) shows convergent validity with measures of related constructs (Duckworth & Quinn, 2009). It has also shown stability over time. Among a sample of high-achieving adolescents at a magnet school, grit was relatively stable over one year (Duckworth & Quinn, 2009). Among a younger, highly diverse sample at a public school, grit showed moderate-to-high stability over time (O'Neal et al., *under review*). Reliability is adequate among upper elementary-aged students (α = .72 - .82; Duckworth et al., 2011; O'Neal, 2017), including dual language learners. The scale was initially developed for self-report, but it has been adapted for informant-report (Duckworth & Quinn, 2009), and it demonstrated good internal consistency among teachers (α = .92; O'Neal, 2018). Among adults, the self-reported Grit-S demonstrates consensual validity with friends' and family members' ratings (r = .45, p < .001; Duckworth & Quinn, 2009); associations were consistent with those commonly found on self- and informant-reported personality questionnaires. Relations between elementary teacher-ratings and the students' self-reported grit are low-to-moderate (O'Neal et al., *under review*), which is relevant for this dissertation as it includes both student and teacher report. The low-moderate correlations between student and teacher respondents suggests that students and teachers may have different perspectives of grit, and that both should be included for a more nuanced understanding of the construct. Critiques of the Grit-S and its subscales are presently described.

Challenges against grit measurement. As support for the grit construct grows, so do challenges against it. Among grit's critiques, one theme is that grit's relation to

achievement may differ by demographics and academic history. A study of 4,500 twins in the U.K. found that after controlling for related personality traits, grit added little predictive value for the twins' performance on a national high school exam (Rimfeld et al., 2016). The authors suggest that earlier research showing small associations between grit and academic achievement depended upon highly selective samples like the Spelling Bee finalists described above; these samples may have shown stronger associations between grit and later achievement than typically-achieving students, like in Rimfeld and colleagues' study. In another study with high school students, grit did not predict high school grades, honors, or academic recognition after controlling for other personality traits (e.g., conscientiousness and emotion regulation ability), suggesting that grit provides little predictive value after accounting for more established constructs (Ivcevic & Brackett, 2014). Among graduate students, Cross (2013) found that grit predicted doctoral course grades, but contrary to expectations, there was no relation to the long-term task of completing a dissertation. In sum, a number of studies suggest that the unitary "grit score" is related to achievement, but others have argued that its explanatory power is too weak to merit the attention it has received.

From a social justice perspective, the findings above raise a different concern. Samples in the initial validation studies of grit had limited diversity, and they may have consisted of students with unique access to educational opportunities (e.g., students who trained as military cadets or attended an Ivy League school). These studies risk conflating individual level factors with systemic inequities (Nathan, 2017). Such research might be interpreted as a deficit-focused approach by attributing a lack of achievement to internal factors (i.e., a lack of grit) and neglecting the structural factors that are relevant for

achievement, such as socioeconomic status, language background, and stereotypes (e.g., Orfield & Lee, 2005). Ultimately, an "and/or" approach may be the most appropriate, in which structural barriers are actively recognized while also studying individual, developmental factors (Baldwin, 2016; Turiel, Chung, & Carr, 2016). The issue will be addressed in more detail in the third part of this literature review, which discusses grit research among minority groups.

As mentioned above, a second critique of grit focuses on the differential functioning of grit's subscales. The general theme is that grit-PE predicts student outcomes but grit-CI does not. A meta-analytic study found small relations between the grit construct and achievement, but that the grit-PE subscale drove the observed relations with achievement (Credé et al., 2016). Likewise, Chang (2014) found that, as a whole, the grit construct failed to predict college GPA; only the grit-PE subscale predicted it. Another study including high school students (*M*age = 16.33, *SD* = .51) also found that grit-PE was predictive of grades, but grit-CI was not (Muenks et al., 2017). Other research also suggests psychometric weaknesses in the grit-CI subscale, such as low internal reliability (O'Neal et al., *under review*). A dissertation (Riley, 2016) suggests a possible reason for these trends. It suggests that grit-CI is not well operationalized in the Grit-S (see Table 1 for items). The scale items do not reflect the underlying assumption that a goal remains one's consistent, passionate interest for a long period of time. The "definitional mismatch" (Riley, 2017, pg. 20) of the grit-CI subscale items with the broader grit construct suggests that more research on grit and achievement should consider examining relations with grit's subscales separately (Credé et al., 2016; Jiang et al., 2019).

One other extant question is grit's prediction of achievement above and beyond the same measure of prior achievement (e.g., controlling standardized literacy scores in the fall before predicting springtime scores on the same test). Few studies have controlled for the same form of prior achievement. This approach could have overestimated grit's predictive value, as has been the case with related socioemotional constructs (e.g., self-beliefs in Valentine & DuBois, 2005). Although it is a more rigorous approach, other noncognitive factors have predicted achievement after adjusting for prior achievement (e.g., Blackwell, Trzesniewski, & Dweck, 2007; Meece, Wigfield, & Eccles, 1990). To my knowledge, five studies have done this, and they found conflicting results. In addition to the studies described earlier, two unpublished studies examined grit among older students. One found that grit predicted college achievement above and beyond prior achievement (Cooper, 2014), although a different unpublished study with college students found no incremental predictive validity from grit (Stewart, 2015). In sum, future grit studies should consider controlling for previous achievement when predicting achievement.

Summary. The grit scale has a number of positive features and relations with achievement. Yet, it was developed under the assumption that the subscales are equally important. It also assumed that grit functions similarly across groups. Other researchers have challenged these two ideas, necessitating an examination of grit's subscales among diverse youth. Contextual differences were touched on here but will be described in depth in Part 3.

Part 2: Direction of Relations between Grit and Achievement

Unidirectional focus on grit-achievement relations. The direction of grit's relation with achievement is another assumption that merits a closer look. Specifically, grit studies are designed to understand its direct effects on achievement, rather than the other way around. The temporal ordering of these constructs is important theoretically and for practical educational outcomes (Valentine & DuBois, 2005). Policymakers, practitioners, and the general public have expressed interest in qualities like grit because of their perceived impact on achievement (e.g., S.1177, 2015; Tough, 2012). Unidirectional models tend to prioritize achievement in a similar manner by featuring achievement as the study outcome; by design, results may suggest that increased grit drives increased achievement. Yet, it is possible that relations between the two are more complex than a unidirectional model can capture.

Duckworth et al.'s (2007) original paper on grit suggested a unidirectional relation of grit on achievement, in which grit impacts achievement. The paper included a prospective, longitudinal study of National Spelling Bee contestants' grit and their advancement through the Bee. The prospective design gave Duckworth et al. "some confidence that… grit is driving the observed correlations with success outcomes rather than the other way around" (2007, pg. 1098). Yet, the study did not test whether graduating to a higher round of the Spelling Bee could have reverse/reciprocal effects on grit; plausibly, advancing to the next round might increase one's investment in the competition, or vice-versa. Consequent studies with students also test unidirectional relations; most of these studies regressed an achievement outcome on the predictor of grit. In a study of high school students, for example, graduation outcomes were regressed

on grit; grit remained a significant predictor of graduation even after controlling for standardized test scores and demographic covariates (Eskreis-Winkler et al., 2014). Research on grit's prediction of 4th-8th grade math achievement (Rojas & Usher, 2012) in addition to high school and college grades (Muenks et al., 2017) also assume a unidirectional relation, and did not control for previous academic outcomes. Overall, most grit research is designed to assess direct effects of grit on achievement outcomes, rather than reverse or reciprocal effects between grit and achievement. This "direct relation" is depicted below in Figure 1.

Although much of the research suggests that socioemotional skills support achievement, unidirectional relations could also occur in the reverse; achievement may impact socioemotional development (i.e., Guo, Sun, Breit-Smith, Morrison, & Connor, 2015). Furthermore, children's beliefs about their abilities may affect self-evaluative processes and their pursuit of challenge (Pomerantz & Saxon, 2001). Reverse relations are especially apparent in early elementary school (e.g., Welsh, Parke, Widaman, & O'Neil, 2001) and among children from under-resourced communities (Miles & Stipek, 2006). Indeed, a large-scale study found that preschool reading achievement predicted later engagement and continued achievement through fifth grade. The strength of these relations was strongest among low-SES students (Guo et al., 2015). It is apparent that these patterns may be especially relevant for dual-language students. Often attending school in their second language (Musu-Gillete et al., 2016) dual-language students may encounter more frustration in literacy, impacting their interest and perseverance in class. Literacy achievement may be especially likely to affect dual-language students' socioemotional processes in under-resourced school systems, which have a record of

providing them with inferior instruction relative to non-dual language peers (Gandara, Rumberger, Maxwell-Jolly, & Callahan, 2003). An illustration of "reverse relations" like these is depicted in Figure 2.

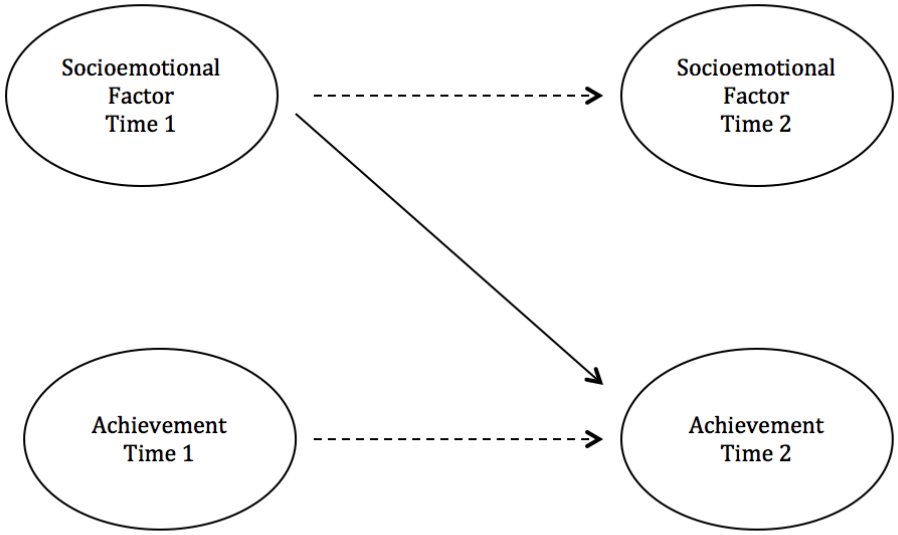

Figure 1. Generic directional model in which the socioemotional factor impacts achievement (solid arrow). Note that predictors and outcomes at Time 1 are controlled for in prediction of Time 2 outcomes (dotted, autoregressive arrows).

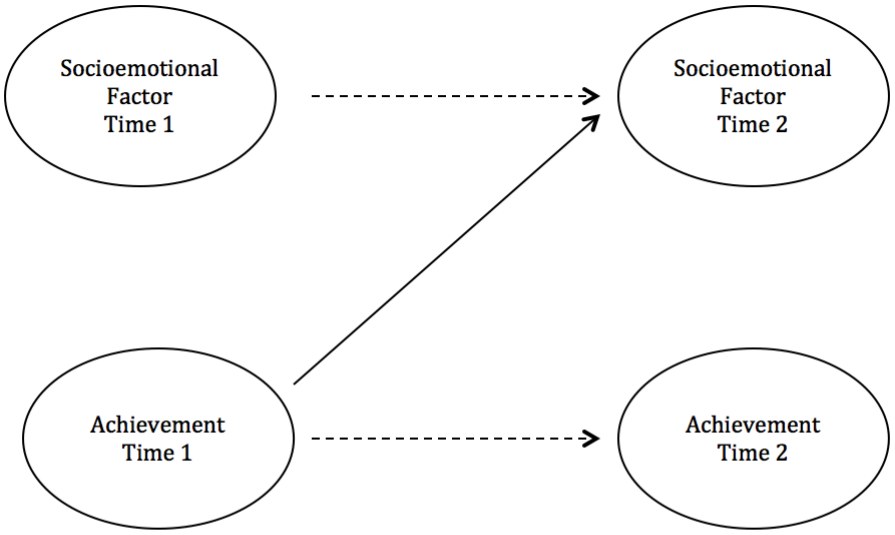

Figure 2. Generic reverse model in which achievement impacts the socioemotional factor (solid arrow). Again, predictors and outcomes at Time 1 are controlled for in prediction of Time 2 outcomes (dotted, autoregressive arrows).

The chick or the egg? Causal ordering of grit and literacy. A reciprocal effect between socioemotional processes and achievement might be even more suitable than the "either/or" unidirectional models above. Cross-lagged panel models posit that socioemotional skills and achievement have reciprocal effects over time. Patterns of behavior do not develop in a vacuum; rather, socioemotional skills and achievement are mutually reinforcing, with one leading to gains in one another (Marsh et al., 2017).

The approach is consistent with Bronfenbrenner's Ecological model (1977), which often assumes reciprocity; ecological studies cannot only consider "the effect of A on B, but also the effect of B on A" (Bronfenbrenner, 1977, pg. 519). Systemic factors (Marsh et al., 2017) like language exposure, socioeconomic status, school placement, and conceptions of gender and race may impact micro-level processes. Dual-language learners in particular may reflect diversity on several of these dimensions, along with macro- and meso-system factors like family levels of education, countries of origin, and migration history (Park, Zong, & Batalova, 2018). The Ecological Model lends a conceptual approach to the current study's cross-lagged modeling, which examines micro-level factors (i.e., socioemotional skills and achievement) and variation between groups. A generic cross-lagged panel model is depicted in Figure 3.

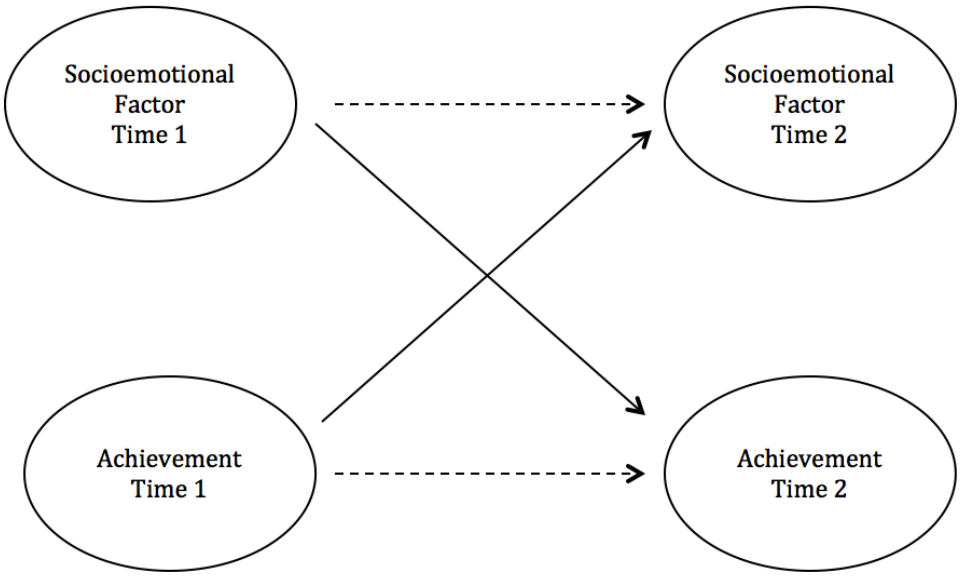

Figure 3. Generic cross-lagged panel model in which achievement impacts socioemotional factors, and socioemotional factors impact achievement (solid arrow). Predictors and outcomes at Time 1 are controlled for in prediction of Time 2 outcomes (dotted, autoregressive arrows).

A related construct, academic self-efficacy, has been studied extensively via cross-lagged modeling (e.g., Marsh et al, 2017), and it may provide a blueprint for reciprocal models of grit. Although academic self-efficacy predicts achievement, it is also predicted by prior academic achievement (e.g., Shavelson et al., 1976). Indeed, a meta-analysis of fifty-six studies suggested that self-beliefs promoted achievement gains, and higher levels of achievement predicted improvements in self-beliefs (Valentine & DuBois, 2005). To account for cultural differences, the participants' country of origin was included as a moderator, but it was not significant. This example illustrates how the cross-lagged approach integrates directional and reverse perspectives on socioemotional-achievement relations. In addition, cross-lagged models may generalize to research among youth and cross-cultural samples, according to a research review on reciprocal effects with self-efficacy (Marsh et al., 2017). Guay, Marsh, & Biovin (2003) tested the

generalizability of cross-lagged models to elementary-aged children's academic self-concept in a multi-cohort, longitudinal study, using teacher ratings as a measure of achievement. Three cohorts of French-Canadian students were tested annually for three years. Overall, achievement affected academic self-concept, and academic self-concept similarly affected achievement, regardless of age.

The direction of grit's relation with literacy warrants study, given evidence of cross-lagged relations between reading achievement and the related skill of effortful engagement (Hughes et al., 2008). Moreover, cross-lagged models reflect the theorized cycle that exists between grit and achievement. A positive record of overcoming challenge may yield an enjoyment of challenge; these successes lead people to seek more challenge and further develop their grit (Duckworth, 2016). One short-term longitudinal study from my lab extended cross-lagged modeling to grit and literacy, examining reciprocal effects of literacy achievement with grit and engagement among elementary-aged, low-income, ethnic minority dual-language learners (DLL; O'Neal et al., 2018). It used the same autoregressive cross-lagged design proposed for this dissertation, using repeated measures to control for previous time points of each variable. Broadly, the study found that a cross-lagged model with literacy fit better than unidirectional models. Grit's impact on later literacy was mediated by engagement, particularly for older elementary-aged students. The findings call for further examination of mutual effects between literacy achievement and socioemotional skills like grit, with the understanding that relations may differ by demographic group. Grit may have had a more direct, rather than reverse or cross-lagged, relation with literacy in a sample that included non-DLL students, or had grit's subscales been examined separately, as further argued below. Most

recently, a short-term, cross-lagged analysis examined reciprocal effects between self-rated grit and mid-semester grades among Chinese elementary school students (Jiang, Xiao, Liu, Guo, Jiang, & Du, 2019). Results suggested cross-lagged associations between the full grit score and achievement, but post hoc testing suggested that these relations were driven by grit-PE. Within the cross-lagged model, reverse paths were most noteworthy, as prior achievement contributed to future grit-PE. Results remained significant even after controlling for age, SES, self-control, and of course, autoregressive relations including prior achievement. These findings provide a good foundation for the current study, which will examine grit-PE and grit-CI within the same model, based on standardized achievement measures and multi-informant reports of grit.

Summary. Cross-lagged models address how socioemotional factors and literacy affect each other. Although much research tests direct effects (where socioemotional skills affect achievement), there is growing support for cross-lagged models. These models may provide a more nuanced understanding of temporal relations between socioemotional skills and achievement, particularly among DLL students. The weight of the evidence leans in support of a cross-lagged model between literacy and grit; I therefore hypothesize that a cross-lagged model will provide better fit than a unidirectional one.

Part 3: Examining Grit-Achievement Relations by Demographic Group

In this section I provide a rationale for examining the directionality of grit-literacy relations among students of different ages, genders, and dual language-status, while controlling for race and ethnicity.

Age. As alluded to above, grit's functioning may vary by age group. On the one hand, elementary students' mean levels of grit (O'Neal et al., under review) are similar to that of high school and college students in other studies. Yet, grit's subscales and factor structure may vary among age groups. Muenks et al. (2016) examined grit's factor structure among high school and college students; they supported grit's conceptualization as a single construct with two scales among the college sample, but as two correlated subscales among high school students. Importantly, age differences were largely due to the high school students' inconsistent responses on one grit-perseverance item ("setbacks don't discourage me"); this suggests that modification of the scale might be appropriate for younger samples. Muenks et al.'s work dovetails with research from my lab examining developmental differences in grit among elementary students. Elementary students tend to rate themselves higher on grit-perseverance than on grit-CI, and grit-CI's internal reliability has been poor in the samples tested by my lab (O'Neal et al., *under review*). These findings indicate that the grit-perseverance subscale may be more valid for elementary students. Indeed, young children may have limited opportunities to set long-term goals based on their personal interests, which is an assumed part of the grit-CI subscale (Riley, 2016). Children also become more adept at goal setting behaviors with age (Pintrich & Zusho, 2002).

It is possible that developmental changes in grit may also be due to social factors. Similar self-regulatory skills are subject to social pressures and individual beliefs about effort, which both change with age (Riley, 2016). Engagement and growth mindset, which are related to grit (Duckworth, 2016), might decline across grade levels as students adopt "sink or swim" beliefs that permeate middle school (Blackwell et al., 2007). A

similar trend is illustrated in students' mastery-versus-performance goals as they transition to middle school. While elementary students endorse mastery goals (e.g., understanding the material), they shift to performance goals in middle school (e.g., getting good grades; Midgley, Anderman, & Hicks, 1995). Social pressures and comparison also become more salient with age, contributing to disengagement (Eccles et al., 1993). Yet even as these noncognitive factors decline, their associations with achievement remain significant as children increasingly rate them based on external indicators (Wigfield & Karpathian, 1991). In sum, changing social pressures and beliefs about effort may contribute to any differences observed between age groups.

It is unclear whether reciprocal relations between grit and achievement are more likely to occur among older or younger students. Wigfield and Karpathian (1991) have argued reciprocal models become increasingly appropriate for children with age, as their understanding of competence develops. As perceptions of ability are established among older students, the relations between socioemotional skills and achievement may become reciprocal. Students' perception of their ability impacts their confidence, "and success on those tasks is likely to bolster their confidence in their ability" (Wigfield & Karpathian, 1991, p. 255). The model in this dissertation may parallel Wigfield and Karpathian's (1991) observations; reciprocal relations between academic achievement and grit may be found among older students. Conversely, a study of academic self-concept and academic achievement did not find age differences (Guay et al., 2003). As mentioned previously, the study included three age cohorts starting with second grade, each with three measurement waves. Guay and colleagues' structural equation model supported reciprocal effects in the full sample, and multigroup comparisons between age cohorts

suggested that developmental effects were not strong enough to be significant. Overall, questions have been raised in the literature about age differences in reciprocal relations, and I do not believe there is enough evidence to indicate that there will be developmental differences in grit-literacy relations for the age range included in this dissertation. I therefore hypothesize that cross-lagged relations will be similar across age groups.

Culture, Race, and Ethnicity. Examinations of grit must not assume monolithic processes. On a broad level, grit's emphasis on autonomy and self-set goals may resonate with some cultures more than others. On a local, community level, diverse students may have a range of commitments prompting them to focus their grit in areas other than school.

A recent study examined the first element of broad, cultural differences in grit's conceptualization, although the findings are not clear-cut. The study (Datu et al., 2016) aimed to validate the Short Grit Scale among high school and college students in the Philippines, which the authors define as a collectivist culture. Factor analyses suggested that in a Philippine context, grit was best conceptualized as a two-correlated factor model rather than the traditional hierarchical model. Specifically, grit-PE loaded onto the higher-order grit factor but grit-CI did not. Although similar findings have been obtained in Western cultures, Datu and colleagues saw their results as an indication that people from collectivist cultures may conceptualize grit differently. Yet, this interpretation of Datu and colleagues' (2016) findings is debatable. Drawing on similarities with Muenks and colleagues' (2017) findings among American students, it may be that grit is sometimes captured by a two-correlated factor model rather than a hierarchical or single grit factor model, and that grit-perseverance is a better predictor of achievement than grit-

CI among youth and young adults – regardless of cultural setting. Interestingly, Muenks et al. reached similar conclusions as Datu et al. (2016) among their high school-aged sample, and they advocated for modifications to the measure as needed. Still, Datu and colleagues' results map onto other research suggesting unique academic-achievement motivations for different cultural groups (Pew Center, 2015).

Within a local context, it is possible that students' grit is emphasized in different settings based on environmental or cultural variations; for some students, grit is emphasized in the school setting while for other students, grit is emphasized and required in daily life outside of school (Nathan, 2017; Turiel et al., 2016). Thus, a caveat to school-based grit measurement is that it may not represent the grit students demonstrate in non-school contexts like their neighborhood (Nathan, 2017). Within school specifically, it is possible that there are racial or ethnic differences in how grit functions and impacts achievement for school children. To my knowledge, one unpublished study examined whether grit, among other noncognitive skills, was equally predictive of standardized achievement for racial or ethnic minority and non-minority students (Boyars, 2016). Results indicated that grit was uniquely predictive of math and reading achievement for racial or ethnic minority students. Comparable skills like engagement also have different relations with achievement among different racial or ethnic groups (e.g., Sciarra & Seirup, 2008). It is unclear whether cultural dynamics within the learning environment could have shaped these patterns, such as school belongingness (Cook et al., 2012).

Boyars' thesis (2016) also did not test whether grit's two subscales functioned similarly between racial or ethnic groups. A short-term longitudinal study (O'Neal et al.,

under review) confirmed grit's two-factor correlated structure among Latino/a elementary students (included in the current study's sample). Yet, the two subscales functioned differently than anticipated. Grit-PE had relatively strong psychometric properties, predicting standardized literacy achievement after four months; grit-CI did not. Grit-PE predicted achievement after controlling for engagement, but not after controlling for literacy achievement a few months prior. This finding echoes that of Datu et al. (2016) among older Filipino students, which found that grit-PE was more predictive of student outcomes than grit-CI. While the conclusions drawn from these studies are limited, they suggest that grit may function differently between racial or ethnic groups. This possibility makes it important to control for race and ethnicity in analyses, particularly when they overlap with other demographic factors (e.g., dual language status).

Gender. A range of opinions exists on whether gender moderates relations between socioemotional skills and achievement. In a meta-analysis, the strength of the association between various socioemotional skills and achievement did not differ between boys and girls (Hansford & Hattie, 1982). Likewise, female students appear to have higher mean levels of skills related to grit, but the differences are not statistically significant (e.g., academic delay of gratification; Bembenutty & Karabenick, 1998). Conversely, other studies have found significant sex differences across constructs related to grit. Among high-achieving eight grade students, teachers, parents, and students rated girls higher in self-discipline, explaining a significant difference in grades (Duckworth & Seligman, 2006). Yet, the study's sample of high achieving students and its concurrent measurement of self-discipline and achievement limit generalizability and causal inferences. Gender differences in growth mindset, a skill related to grit (Duckworth,

2016), have been studied through the lens of stereotype threat. They suggest that females who rate themselves as having a growth mindset are less vulnerable to negative stereotypes around ability, and they tend to earn higher grades in subjects such as math (Dweck, 2014). Regarding grit itself, slight differences between men and women have been found in some samples, but the data are not consistent enough to reliably claim differences between genders (Duckworth, 2018), or that grit's relation with achievement varies for males and females. One unpublished study examined whether effects with grit's subscales vary by gender. High school grit-PE was a predictor of first-semester college grades for females; a different measure, high school self-control predicted college grades for males (Stewart, 2015). Overall, there is not enough evidence to hypothesize gender differences in grit-literacy relations generally, though it is possible that gender will intersect with other demographic variables in this study.

Dual Language Learners (DLL). As described above, grit-literacy relations may vary by cultural/ethnic group. How might cultural variations in grit manifest for students who are young dual language learners? DLL students are defined as children who have at least one parent who speaks a language other than English in the home (Park et al., 2018). These children make up approximately a third of the American population from birth to age eight. DLL students vary widely in their countries of origin, the languages they speak, their usage of multiple languages, their SES, and so on (Hammer et al., 2014); however, a review of research suggests certain commonalities. First, DLL students have cognitive and social assets that may serve them well in an increasingly diverse society (Child Trends, 2014). For the many DLL students from immigrant families (Fortuny, Chaudry, & Capps, 2010), parents may be deeply committed to helping their children

attain a better quality of life through school achievement (Pew, 2015). Likewise, students who are first- or second generation immigrants may have more positive academic attitudes, robust multiethnic identities, or supportive microsystems than native-born Americans (Marks, Ejesi, & García Coll, 2014). DLL students account for about ten percent of enrollment in American public schools (National Academies of Sciences, Engineering, and Medicine, 2017); their success is important on an individual level, and for American society as well.

DLL students may also face unique challenges. First, and most obvious, DLL students often attend school in their second language (Musu-Gillete et al., 2016). They may also face more systemic obstacles: DLL students are significantly more likely to live in poverty (Park et al., 2018), and they tend to receive relatively inferior instruction relative to non-dual language peers (Gandara et al., 2003). They may undergo added bicultural stressors (e.g., Romero & Roberts, 2003), discrimination (Berkel et al., 2010), difficult immigration experiences (Fortuny et al., 2010), and the loss of opportunity resulting from these challenges. Furthermore, students may be at a disadvantage in school when they or their parents lack proficiency in English (Child Trends, 2014). Despite the cognitive and social-emotional benefits of bilingualism (e.g., Hammer et al., 2014; Marks et al., 2014), DLL students' academic achievement tends to lag behind that of students whose only home language is English (Child Trends, 2014). On NAEP assessments between 2000-2013, there was a consistent achievement gap between fourth-grade DLL and non-DLL students of about forty points; just under one-third of ELL students scored reached the basic level in reading, whole more than two-third of non-DLL students did. In Maryland, the majority of DLL students are tested with accommodations, but the

achievement gap remains significant (Child Trends, 2014). These trends may jeopardize DLL students' prospects of postsecondary education and competitive employment (National Academies of Sciences, Engineering, and Medicine, 2017). However, the percentage of DLL students who achieve "at or above" basic reading levels varies considerably between states (Child Trends, 2014) and suggests that progress is possible.

Grit may be especially relevant for DLL students because of their adversities (Goldthrite, 2019). Grit-perseverance was more than twice as strong in magnitude as a predictor of literacy and math achievement for DLL than for monolingual students in an unpublished study using part of this dissertation's sample (Boyars, *in preparation*). A reciprocal model could explain this relation further by examining whether students' initial level of achievement influenced their later grit. Five published studies have also examined grit among DLL students, with mixed results: first, a study with college students found that documented and undocumented first generation immigrants used grit to overcome obstacles related to their education, and immigrant status moderated the relation between grit and depression (O'Neal et al., 2016). Second, a study among Mexican American high school students indicated that grit and hope were uniquely related to academic motivation (Piña-Watson et al., 2015). Lastly, three studies with part of the present sample examined grit among DLL elementary students (O'Neal, 2017; O'Neal, 2018; O'Neal et al., 2018). O'Neal (2018) examined stress's impact on elementary literacy through the mediators of grit and engagement. Engagement – not grit – mediated stress's negative impact on literacy. Although the study was not able to test it, it is plausible that grit would have been a significant mediator among White, monolingual students, as much of the research supporting grit has occurred within this demographic;

such possibilities underscore the importance of diverse samples that allow for model testing between monolingual and DLL students. Most relevant for this dissertation, O'Neal, Goldthrite, Riley, and Atapattu (2018) examined a reciprocal, moderated mediation model of literacy with grit and engagement. Among the DLL, ethnic minority sample, a reciprocal model fit better than unidirectional models. Although the current dissertation does not include engagement, it expands on this study with (a) a larger sample that allows for model comparisons across DLL and non-DLL students; (b) an examination of grit's subscales within these samples; and (c) both teacher- and self-reported grit. Based on the literature above, this dissertation will explore whether reciprocal relations fit better for DLL students than non-DLL students, as there is not enough evidence to hypothesize either way.

Summary. Relations between grit and literacy may vary between demographic groups, and reciprocal models may be more appropriate for some groups than others. It is worth exploring whether reciprocal models fit best for students of different ages, genders, and language backgrounds.

Study Aims and Hypotheses

Recent research suggests that socioemotional skills may have cross-lagged ("reciprocal") relations with achievement, and that socioemotional-achievement relations may vary across demographic groups. To date, two cross-lagged studies have examined grit-achievement relations; one among elementary-aged Chinese students (Jiang et al., 2019), and another among elementary-aged dual language learners in the United States (O'Neal et al., 2018). Both provide support for the use of cross-lagged models in grit research. Recent research also indicates that grit is related to literacy achievement but that

grit's perseverance subscale (grit-PE) may drive these effects (e.g., Credé et al., 2016). My study, therefore, aims to (a) further examine the directionality between grit and literacy; (b) test whether grit-PE drives the effects; and (c) examine whether directionality differs across demographic groups.

A review of the literature suggests that extant research does not answer my study's questions, and this study will build on existing research. The first aim of this study is to examine whether grit-literacy relations are best predicted in the typical unidirectional model (i.e., grit affects literacy) or a reciprocal one (i.e., grit and literacy affect one another at a later point in time). The design of most socioemotional studies – including grit – features a unidirectional model; when studies of similar socioemotional skills allowed for alternative models, a more nuanced picture arose from reverse or cross-lagged models ("reciprocal" relations; Marsh et al., 2017; Hughes et al., 2008; Valentine & DuBois, 2005). Likewise, a recent study including grit found that a cross-lagged model fit better than unidirectional models with low-income dual language learners (O'Neal et al., 2018). The direction of grit-achievement relations has important implications for school psychologists' understanding of the grit construct and future interventions. Although individual-level factors like grit do not resolve system-level challenges in education, they may serve as a protective factor (Hoerr, 2013). It is apparent that these models merit future research, particularly with grit and children's literacy.

In this study, I hypothesize that a cross-lagged model between grit and literacy (Figure 3) will fit better than unidirectional models. Specifically, I anticipate examining a cross-lagged model between literacy and grit's subscales (grit-PE and grit-CI), assuming that confirmatory factor analysis supports a two-correlated factor model in this sample.

By using grit's subscales instead of a single grit factor, I can explore the relative contribution of grit's subscales for literacy achievement. An illustration of this model is provided in Figure 4. In studies that have examined the subscales separately, grit-PE was related with students' achievement but grit-CI was not (Chang, 2014; Credé et al., 2016; Muenks et al., 2017). Other studies suggest psychometric weaknesses in the grit-CI subscale (e.g., low internal reliability; O'Neal et al., *under review*), making it especially important to analyze the subscales separately. I hypothesize that grit-PE and literacy will have relations that are reciprocal, but grit-CI will not.

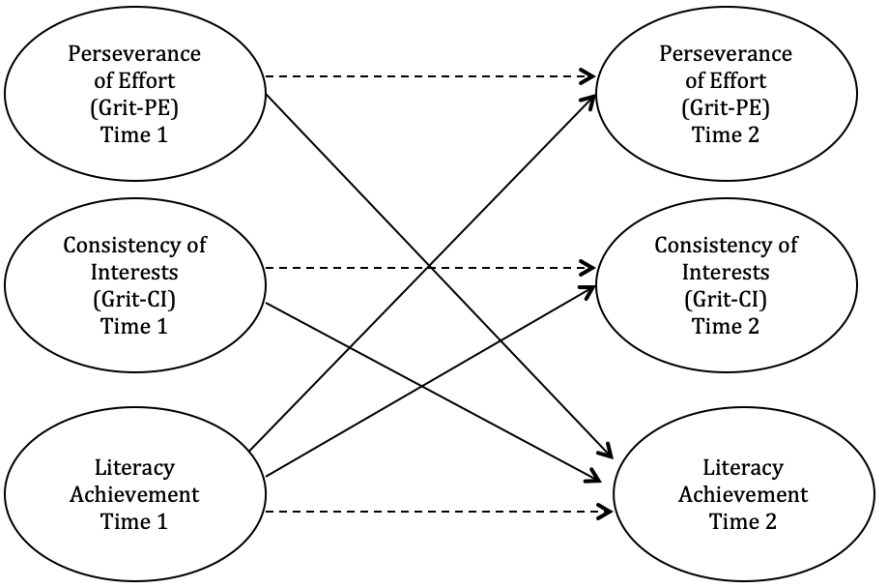

Figure 4. Cross-lagged panel model of grit subscale relations with literacy achievement. All variables at T1 will covary with one another to control for overlap. T2 variables will control for the same variable at T1 (dotted, autoregressive arrows).

The third aim of this study is to explore whether grit-achievement relations function similarly across demographic groups. For research to inform intervention, it is imperative that grit studies reflect the diversity of our students. A few studies have examined grit's functioning between age groups: while mean grit levels are similar, the psychometric strength of grit's subscales and grit's factor structure may vary across

developmental groups (Muenks et al., 2017). The literature is also ambiguous as to whether relations between socioemotional skills and achievement increase (e.g., Wigfield & Karpathian, 1991) or remain the same (Guay et al., 2003) with development. Future grit research must establish consistency between age groups before generalizing findings to students of all ages. Likewise, there is equivocal support for grit differences between genders (Duckworth, 2016). Some research has found gender differences in associations between socioemotional skills and achievement (Duckworth & Seligman, 2006), while others have not (e.g., Hansford & Hattie, 1982). Overall, there is insufficient evidence to hypothesize that there are gender differences. Last but not least, the grit construct may or may not be universally relevant across culturally and linguistically diverse students (Datu et al., 2017; Eskreis Winkler et al., 2014). Grit appears to have stronger relations with achievement among students who are dual langauge learners than for non-dual language learners (Boyars & O'Neal, *in preparation*). To date, however, no research uses a cross-lagged analysis to explore whether grit and literacy are equally relevant across student groups. Model testing between both dual language learners and non-dual language learners is scarce, and grit-literacy relations will be examined for these students.

Chapter 3: Method

Sample

This study included 396 third, fourth, and fifth grade students (Table 2). Students were first recruited from three public elementary schools. Parental consent was sought, and parents provided demographic information on consent forms. At Time 1, grit questionnaires and a literacy test were administered to students. Teachers also completed grit questionnaires on their students. Measures were repeated at Time 2.

In all three schools, participating students' demographics resembled that of the schools' total student body. The total sample was 55% female and an average age of 9.62 years old. Students' ethnicities included 6% Asian, 12% Black, 28% Latino/a, and 40% White students. Fifty-six percent of students spoke a language other than English at home (classified as dual language learners in this study; Park et al., 2018), as reported by both parents and students. Thirty percent of the sample was in third grade, 29% in fourth grade, and 35% in fifth grade. Fifty-two students identified as highly gifted and were enrolled in an enriched instruction program. Although these students scored higher on literacy assessments, they were similar to their peers on other measures.

On consent forms, parents reported gender, race and ethnicity, age, and grade-level demographics. Hypothesis 3 of this study inquires about group differences in grit-literacy reciprocal relations. Thus, it is particularly important to consider demographic confounds. The school district did not give permission to ask about individual participants' family income level or immigration status. However, school-level estimates of free and reduced meal status provide a guideline around socioeconomic status and indicate differences between the schools. The first school was a Title 1 elementary school

serving primarily low-income, dual language families; 95% of the students in the school received free or reduced meals, and the students in this study's sample identified as ethnic minority. Thus, DLL-non-DLL differences from this school might be due to ethnic or socioeconomic rather than dual language differences. The second and third schools did not have the same confounds. About 14% of students received free or reduced meals in each school. Across the latter two schools, which were in a more affluent area, less than 5% of White students, 6% of Latino/a, and 7% of Black students were eligible for free and reduced meals. In the analytic method below, analyses will adjust for ethnic membership and school attended (via classroom clusters), and the description of results will recognize these potential confounds.

Socioemotional skills are measured best through multi-informant report (Fredricks & McColskey, 2012). Family and peers can reliably report on adults' grit (Duckworth & Quinn, 2009); this study included both student- and teacher-reported grit questionnaires. One study using part of this dissertation's sample examined teacher-reported grit (O'Neal et al., *under review*). Psychometrically, it found that teacher-reported grit functioned better than student-reported grit. Correlations between student and teacher report were low-moderate, compared to moderate correlations between adults' self-ratings and ratings from their family and friends (e.g., Duckworth & Quinn, 2009). In the current study, 36 teachers of 3rd, 4th, and 5th grade classes completed questionnaires on their participating students (22% male). Teachers were invited to complete the questionnaires via Qualtrics, and they were compensated for their time. In the analyses section, I describe design-based approaches that I used to adjust for teacher cluster effects, addressing any differences in individual teachers' ratings.

Table 2

Sample Demographics

	Full Sample	
Demographic Variables	*N*	%
Child Sex		
Female	218	55
Not Reported	8	2
Age at Time 1		
8 years	48	12
9 years	134	34
10 years	135	34
11 years	74	19
12 years	1	.2
School		
B.A.[a]	145	35
N.C.C.	122	31
C.C.E.S.	129	33
Gifted Program		
Enrolled	52	13
Admin. Format		
Group	46	12
Grade Level		
3rd	124	31
4th	121	31
5th	145	36
Race and Ethnicity		
Asian	25	6
Black	45	11
Latina/o	114	29
Multiracial	33	8
Native American	1	.2
Not Reported	14	4
Other	2	.5
White	156	39
Language Status[b]		
DLL	235	59
Not Reported	1	.2

Total n = 396. [a]B.A. is a 95% Title 1 school that primarily serves dual language learners (DLL). [b]Children were coded as DLL if the child spoke another language with at least one parent (Park, Zong, & Batalova, 2018).

Procedures

Recruitment and study procedures were in compliance with our university's Internal Review Board as well as the school district's Office of Shared Accountability. This short-term, longitudinal study used data from the first and last time points of a three-time-point study. These time points were selected because they contained the least overlap between waves and had the largest numbers of participants. Student- and teacher-reported grit and literacy achievement were collected at both time points. Teacher reports were collected soon after student reports were completed. At the first school, Time 1 was collected from January to mid-March 2014, and Time 2 from May to mid-June 2014. In schools 2 and 3, Time 1 data was collected from late February to May 2015, and Time 2 data was collected from late May through mid-June 2015.

Graduate research assistants read questionnaire items out loud one-on-one or in small groups to participating students. In one-on-one administration, students followed along on a printout of the questionnaires and pointed to or said their response. In small groups, students circled their response and indicated if they had questions. The close attention afforded by these administration styles allowed us to best judge whether students, especially the dual language students, comprehended the questionnaire items and to provide explanation if needed. Afterward, students completed a three-minute literacy achievement performance task that included one-on-one instructions from a graduate assistant. Students with limited English language skills (n = 6) were interviewed by Spanish-speaking researchers; one French-speaking student was interviewed by a French-speaking researcher. The reading task was administered in English regardless of language proficiency.

Using Qualtrics, the teachers completed online questionnaires on students' grit. The teacher items paralleled those of the students, with identical wording except for the pronoun (a.k.a., "*The student*…" was used to introduce items instead of the pronoun "*I*...").

Measures

Grit-S. Student- and teacher-reported grit was assessed with an adapted eight-item Short Grit Scale (Grit-S; Duckworth & Quinn, 2009). The original Grit-S was a self-report measure designed for older students or adults. Our lab adapted the Grit-S scale item vocabulary and phrasing to improve comprehension of the Grit-S scale for a younger, limited English proficiency sample, with a focus on the school setting (see Table 1). For instance, the original item "I have difficulty maintaining my focus on projects that take more than a few months to complete" was adapted to "It's hard to focus on school work that takes a long time to complete." Similar adaptations were used in other publications on students' grit (e.g., Eskreis-Winkler et al., 2014, also adapted grit items for middle and high school students). See Table 1 for a comparison between the original Grit-S items and all our adapted items. Past grit research reveals convergent validity with related measures (Duckworth & Quinn, 2009), and adequate reliability (α = .72 - .82) among elementary-aged dual language learners and 7-12 year olds in the National Spelling Bee (Duckworth et al., 2011; O'Neal, 2017). Mean scores have ranged from 3.44 (.78) to 3.81 (.68) for these students. The reliability of grit subscales has also been examined (α = .67 - .90) among high school students (Eskreis-Winkler et al., 2014; Muenks et al., 2017), with a mean of 2.91 (.71) for grit-CI and 3.69 (.58) for grit-PE

(Muenks et al., 2017). In this study, CFA testing will help determine whether to use one grit-factor or sub-factors of grit (grit-PE and grit-CI).

Teacher questionnaires were identical to those used with students, except they were changed from first to third person (e.g., "The student gets very interested in a new topic in school but then quickly gets bored with it.") In past research with part of this study's sample, teacher-reported grit has shown good internal consistency ($\alpha = .92$ at both time points).

TOSREC. Test of Silent Reading Efficiency and Comprehension (TOSREC) is a well-established measure that was used to assess literacy achievement for this study's sample (Wagner, Torgesen, Rashotte, & Pearson, 2010). It is an achievement performance task testing students' silent reading decoding (accuracy), fluency (speed), and comprehension. Students had three minutes to read as many sentences as possible and decide if each was true or false (e.g., "All pickles are pink."). Scores were calculated by first summing the correct items, and then subtracting the number of incorrect items. Incorrect items were scored as -1 to correct for guessing. Raw scores were translated to percentile ranks and index scores ($M = 100$, $SD = 15$). The TOSREC has strong psychometric properties, including moderate to strong correlations with similar measures like the WJ-III Oral Comprehension ($r = .51$; Wagner et al., 2010), WJ-III Passage Comprehension ($r = .69$), and the *Dynamic Indicators of Basic Early Literacy Skills (DIBELS)* Oral Reading Fluency (ORF; $r = .81$; Kim, Wagner, & Foster, 2011). Across all grade levels, reliability coefficients exceed .85 (Wagner et al., 2010).

Demographic variables.

Age. Parents indicated their child's age on the consent form. For the purposes of model comparisons, a dichotomous variable was created. Students were classified as younger (8-9 years) or older (10-11).

Gender. Parents indicated their child's gender on the consent form. A dichotomous variable of female and male students was used.

Language status. Children who only used English with parents were classified as monolingual. Children were coded as bilingual/dual language learners (DLL) if they used another language with parents (Park et al., 2018). This study's DLL participants were more ethnically diverse than their non-DLL counterparts. Note that all of the students in School 1 were DLL and low-income. Schools 2 and 3 were only a minority DLL (35%). Model testing adjusted for ethnic affiliation and school membership (via classroom clusters).

Analytic Approach

SPSS Version 24 (SPSS Inc., 2017) and Mplus Version 8.1 software (Muthen & Muthen, 2018) were used for analyses. Preliminary descriptive statistics were generated for grit and its subscales (e.g., mean, standard deviation, and Cronbach's alpha coefficient) to examine the data's soundness and its agreement with previous research. Due to attrition, 54 participants were lost between Time 1 and Time 2. Because the dataset is known to have missing data, I used a restricted maximum likelihood robust standard error estimation approach (i.e., MLR) in Mplus, which can manage missing and non-normal data (Muthen & Muthen, 2018). Using a design-based approach (Hancock, 2018), I also adjusted for cluster sampling between classrooms.

Hypotheses 1 and 2. I hypothesized that there are cross-lagged effects between grit and literacy for the full sample, and that these effects will be driven by grit-PE. Before addressing these hypotheses, I first needed to determine grit's structure via confirmatory factor analyses (CFA). As a two-correlated factor model was supported, I used the interest items as indicators of grit-CI, and the effort items as indicators of grit-PE. These items were used to create two latent grit subscale variables to investigate reciprocal relations. Initially, teacher-student items were both set to load onto the same latent factor (see Figure 5 for illustration). Due to inadequate model fit, teacher- and student-reported data were ultimately examined separately as single-rater factors (Figure 6). I also adjusted for cluster effects between teachers. Similarly worded student- and teacher-items were correlated within time points. Last, I completed the CFA at Time 2 to cross-validate my results. I then examined the data for temporal invariance to ensure the model held across time. This last step was important because change over time can only be tested if the latent variables in the model are conceptualized in the same way across time points (Bialosiewicz, Murphy, & Berry, 2013; Byrne, 2011).

I then examined the temporal relations between grit and literacy. Figure 5 depicts path diagrams of the initial models that I planned to test. These models aimed to identify the relations between grit and literacy across the two time points. Specifically, I used an autoregressive cross-lagged design, which is useful for research into the directionality of one variable's effect on another, and for investigating for whom the effect occurs (Selig & Little, 2012). To examine cross-lagged effects, I tested if there were differences in model fit of an autoregressive, cross-lagged panel model (including latent grit affecting literacy achievement, and vice-versa) with (a) a nested, directional model in which grit

affects literacy, and (b) a nested, reverse model in which literacy affects grit (see Figure 5 below for a schematic of this approach in the initial model). I used maximum likelihood estimation with robust standard errors (MLR; Muthen & Muthen, 2018) due to missing data in my sample. The TOSREC total score (index) was used as an observed indicator of literacy achievement. The structural equation models controlled for age, gender, ethnic minority status (White vs. non-White), school, gifted track, group vs. individual administration, and all exogenous variables were allowed to covary. CFA results, described in the Results section below, suggested a modified version of this model that I used in the final analyses (see Results, Figure 6)

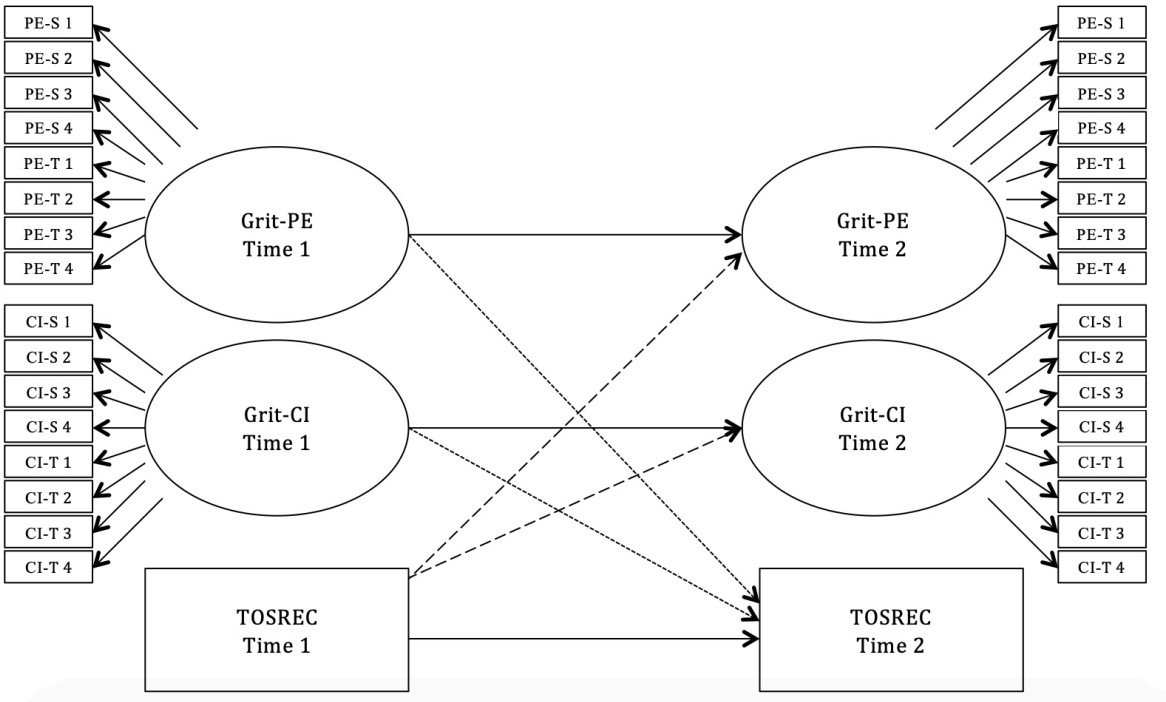

Figure 5. Initial, autoregressive cross-lagged reciprocal model (Model A; dotted and dashed lines) with paths between grit subscales (grit-persistence and grit-CI) and TOSREC, versus Directional Model (Model B1; dotted lines), and Reverse Model (Model B2; dashed lines). In this initial model, latent subscale factors were derived from both student-reported and teacher-reported items (E.g., PE-S and PE-T). Parallel student-teacher items at T1 were set to covary with each other, as were parallel items between T1 and T2.

Evaluation of model fit was guided using several fit indices (Byrne, 2012; Hu & Bentler, 1999): χ^2 goodness-of-fit value, comparative fit index (CFI; .90 or greater for acceptable fit), "misfit" indices including standardized root mean square residual (SRMR; less than .08 for acceptable fit and <.05 for good fit) and root mean square error of approximation (RMSEA; less than .06 for good fit), and Akaike Information Criterion (AIC). Model fit was adequate and modifications were not deemed necessary. Lastly, comparative model fit for the competing models (i.e., direct and reverse) was investigated using a Satorra-Bentler scaled chi-square difference test, which is appropriate for models using MLR (Satorra & Bentler, 2010; Nguyen, n.d.).

Hypothesis 3. I used multi-group structural equation modeling approaches to examine whether the overall cross-lagged model fit each subgroup equally well. Due to constraints of sample size, I completed multi-group analyses via dichotomous variables for age, gender, and dual language learner status, controlling for ethnic membership. My ultimate goal was to assess equality of the path estimates in the cross-lagged model. As a preliminary step, however, measurement invariance between subgroups was examined to ensure that the same underlying construct (grit) was being measured across students (Bialosiewicz et al., 2013; Byrne, 2012). This was accomplished by comparing increasingly restricted models (i.e., configural and metric models) to ensure similarity of factor loadings.

Once this requirement was met for all groups, I then tested whether the strength of relations between grit and literacy varied between subgroups (male and female; DLL and non-DLL; younger and older). If the model exhibited adequate fit to the data, I would test

overall structural invariance by running constrained and unconstrained models for each dichotomous group. A comparison of these models would indicate whether model fit improved significantly when the path estimates were free to vary between subgroups (i.e., in the unconstrained model), suggesting multi-group differences. Due to this study's use of MLR, a Satorra-Bentler scaled chi-square difference test (TRd) was used to calculate the change in model fit (Nguyen, n.d.; Satorra & Bentler, 2010). Lastly, if the change in overall model fit was significant, post-hoc analyses would be conducted to determine which paths differed across groups.

Chapter 4: Results

Descriptive Statistics

Table 3 provides the means, standard deviations, and alpha coefficients for the variables of interest, for the full sample (Table 3a) and by subgroup (Table 3b). Mean grit-PE and grit-CI scores appeared somewhat higher in this sample compared to a sample of high school students (*M*Grit-CI = 2.91 and *M*Grit-PE = 3.69; Muenks et al., 2017). Internal reliability coefficients for teacher-reported grit were consistently high. Internal reliability coefficients for student-reported grit were generally adequate, with a few exceptions flagged in Table 3. Of note, however, this study's use of latent variables make lower alpha coefficients less of a concern (Hancock, 2018).

Summary scores and t-tests were calculated in SPSS. Teachers rated girls higher than boys in Grit-PE ($t(334.81) = -4.39$, $p < .001$ at Time 1; $t(324.64) = -5.02$, $p < .001$ at Time 2) as well as Grit-CI ($t(332.02) = -5.45$, $p < .001$ at Time 1; $t(306.12) = -5.87$, $p < .001$ at Time 2). For student ratings, there was only a difference in Grit-CI at Time 2 ($t(348) = -2.23$, $p < .05$) with girls rating themselves higher than boys.

At both time points, non-DLL students rated their Grit-PE significantly higher than their DLL peers did ($t(382.18) = 3.27$, $p < .01$ at Time 1; $t(344.57) = 2.81$, $p < .01$ at Time 2). There were no differences in teacher ratings between non-DLL and DLL students. The dichotomous control variable of race and ethnicity was also explored. White students rated themselves higher in Grit-PE than non-White students at Time 1 ($t(362.67) = 2.66$, $p < .01$) and also Time 2 ($t(317.92) = 2.15$, $p < .05$); teachers did the same at Time 2 ($t(347.40) = 2.10$, $p < .05$). This is consistent with research suggesting that teachers may have lower expectations and ratings for ethnic minority students (e.g.,

meta-analyses by Tenenbaum & Ruck, 2007) and that students are at risk of adopting these mindsets, especially when racial identity development is not prioritized (Grantham & Ford, 2003).

For other variables, mean subgroup differences were statistically non-significant. Comparisons were done between the two schools in an affluent area with the third, Title 1 school that serves low-income, DLL families. This was done to assess any overarching differences in these sources for the study's sample. (Later SEM analyses achieve a similar goal by accounting for classroom clusters.) There were no differences in grit ratings between schools, with the exception of Time 2 student-reported Grit-PE ($t(260.03) = 2.96$, $p < .05$), with students at the more schools in a more affluent area rating themselves slightly higher. There were no mean differences between age groups (older vs. younger), or the control variable of Interview Format (those interviewed individually vs. in groups). Students' participation in a Highly Gifted Program served as an additional control variable because of potential associations with study outcomes. Compared to the other students, those enrolled in a Highly Gifted Program rated themselves higher in Time 1 Grit-PE ($t(91.36) = -2.59$, $p < .05$), and teachers rated the Highly Gifted students higher in Time 2 Grit-PE ($t(81.77) = -2.17$, $p < .05$) compared to how teachers rated other students across all three schools.

On the TOSREC literacy outcome, there were no mean differences by age. There was a slight gender difference, with girls earning a higher score than boys at Time 2 ($t(336) = -2.20$, $p < .05$). There was a substantial literacy achievement gap between DLL and non-DLL students at both time points ($t(382) = 10.91$, $p < .001$ at Time 1; $t(332) = 11.07$, $p < .001$ at Time 2), with non-DLL students scoring higher. Likewise, there was an

achievement gap between ethnic groups at both time points ($t(375) = 11.06$, $p < .001$ at Time 1; $t(324) = 10.22$, $p < .001$), with White students scoring higher on the TOSREC than non-White students. Similar trends occurred when comparing the Title 1 school to the two schools located in a more affluent area, with students in the latter schools earning markedly higher TOSREC scores ($t(382) = 16.20$, $p < .001$ at Time 1; $t(331.87) = 17.00$, $p < .001$ at Time 2). Students in the Highly Gifted Program earned a higher TOSREC score than their peers at both time points ($t(89.21) = -14.41$, $p < .001$ at Time 1; $t(113) = -19.32$, $p < .001$ at Time 2). Students interviewed in groups also earned a higher score than those interviewed individually ($t(67.60) = -2.34$, $p < .05$ at Time 1; $t(14.67) = -4.89$, $p < .001$ at Time 2), but in reality this finding reflects school differences. (All students at the third, Title 1 school were administered the TOSREC individually.)

Table 3a:

Descriptive Statistics of Summary Scores (Total Sample)

Measures	*M (SD)*	*α*	Range
1. Grit Time 1 – Student Rating	3.86 (.58)	**.69**	2.00 – 5.00
Grit-CI subscale	3.58 (.77)	.56	1.50 – 5.00
Grit-PE subscale	4.13 (.68)	**.72**	1.75 – 5.00
2. Grit Time 1– Teacher Rating	3.97 (.89)	**.92**	1.00 – 5.00
Grit-CI subscale	3.87 (.91)	**.82**	1.00 – 5.00
Grit-PE subscale	4.06 (.97)	**.91**	1.00 – 5.00
3. Grit Time 2 – Student Rating	3.90 (.56)	**.74**	2.25 – 5.00
Grit-CI subscale	3.54 (.75)	**.69**	1.25 – 5.00
Grit-PE subscale	4.17 (.92)	**.68**	1.00 – 5.00
4. Grit Time 2– Teacher Rating	4.01 (.87)	**.93**	1.50 – 5.00
Grit-CI subscale	3.97 (.90)	**.83**	1.00 – 5.00
Grit-PE subscale	4.17 (.92)	**.93**	1.00 – 5.00
5. TOSREC standard index scores T1	101.38 (21.53)	--	55 – 146
6. TOSREC standard index scores T2	103.49 (21.66)	--	55 – 146

Note. Alpha coefficients in bold demonstrate acceptable internal reliability of .65 or higher (DeVellis, 2016). TOSREC = Test of Silent Reading Efficiency and Comprehension (Wagner, Torgesen, Rashotte, & Pearson, 2010). Alpha listwise $N = 412$.

Table 3b:

Descriptive Statistics among Subgroups

Language (DLL and non-DLL)				
Measures	*DLL M (SD)*	*DLL α*	*Non-DLL M (SD)*	*Non-DLL α*
1. Grit Time 1 – Student Rating	3.81 (.62)	**.69**	3.91 (.55)	**.70**
Grit-CI subscale	3.90 (.93)	.56	3.56 (.74)	.57
Grit-PE subscale	4.04 (.74)	**.72**	4.25 (.57)	**.71**
2. Grit Time 1– Teacher Rating	3.94 (.91)	**.92**	3.99 (.87)	**.92**
Grit-CI subscale	3.90 (.93)	**.84**	3.85 (.89)	**.81**
Grit-PE subscale	3.98 (.99)	**.91**	4.15 (.93)	**.91**
3. Grit Time 2 – Student Rating	3.85 (.57)	**.71**	3.97 (.55)	**.78**
Grit-CI subscale	3.51 (.78)	**.71**	3.58 (.73)	**.66**
Grit-PE subscale	4.18 (.63)	.64	3.55 (.53)	**.74**
4. Grit Time 2– Teacher Rating	4.01 (.91)	**.93**	4.18 (.78)	**.93**
Grit-CI subscale	3.94 (.92)	**.83**	4.05 (.83)	**.83**
Grit-PE subscale	4.09 (.99)	**.94**	4.30 (.80)	**.91**
5. TOSREC standard index scores T1	91.71 (20.82)	--	112.58 (16.31)	--
6. TOSREC standard index scores T2	93.18 (18.95)	--	115.79 (18.05)	--
Gender (Male and Female)				
Measures	*Male M (SD)*	*Male α*	*Female M (SD)*	*Female α*
1. Grit Time 1 – Student Rating	3.79 (.57)	**.65**	3.91 (.59)	**.72**
Grit-CI subscale	3.49 (.74)	.49	3.64 (.79)	.61
Grit-PE subscale	4.08 (.71)	**.76**	4.18 (.64)	**.69**
2. Grit Time 1– Teacher Rating	3.71 (.94)	**.92**	4.17 (.78)	**.92**
Grit-CI subscale	3.60 (.97)	**.81**	4.10 (.80)	**.81**
Grit-PE subscale	3.82 (1.04)	**.91**	4.25 (.87)	**.91**
3. Grit Time 2 – Student Rating	3.82 (.55)	**.71**	3.96 (.56)	**.75**
Grit-CI subscale	3.44 (.77)	**.70**	3.62 (.73)	**.67**
Grit-PE subscale	4.20 (.60)	**.67**	4.30 (.58)	**.69**
4. Grit Time 2– Teacher Rating	3.81 (.93)	**.93**	4.30 (.72)	**.92**
Grit-CI subscale	3.70 (.97)	**.84**	4.22 (.73)	**.79**
Grit-PE subscale	3.92 (.98)	**.91**	4.39 (.80)	**.94**
5. TOSREC standard index scores T1	98.98 (20.62)	--	103.27 (22.09)	--
6. TOSREC standard index scores T2	100.50 (20.89)	--	105.71 (21.99)	--
Age (Younger and Older)				
Measures	*Younger M (SD)*	*Younger α*	*Older M (SD)*	*Older α*
1. Grit Time 1 – Student Rating	3.82 (.62)	**.71**	3.89 (.56)	**.68**
Grit-CI subscale	3.51 (.82)	.62	3.63 (.71)	.48
Grit-PE subscale	4.14 (.68)	**.69**	4.14 (.66)	**.74**
2. Grit Time 1– Teacher Rating	4.09 (.76)	**.89**	3.86 (.98)	**.94**
Grit-CI subscale	3.96 (83)	**.79**	3.80 (.98)	**.84**
Grit-PE subscale	4.22 (.81)	**.86**	3.92 (1.07)	**.93**
3. Grit Time 2 – Student Rating	3.90 (.56)	**.70**	3.89 (.57)	**.78**
Grit-CI subscale	3.12 (.79)	**.69**	3.55 (.73)	**.70**

Grit-PE subscale	4.29 (.60)	**.67**	4.23 (.59)	**.71**
4. Grit Time 2– Teacher Rating	4.17 (.74)	**.92**	4.02 (.94)	**.93**
Grit-CI subscale	4.08 (.77)	**.81**	3.92 (.97)	**.84**
Grit-PE subscale	4.26 (.78)	**.92**	4.13 (1.00)	**.93**
5. TOSREC standard index scores T1	101.24 (16.50)	--	101.84 (25.07)	--
6. TOSREC standard index scores T2	100.92 (17.53)	--	105.64 (24.61)	--

Note. Bolded alpha coefficients meet an acceptable level of internal reliability of .65 or higher (DeVellis, 2003). TOSREC = Test of Silent Reading Efficiency and Comprehension (Wagner, Torgesen, Rashotte, & Pearson, 2010). DLL Alpha listwise $N = 214$, Non-DLL Alpha listwise $N = 183$; Male Alpha listwise $N = 177$, Female Alpha listwise $N = 226$; Younger Alpha listwise $N = 181$, Older Alpha listwise $N = 210$.
* = significant difference between means, $p < .05$

Correlations. Tables 4 and 5 include correlation matrices for the full sample and by subgroup. Student-reported grit-CI and grit-PE were moderately correlated; in contrast, teacher-reported grit-CI and grit-PE were strongly correlated. TOSREC scores were relatively consistent between time points, as indicated by their high correlations. At Time 1, grit-PE generally showed stronger correlations with TOSREC scores than grit-CI did. This pattern at Time 1 was observed across most subgroups. It was especially noticeable among some, such as males. For the full sample at Time 2, differences between grit-PE and grit-CI's correlations with TOSREC were less noteworthy, and TOSREC correlations with grit subscales were all significant.

A few subgroups diverged from the general trends observed among the full sample. Specifically among non-DLL students, neither student-reported grit-PE nor grit-CI were correlated with TOSREC at Time 1, but teacher-reported grit-PE and grit-CI were. Among DLL students, however, both student- and teacher-reported grit-PE were significantly correlated with TOSREC at Time 1, but grit-CI was not. For older students, correlations between TOSREC scores and grit were relatively consistent, but for younger students, significant correlations and were few and small in magnitude. Of note, participation in a Highly Gifted Program held moderate-large correlations with TOSREC scores at both time points.

Table 4:

Correlation Matrix for Full Sample

Measure	1	2	3	4	5	6	7	8	9	10	11	12	13	14
							Full Sample							
1. Grit T1 (Student)	--	.34***	.79***	.37***	.84***	.27***	.19***	.53***	.31***	.57***	.32***	.44***	.28***	.21***
2. Grit T1 (Teacher)		--	.34***	.95***	.23***	.94***	.18***	.31***	.81***	.37***	.81***	.17***	.74***	.18***
3. Grit-PE T1 (Student)			--	.37***	.33***	.26***	.29***	.46***	.30***	.58***	.31***	.23***	.26***	.26***
4. Grit-PE T1 (Teacher)				--	.24***	.79***	.22***	.32***	.78***	.39***	.81***	.17***	.67***	.24***
5. Grit-CI T1 (Student)					--	.19***	.09	.51***	.22***	.37***	.22***	.48***	.20***	.09
6. Grit-CI T1 (Teacher)						--	.12*	.27***	.76***	.31***	.71**	.13***	.74***	.10
7. TOSREC Time 1							--	.21***	.24***	.26***	.25***	.12*	.21***	.89***
8. Grit T2 (Student)								--	.29***	.79***	.27***	.88***	.28***	.25***
9. Grit T2 (Teacher)									--	.35***	.96***	.15**	.95***	.23***
10. Grit-PE T2 (Student)										--	.36***	.39***	.32***	.26***
11. Grit-PE T2 (Teacher)											--	.13*	.83***	.25***
12. Grit-CI T2 (Student)												--	.16**	.17***
13. Grit-CI T2 (Teacher)													--	.19***
14. TOSREC T2														--
15. Non-White	-.08	-.04	-.13*	-.09	-.00	.01	-.47***	-.13*	-.08	-.11*	-.11*	-.10	-.04	-.49***
16. Highly Gifted	.06	.03	.10	.04	.00	.02	.47***	.06	.11*	.05	.09	.06	.13*	.59***
17. Group Administration	.03	-.07	.02	-.05	.02	-.08	.09	-.01	-.08	.02	-.07	-.03	-.09	.14*
19. Older	.09	-.12*	.07	-.13**	.07	-.10	-.03	.03	-.12*	-.01	-.10	.05	-.13*	.06
20. DLL	-.08	-.04	-.16**	-.09	.02	.02	-.49***	-.11*	-.09	-.15**	-.12*	-.05	-.06	-.52***
21. Female	.10*	.26***	.08	.22***	.10	.27***	.10	.13*	.29***	.09	.25***	.12*	.30***	.12*

Table 5:

Correlation Matrix by Subgroup

Measure	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Dual Language Learners														
1. Grit T1 (Student)	--	.27***	.80***	.32***	.82***	.18*	.21**	.53***	.28***	.53***	.30***	.35***	.23***	.21**
2. Grit T1 (Teacher)		--	.33***	.95***	.11	.94***	.17*	.21***	.83***	.30***	.83***	.06	.75***	.16*
3. Grit-PE T1 (Student)			--	.36***	.30***	.25***	.26***	.40***	.30***	.54***	.32***	.15*	.26***	.26***
4. Grit-PE T1 (Teacher)				--	.16*	.77***	.20**	.23**	.79***	.31***	.83***	.07	.68***	.20**
5. Grit-CI T1 (Student)					--	.05	.09	.46***	.17*	.34***	.18**	.41***	.13	.09
6. Grit-CI T1 (Teacher)						--	.13	.17*	.76***	.26***	.73***	.03	.73***	.09
7. TOSREC Time 1							--	.21**	.21**	.29***	.21**	.08	.19**	.86***
8. Grit T2 (Student)								--	.25***	.75***	.22**	.85***	.24***	.26***
9. Grit T2 (Teacher)									--	.33***	.96***	.09	.95***	.14
10. Grit-PE T2 (Student)										--	.32**	.30***	.31***	.27***
11. Grit-PE T2 (Teacher)											--	.07	.81***	.15*
12. Grit-CI T2 (Student)												--	.10	.16*
13. Grit-CI T2 (Teacher)													--	.12
14. TOSREC T2														--
15. Non-White	-.07	-.02	-.04	-.00	-.08	-.03	-.37***	-.10	-.00	-.01	.01	-.14	-.02	-.41***
16. Highly Gifted	.05	.10	.11	.10	-.02	.10	.42***	.04	.10	.07	.08	-.01	.12	.58***
17. Group Admin.	.08	-.14*	.00	-.10	.12	-.16*	.12	--	-.16*	--	-.16*	--	-.15*	--
19. Older	-.06	-.22**	-.06	-.23**	-.03	-.18**	-.08	-.14	-.21**	-.12	-.15*	-.10	-.26***	.03
21. Female	.05	.23**	.07	.21**	.02	.22**	.07	.03	.26***	.05	.23**	.01	.27***	.13
Measure	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Non-Dual Language Learners														
1. Grit T1 (Student)	--	.43***	.79***	.42***	.88***	.40***	.14	.68***	.34***	.62***	.32***	.58***	.33***	.16
2. Grit T1 (Teacher)		--	.36**	.96***	.37***	.95***	.24***	.44***	.79***	.47***	.78***	.32***	.74***	.23**
3. Grit-PE T1 (Student)			--	.36***	.39***	.31***	.08	.54***	.26***	.63***	.26***	.36***	.24**	.15
4. Grit-PE T1 (Teacher)				--	.35***	.82***	.24***	.43***	.74***	.48***	.78***	.30***	.65***	.25***
5. Grit-CI T1 (Student)					--	.36***	.15	.59***	.31***	.44***	.29***	.58***	.31***	.11
6. Grit-CI T1 (Teacher)						--	.21**	.41***	.76***	.41***	.71***	.31***	.75***	.20*
7. TOSREC Time 1							--	.17*	.27***	.13	.27***	.17*	.25***	.84***
8. Grit T2 (Student)								--	.34***	.83***	.33***	.91***	.32***	.17*
9. Grit T2 (Teacher)									--	.36***	.96***	.24**	.96***	.30***
10. Grit-PE T2 (Student)										--	.38***	.53***	.32***	.12
11. Grit-PE T2 (Teacher)											--	.21**	.84***	.31***
12. Grit-CI T2 (Student)												--	.24**	.17*

13. Grit-CI T2 (Teacher)													--	.27***
14. TOSREC T2														--
15. Non-White	.00	-.02	-.04	-.07	.04	.03	-.17*	-.05	-.05	-.04	-.10	-.04	-.00	-.13
16. Highly Gifted	.04	-.03	.03	-.03	.03	-.03	.49***	.05	.10	-.04	.06	.10	.12	.59**
17. Group Admin.	-.05	-.03	-.01	-.03	-.07	-.02	-.06	-.10	-.04	-.04	-.02	-.12	-.05	.02
19. Older	.19*	-.03	.05	-.08	.23**	.03	.04	.14	.07	.05	.02	.18*	.12	.13
21. Female	.18*	.31***	.09	.25**	.20**	.34***	.19**	.25**	.35***	.16	.37**	.27**	.36**	.15
Measure	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Females														
1. Grit T1 (Student)	--	.35***	.80***	.40***	.87***	.24***	.24***	.63***	.35***	.58***	.35***	.50***	.32***	.26***
2. Grit T1 (Teacher)		--	.36***	.95***	.23***	.93***	.15*	.30***	.80***	.34***	.80***	.18*	.71***	.18*
3. Grit-PE T1 (Student)			--	.40***	.40***	.27***	.25***	.50***	.35***	.58***	.33***	.30***	.33***	.28***
4. Grit-PE T1 (Teacher)				--	.28***	.77***	.18**	.34***	.76***	.36***	.80***	.22**	.64***	.22**
5. Grit-CI T1 (Student)					--	.15*	.16*	.56***	.27***	.42***	.27***	.52***	.23**	.17*
6. Grit-CI T1 (Teacher)						--	.11	.22**	.74***	.27***	.70***	.11	.71***	.11
7. TOSREC Time 1							--	.27***	.22***	.28***	.20**	.19**	.21**	.89***
8. Grit T2 (Student)								--	.34***	.81***	.35***	.89***	.30***	.33***
9. Grit T2 (Teacher)									--	.37***	.95***	.23***	.94***	.24**
10. Grit-PE T2 (Student)										--	.37***	.46***	.33***	.30***
11. Grit-PE T2 (Teacher)											--	.24**	.79***	.24**
12. Grit-CI T2 (Student)												--	.19**	.27***
13. Grit-CI T2 (Teacher)													--	.22**
14. TOSREC T2														--
15. Non-White	-.13	-.06	-.12	-.10	-.09	-.01	-.45***	-.15*	-.08	-.10	-.11	-.16*	-.03	-.46***
16. Highly Gifted	.08	.09	.09	.09	.04	.07	.52***	.10	.18**	.10	.15*	.07	.19**	.61***
17. Group Admin.	.02	-.11	.02	-.11	.00	-.11	.08	-.05	-.18**	-.05	-.17*	-.04	-.17*	.10
19. Older	.11	.04	.08	.03	.09	.05	.11	.03	.04	.03	.07	.03	-.00	.24**
20. DLL	-.13	-.08	-.17*	-.12	-.06	-.04	-.51***	-.20**	-.14*	-.19**	-.16*	-.16*	-.10	-.52***
Measure	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Males														
1. Grit T1 (Student)	--	.30***	.78***	.30***	.79***	.26***	.11	.53***	.25***	.54***	.26***	.35***	.21***	.11
2. Grit T1 (Teacher)		--	.29***	.95***	.18*	.94***	.16*	.29***	.80***	.38***	.79***	.11	.74***	.13
3. Grit-PE T1 (Student)			--	.32***	.24**	.23**	.22**	.41***	.24**	.57***	.28***	.15	.18*	.22**
4. Grit-PE T1 (Teacher)				--	.16*	.79***	.23**	.27***	.77***	.39***	.81***	.08	.66***	.23**
5. Grit-CI T1 (Student)					--	.18*	-.04	.44***	.15*	.29***	.14	.40***	.15*	-.05
6. Grit-CI T1 (Teacher)						--	.08	.27***	.74***	.32***	.68***	.14	.73***	.02
7. TOSREC Time 1							--	.10	.23***	.21*	.28***	-.01	.17*	.89***
8. Grit T2 (Student)								--	.20*	.75***	.17*	.86***	.23***	.12
9. Grit T2 (Teacher)									--	.33***	.96***	.03	.96***	.17*
10. Grit-PE T2 (Student)										--	.33***	.29***	.30***	.19*

11. Grit-PE T2 (Teacher)											--	-.03	.82***	.21*
12. Grit-CI T2 (Student)												--	.09	.02
13. Grit-CI T2 (Teacher)													--	.12
14. TOSREC T2														--
15. Non-White	-.01	-.00	-.14	-.06	.12	.05	-.50***	-.08	-.07	-.13	-.10	-.02	-.04	-.54***
16. Highly Gifted	.01	-.07	.09	-.05	-.08	-.09	.39***	.00	.02	-.04	.00	.03	.03	.56***
17. Group Admin.	.05	-.03	.02	.01	.05	-.07	.11	.03	.00	.11	.03	-.04	-.02	.19*
19. Older	-.02	-.32***	-.11	-.35***	.07	-.24**	-.13	-.06	-.22**	-.13	-.23**	.01	-.19*	-.10
20. DLL	-.03	-.01	-.16*	-.08	.12	.07	-.47***	.01	-.07	-.10	-.10	.09	-.03	-.54***
Measure	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Younger (8-9 Years)														
1. Grit T1 (Student)	--	.32***	.78***	.35***	.86***	.24**	.05	.57***	.32***	.55***	.31***	.40***	.30***	.05
2. Grit T1 (Teacher)		--	.32***	.92***	.21**	.93***	.10	.18*	.74***	.21***	.72***	.09	.70***	.05
3. Grit-PE T1 (Student)			--	.36***	.35***	.23**	.15	.46***	.31***	.58***	.33***	.22**	.26***	.12
4. Grit-PE T1 (Teacher)				--	.23**	.70***	.16*	.19*	.67***	.23**	.69***	.09	.59***	.14
5. Grit-CI T1 (Student)					--	.17*	-.01	.50***	.24**	.37***	.20**	.43***	.25***	-.03
6. Grit-CI T1 (Teacher)						--	.03	.14	.70***	.15	.63***	.08	.71***	-.05
7. TOSREC Time 1							--	.16*	.11	.23**	.17*	.05	.05	.84***
8. Grit T2 (Student)								--	.23**	.74***	.23**	.86***	.20*	.17*
9. Grit T2 (Teacher)									--	.27***	.95***	.11	.95***	.08
10. Grit-PE T2 (Student)										--	.28***	.28***	.23**	.20*
11. Grit-PE T2 (Teacher)											--	.11	.82***	.15
12. Grit-CI T2 (Student)												--	.11	.10
13. Grit-CI T2 (Teacher)													--	.00
14. TOSREC T2														--
15. Non-White	.11	.11	.04	.06	.13	.14	-.43***	-.00	.10	-.01	.00	.00	.18*	-.36***
16. Highly Gifted	-.05	-.01	.04	.00	-.10	-.06	.22**	.02	.06	.03	.07	.00	.05	.39***
17. Group Admin.	-.03	-.08	-.05	-.06	.00	-.09	.14	-.08	-.12	-.05	-.10	-.07	-.12	.20*
20. DLL	.04	.07	-.11	-.02	.15*	.15	-.56***	.03	.07	-.06	-.03	.09	.16*	-.57***
21. Female	.03	.08	-.03	.01	.07	.13	-.03	.08	.18*	.01	.12	.11	.23**	-.08
Measure	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Older (10-11 Years)														
1. Grit T1 (Student)	--	.37***	.81***	.40***	.83***	.31***	.30***	.64***	.31***	.62***	.33***	.51***	.27***	.33***
2. Grit T1 (Teacher)		--	.37***	.96***	.26***	.95***	.22**	.40***	.84***	.48***	.85***	.24**	.76***	.27***
3. Grit-PE T1 (Student)			--	.40***	.35***	.30***	.32***	.50***	.30***	.62***	.30***	.29***	.27***	.35***
4. Grit-PE T1 (Teacher)				--	.28***	.83***	.25***	.41***	.82***	.49***	.86***	.24***	.70***	.31***
5. Grit-CI T1 (Student)					--	.21**	.18*	.55***	.22**	.39***	.24***	.54***	.17*	.19*
6. Grit-CI T1 (Teacher)						--	.17*	.35***	.79***	.42***	.75***	.21**	.75***	.19*
7. TOSREC Time 1							--	.27***	.31***	.30***	.29***	.18*	.29***	.91***

8. Grit T2 (Student)								--	.33***	.83***	.31***	.89***	.33***	.32***
9. Grit T2 (Teacher)									--	.41***	.96***	.19*	.95***	.32***
10. Grit-PE T2 (Student)										--	.41***	.49***	.38***	.33***
11. Grit-PE T2 (Teacher)											--	.15*	.82***	.31***
12. Grit-CI T2 (Student)												--	.20**	.23**
13. Grit-CI T2 (Teacher)													--	.31***
14. TOSREC T2														--
15. Non-White	-.24***	-.14*	-.28***	-.19**	-.12	-.08	-.51***	-.23**	-.20**	-.20**	-.18**	-.20**	-.19**	-.57***
16. Highly Gifted	.10	.09	.14*	.109	.02	.06	.56***	.10	.17*	.08	.13	.10	.19**	.67***
17. Group Admin.	.06	-.08	.08	-.06	.03	-.09	.06	-.01	-.08	.08	-.08	-.07	-.08	.04
20. DLL	-.20**	-.12	-.22**	-.16*	-.10	-.08	-.46***	-.24**	-.21**	-.23**	-.19**	-.18*	-.22**	-.49***
21. Female	.16*	.40***	.16*	.37***	.11	.39***	.18*	.17*	.39***	.17*	.37***	.13	.37***	.24**

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

Hypotheses 1 and 2: Direction of Relations between Grit Subscales and Literacy

The first hypotheses are that (a) there are cross-lagged effects between grit and literacy for the full sample; and (b) these effects will be driven by grit-PE, not grit-CI, in all models tested (direct, reverse, cross-lagged). To test these hypotheses, I first needed to confirm model factor structure. I suspected that a two-correlated factor model would fit best, as presently described.

Confirmatory factor analyses and temporal invariance. Confirmatory factor analyses (CFA) were used to determine whether a two-correlated factor model would fit my sample. Beyond the empirical support for this model among children, the two-correlated model was advantageous because the original second-order grit factor model (Duckworth, et al., 2007) would be underidentified in the context of structural equation modeling (e.g., Bollen, 1989). I also wanted to determine if and how student- and teacher-reported items could be included in the same model, with all the items loading onto their respective latent factors. As detailed below, the data fit a two-correlated factor model well.

Confirmatory factor analyses (CFA) were conducted in Mplus Version 8.1 (Muthen & Muthen, 2018). The CFA was first conducted with Time 1 data, and then later with Time 2 data to see if it fit at both time points. In the initial testing phase, a two-correlated factor model ran successfully; however, model fit was inadequate since teacher and student data were combined within latent factors. As shown in Figure 5 (Chapter 3: Methods), this initial model had all student- and teacher-reported data loading onto the same, overarching grit-PE and grit-CI factors. Yet, the data suggested that student- and

teacher-respondents were unique enough that their responses should not be included within the same factors, as evidenced by the poor fit.

As stated above, the first round of CFA analyses suggested that student- and teacher-report could not be included in the same factor. Yet, I believed that having them in the same model would be more parsimonious and useful for evaluating their associations with literacy. I therefore decided to re-examine ways to incorporate student- and teacher-report in the same model, even if they could not be included in the same factor. As shown in Figure 6, I ultimately ran a new CFA with single-rater factors; for example, student-rated grit-PE and teacher-rated grit-PE were created as separate factors, albeit in the same model. This revised model demonstrated good fit. In the final model supported by the CFA, corresponding student- and teacher-reported items were correlated, and identical items were correlated between Time 1 and Time 2 (Hancock, 2018). Items between Time 1 and Time 2 were also set to have equal factor loadings (For inter-correlations between items, please see Tables 6a-6c in the Appendix.). Fit was acceptable both with and without controlling for teacher clusters.

Table 6:

Total Sample Fit Statistics for Grit Confirmatory Factor Analyses

Model Fit Statistics					
Model	χ^2	*RMSEA*	*SRMR*	*CFI*	AIC Index
Time 1 [a]	161.09*	.05	.04	.96	15795.26
Time 2 [b]	165.37*	.05	.04	.97	13706.77

RMSEA = root mean square error of approximation. SRMR = standardized root mean square residual. CFI = comparative fit index.
[a]N = 394.
[b]N = 395.
*p < .05.

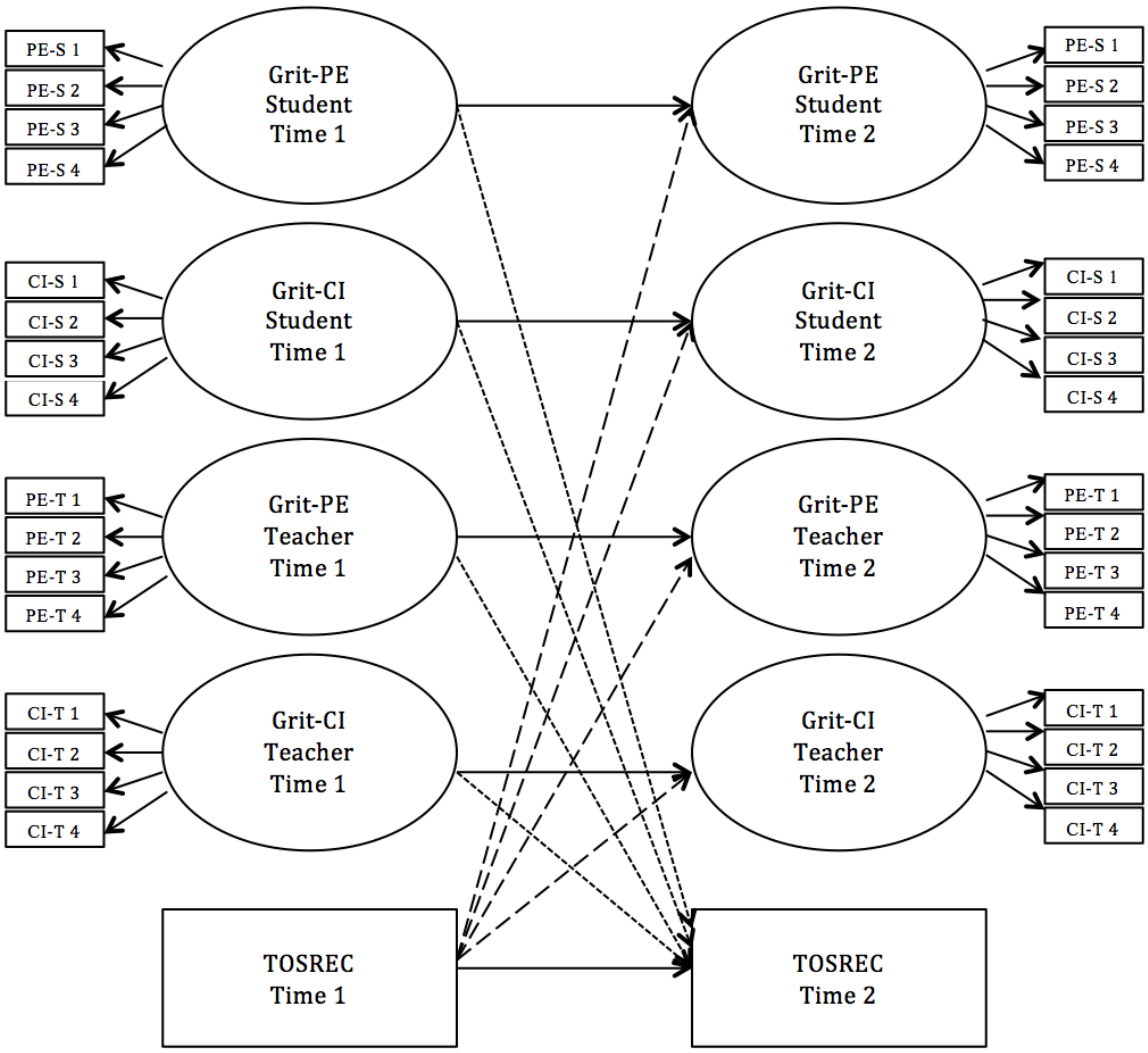

Figure 6. Modified two-correlated factor model with single-rater factors, as supported by CFA. *Note:* Factor loadings were fixed between time points, and identical teacher-student items were correlated.

Lastly, temporal invariance testing suggested no significant difference in the factor structure between the two time points, as expected (see Table 7). As stated earlier, these analyses were important for confirming that participants conceptualized the

measures similarly during each administration, such that the measures could represent the same latent factors at Time 1 and Time 2. To do invariance testing, as described in Byrne (2012), a baseline model was compared to one in which factor loadings were fixed to be equivalent across time points. I then calculated a Satorra-Bentler scaled chi-square difference test TRd (Nguyen, n.d.; Satorra & Bentler, 2010). In sum, Figure 6 illustrates this final model and Table 6 displays the model fit statistics at each time point. Table 7 demonstrates temporal invariance by showing the baseline "configural" model in comparison to the fixed "metric" model.

Table 7:

Temporal Invariance Testing

	Model Fit Statistics				
Model	χ^2	*RMSEA*	*SRMR*	*CFI*	AIC Index
Configural	593.74***	.03	.047	.97	28941.61
Metric	605.94***	.03	.049	.97	28936.10

Model Comparison	Δdf	TRd	*p*
Time 1 vs. Time 2	12	13.35	.35

TRd = Satorra-Bentler scaled chi-square difference test
*$p < .05$.
** $p < .01$.
***$p < .001$.

Direct, reverse, and cross-lagged model comparisons. Direct, reverse, and cross-lagged panel analyses were individually run for the full sample. Fit statistics were adequate for all three models (Table 8). After running the panel analyses individually, the

models were compared using Satorra-Bentler chi-square difference tests. The cross-lagged model was used for comparison in this nested model testing because it was the full model, with the direct and reverse models nested within it. As expected, the cross-lagged model showed significantly better fit indices. The difference test suggested a significant difference between the direct and cross-lagged model ($\Delta df = 4$, TRd = 16.50, $p < .01$) and the reverse and cross-lagged model ($\Delta df = 4$, TRd = 13.26, $p < .05$). In sum, the cross-lagged model fit the sample better than the direct or reverse models did (see TRd values in Table 8) as hypothesized. Similar results were found when analyzing student- and teacher-responses in separate models.

Table 8:

Model Fit Comparison of Directional, Reverse, and Autoregressive Cross-Lagged Models

	Model Fit Statistics				
Model	χ^2	*RMSEA*	*SRMR*	*CFI*	AIC Index
Direct	904.13***	.03	.07	.95	28329.69
Reverse	898.43***	.03	.07	.95	28321.53
Cross-Lagged	887.33***	.03	.07	.95	28319.25

Model Comparisons			
Comparison	Δdf	TRd	*p*
Direct vs. Cross-Lagged	4	16.50**	.002
Reverse vs. Cross-Lagged	4	13.26*	.010

TRd = Satorra-Bentler scaled chi-square difference test

Table 9 shows unstandardized and standardized path estimates within the cross-lagged model controlling for age, gender, race and ethnicity, participation in a Highly Gifted Program, and group vs. individual administration. As stated previously, adjustments were also made by controlling for classroom clusters. Figure 7 provides a visual of the standardized results. Within the context of a cross-lagged model – which contained both the direct and reverse effects – the only significant relation was between TOSREC at Time 1 and student-reported Grit-PE at Time 2 (Estimate (S.E.) = 0.01 (0.00), $p < .01$). This relationship aligned with the hypothesis that early literacy achievement predicts later grit – particularly its subscale on perseverance of effort – in the context of a reciprocal effects model. Autoregressive relationships were all significant across grit factors and TOSREC.

Table 9:

Cross-Lagged Paths for the Full Sample

Estimates	Unstandardized (SE)		Standardized (SE)		*p*-value
Grit-PE Student T1 →					
Grit-PE Student T2;	**0.59**	**(0.07)**	**0.68**	**(0.07)**	**.000**
TOSREC T2	2.78	(1.76)	0.06	(0.04)	.114
Grit-CI Student T1 →					
Grit-CI Student T2;	**0.54**	**(0.10)**	**0.53**	**(0.10)**	**.000**
TOSREC T2	1.83	(1.43)	-0.04	(0.03)	.202
Grit-PE Teacher T1 →					
Grit-PE Teacher T2;	**0.75**	**(0.05)**	**0.82**	**(0.04)**	**.000**
TOSREC T2	3.57	(2.23)	0.14	(0.09)	.110
Grit-CI Teacher T1 →					
Grit-CI Teacher T2;	**0.73**	**(0.06)**	**0.80**	**(0.05)**	**.000**
TOSREC T2	2.49	(2.61)	-0.08	(0.09)	.340
TOSREC T1 →					
TOSREC T2;	**0.76**	**(0.05)**	**0.78**	**(0.05)**	**.000**
Grit-PE Student T2;	**0.00**	**(0.00)**	**0.30**	**(0.09)**	**.002**
Grit-CI Student T2;	0.00	(0.00)	0.10	(0.07)	.121
Grit-PE Teacher T2;	0.00	(0.00)	0.08	(0.06)	.173
Grit-CI Teacher T2	0.00	(0.00)	0.07	(0.07)	.316

* $p < 0.05$
** $p < 0.01$
*** $p < 0.001$
Note: Along with classroom clusters, control variables included age, gender, race and ethnicity, participation in a Highly Gifted Program, and group vs. individual administration.

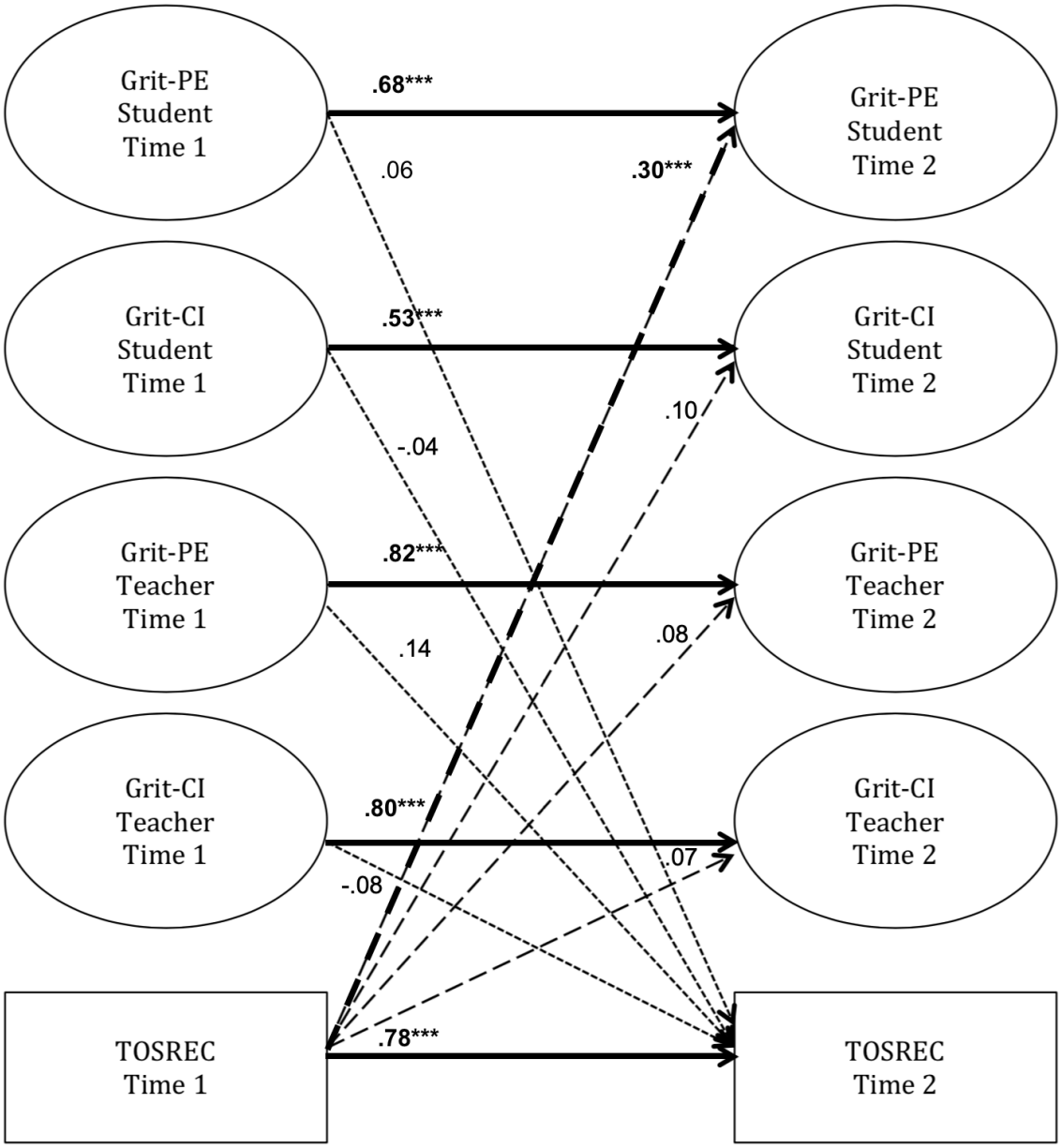

Figure 7. Standardized results for autoregressive cross-lagged panel model (unstandardized results are reported in Table 9). Correlations among predictors within and across the two time points are not depicted in the figure but they were included in analyses. Bolded font and path lines indicate significant paths. ** $p < .01$; *** $p < .001$.

Hypothesis 3: Grit-Literacy Relations within Subgroups

The last hypothesis was that there would be cross-lagged relations for all subgroups (e.g., age, language status, and gender). This hypothesis was first tested by comparing fixed and non-fixed multi-group models; if needed, I would conduct post-hoc path difference tests to determine which paths drove these overall group differences. Before proceeding, however, it was necessary to confirm factor invariance between subgroups, as presently described.

Multi-group invariance. Factor invariance was used to confirm that the same underlying construct was being measured across groups (Bialosiewicz et al., 2013). This preliminary process was necessary to confirm that any group differences found later had substantive meaning. The three-step process was completed for gender (male and female), language (non-DLL and DLL), and age (younger and older). Using the procedures described in Byrne (2012), configural invariance was first assessed by examining whether the factor structure was the same across demographic groups. See Table 10 for overall model fit information, which indicated that configural invariance held in my sample. Building on this baseline model, I then tested metric invariance by fixing the factor loadings of the items (also in Table 10). Since I would not be assessing mean differences between groups, it was not necessary to test scalar invariance (Bialosiewicz et al., 2013; Byrne, 2012).

Satorra-Bentler scaled chi-square difference test indicated that for all groups, there were no significant decrements in fit from the configural to the metric model. In other words, factor loadings were invariant between subgroups and later group comparisons was defensible. For gender, the TRD-adjusted chi-square of 14.55 (df = 12)

was not significant. For language, the TRD-adjusted chi-square of 13.84 (*df* = 12) was not significant. Likewise for age, the TRD-adjusted chi-square of 14.60 (*df* = 12) was not significant. In sum, results provide evidence that loadings were invariant across all groups.

Table 10:

Multi-group Invariance Testing

	Model Fit Statistics				
Model	χ^2	*RMSEA*	*SRMR*	*CFI*	AIC Index
Gender: Configural	279.34***	.05	.06	.95	15363.58
Gender: Metric	292.98***	.05	.07	.95	15359.58
Age: Configural	271.64***	.05	.06	.96	15214.98
Age: Metric	285.13***	.05	.07	.96	15212.97
Language: Configural	261.60***	.05	.05	.96	15271.75
Language: Metric	274.44***	.05	.07	.96	15267.86

Configural vs. Metric			
Model Comparison	Δdf	TRd	*p*
Gender	12	14.55	.267
Age	12	14.60	.263
Language	12	13.84	.311

*$p < .05$.
**$p < .01$.
***$p < .001$.

Multi-group analyses. Multi-group analyses were used to test whether the cross-lagged model fit the demographic subgroups groups similarly. This process was completed for gender (male and female), language (non-DLL and DLL), and age (younger and older). For each dichotomous group, two models were run: in the first model, the path estimates were free to vary between subgroups. In the second model, path estimates were fixed across subgroups. If path estimates differed between subgroups, the non-fixed model would be significantly better than the fixed one. If the cross-lagged model fit the dichotomous groups similarly, there would not be a significant difference between the non-fixed and fixed models.

Indeed, Satorra-Bentler scaled chi-square difference tests indicated that the fixed and non-fixed models were similar between male and female, younger and older, and DLL and non-DLL students (Table 11). In other words, omnibus testing suggested that the overall cross-lagged model fit the subgroups similarly. There were no differences between subgroups in data fit for the cross-lagged model. Path estimates for each subgroup are reported in Tables 11a-11c in the Appendix.

Table 11:

Multi-group Omnibus Comparisons

Model	Model Fit Statistics				
	χ^2	*RMSEA*	*SRMR*	*CFI*	AIC Index
Gender: Not fixed	1761.43***	0.05	0.09	0.91	28340.47
Gender: Fixed	1807.16***	0.05	0.10	0.91	28314.80
Age: Not Fixed	1961.26***	0.06	0.10	0.90	28423.29
Age: Fixed	2006.77***	0.06	0.10	0.89	28396.26
Language: Not Fixed	1786.98***	0.05	0.09	0.91	28363.05
Language: Fixed	1824.78***	0.05	0.09	0.91	28337.35

Omnibus Comparisons

Comparison	Δdf	TRd	*p*
Male vs. Female	33	45.52	0.07
Younger vs. Older	33	44.74	0.08
DLL vs. Non-DLL	33	38.23	0.24

Note: Analyses for Language group exclude the control variable "Interview Format" because too few students participated in the group format when split by language status (17 DLL; 27 non-DLL).
*$p < .05$.
**$p < .01$.
***$p < .001$.

Chapter 5: Discussion

This study contributed to the literature on grit by providing initial evidence that there are cross-lagged effects between grit and the narrow academic outcome of literacy achievement, regardless of age, gender, or DLL status. This study aimed to test (a) whether there were reciprocal, cross-lagged effects between grit and literacy, (b) if these results were driven by grit-PE, not grit-CI, and (c) whether similar cross-lagged relations held across subgroups. First, I examined the directionality of effects across the full sample. Results indicated that the data fit the cross-lagged model better than direct or reverse models. This finding holds important implications for how researchers approach grit and similar socioemotional skills. Grit and literacy are mutually reinforcing, so helping students develop grit is not enough for success; educators need to support students' literacy to help those students develop grit. Second, I examined grit-PE and grit-CI separately to understand how they each contribute to literacy outcomes. Within a cross-lagged model, earlier literacy led to changes in students' grit-PE; this relation was not significant with grit-CI. Results dovetail with a growing chorus of research suggesting that grit-PE and grit-CI must be examined separately, as they have different associations with indicators of success. For elementary school literacy, this study suggests that grit-PE is more relevant than grit-CI. Third, I examined whether the cross-lagged model had similar fit across student subgroups (dichotomous groups of male and female; DLL and non-DLL; younger and older). Patterns of relations were similar across gender, language status, and age. Results imply that a cross-lagged approach is generalizable, meaning that the bi-directional, "chicken or egg" relationship between grit

and literacy is meaningful across student groups. Potential reasons for these trends are discussed below.

Cross-Lagged Effects between Grit and Literacy

In line with my expectations, a cross-lagged model fit the sample better than direct or reverse models alone. This finding advances research on grit by (a) providing further evidence that grit predicts later literacy, and (b) suggesting that prior literacy also has a meaningful impact on grit. There was no individual reciprocal effect responsible for the significantly greater model fit for the cross-lagged model; yet, the relative, overall strength of a cross-lagged model suggests a mutual dependence (Marsh & Craven, 1997; Valentine & DuBois, 2005) between grit and literacy. The findings are consistent with the literature on related constructs such as academic self-concept, which demonstrates longitudinal cross-lagged relations with achievement among elementary students in a variety of studies (Marsh et al., 2017).

Results support calls for more socioemotional research to take a cross-lagged approach. These calls were further voiced in two studies grit. The first study examined grit, engagement, and literacy among low-income DLL students (O'Neal, et al., 2018), and it found that a cross-lagged model fit better than unidirectional models. The second study found bidirectional relationships between grit and grades among Chinese upper elementary school students. Post-hoc testing suggested that grit-PE drove the results (Jiang et al., 2019). This dissertation was distinct from O'Neal et al. (2018) and Jiang et al.'s (2019) studies in its use of student- and teacher-report, the inclusion of grit-PE and grit-CI in the same model, and multi-group analyses. Nonetheless, all three studies support the relevance of a cross-lagged model between grit and elementary school

outcomes. Future research and policy on socioemotional skills may benefit from the holistic view afforded by cross-lagged methods. As stated earlier, the implication for researchers and practitioners is that we must not only consider "the effect of A on B, but also the effect of B on A" (Bronfenbrenner, 1977, pg. 519). Put more strongly, this dissertation provides nascent evidence that a directional model (without cross-lagged relations) may be incomplete.

Effect of literacy on grit. Another implication from this study's cross-lagged model is the importance of reverse effects of literacy on grit in intervention planning. By supporting students' literacy, these results suggest that educators will, as a consequence, support students' grit. To date, most socioemotional research examines how socioemotional skills may impact achievement (Durlak, Weissberg, Dymnicki, Taylor, & Schellinger, 2011), and educational policy is molded around this approach (e.g., S.1177). For literacy, specifically, it takes both "skill *and* will" to develop into effective learners (Cambria & Guthrie, 2010, p. 16). Many prior studies on grit suggested that grit provides the "will" for academic achievement. For example, grit was a unique predictor of 4th-8th grade math achievement (Rojas & Usher, 2012), and of high school graduation, above and beyond standardized test scores and demographic covariates (Eskreis-Winkler, et al., 2014). Yet, this approach provides only part of the picture.

Cross-lagged research addresses the necessary element of "skill." These models serve as a reminder that achievement may affect later socioemotional processes (i.e., Guo, Sun, Breit-Smith, Morrison, & Connor, 2015). Children's self-evaluation of their abilities and their socioemotional skills impact their pursuit of challenge (Pomerantz & Saxon, 2001), thereby shaping their future achievement. In studies of student

achievement, it is not enough to merely consider whether children are persistent or interested. One must also consider how prior achievement shapes later grit. Indeed, this study provides initial evidence that within the context of a cross-lagged model, the reverse path between literacy and grit-PE was significant. The finding that prior literacy shapes Grit-PE later may connect to the cyclical processes of learned helplessness (Hiroto & Seligman, 1975) versus learned mastery in education (Dweck, 1975; Dweck, 2014). A successful history of overcoming challenges may lead to a sense of mastery, encouraging people to seek additional challenge and develop their grit (Duckworth, 2016). The implication is for educators to provide enough support or tailored assignments for students to develop a sense of mastery. School psychologists can use their training in psychology and education to conveying this message to teachers and families.

Beyond its examination of bi-directional effects, cross-lagged models include autoregressive relations. Autoregressive effects describe the effect of a construct on itself later in time, and they demonstrate the stability of individual differences between time points (Selig & Little, 2012). The strong effects between TOSREC scores at Time 1 and Time 2 provide additional impetus to support students' literacy. The autoregressive effects leave little question that over a period of a few months, literacy ability remains stable without deliberate intervention. Thus, beyond helping students bolster their grit, a concerted focus on students' early literacy seems to be an important way to improve students' literacy later on.

This study's inclusion of autoregressive relations is relatively unique in the grit literature. Four studies of grit have controlled the same measure of prior achievement. In studies of direct relations between grit and literacy using our Title 1 school sample and

relatively affluent school samples, respectively (O'Neal, Boyars, & Riley, *under review*; Riley, 2016), grit did not predict later literacy achievement after adjusting for that same measure of achievement – even when grit was combined with the well-studied socioemotional skill of engagement. These studies concluded that in the short run, prior literacy is a better indicator of future literacy than grit is. The findings were surprising, given that other socioemotional skills like motivation have predicted achievement even after accounting for prior achievement (Blackwell, Trzesniewski, & Dweck, 2007; Meece, Wigfield, & Eccles, 1990). Given such findings, it is noteworthy that in this dissertation, a significant path remained in this study's cross-lagged model beyond the autoregressive paths. Specifically, literacy's effect on Grit-PE was significant even after controlling for prior Grit-PE and literacy. Though it is only one study, this dissertation suggests that effects do exist between grit and literacy, even after accounting for prior achievement. This relationship substantiates the need to simultaneously invest in academic subjects like literacy and socioemotional skills like grit. Because of their expertise in child development and learning, school psychologists can advocate for this balance in schools.

Teacher and student report. In the context of cross-lagged relations, I explored how student- and teacher-report could be included within the same model. Doing so would shed light on the relative associations of each with achievement. Moreover, best practices call for multi-informant investigation (e.g., Fredricks & McColskey, 2012). although only two studies report on multi-informant grit, and only one of those uses teacher report (Duckworth & Quinn, 2009; O'Neal, et al., *under review*).

Based on their low-to-moderate correlations, student- and teacher-report may reflect different aspects of grit (e.g., behavioral versus cognitive). As in Duckworth & Quinn, 2009, this study found low-moderate relations between self- and third-person grit scores. More importantly, student- and teacher-reported grit-PE and grit-CI would not converge into single factors, suggesting that they may be distinct. Research suggests that teacher-reported grit is psychometrically stronger than student-reported grit (O'Neal, et al., *under review*), and in principle, it may be less forgiving than students' ratings of themselves (Duckworth & Yeager, 2015). Yet, teacher ratings may be based solely on observable behaviors in class rather than internal states or life experiences. Depending on their circumstances, for example, simply attending class may require grit from some students (Nathan, 2017), but this may be difficult for teachers to observe. Teachers may also be less likely to distinguish between grit-PE and grit-CI; while student-rated grit-PE and grit-CI held small-to-moderate correlations, teacher-ratings held large correlations. Overall, it is likely that teachers and students have different perspectives on student grit. It is possible that these perspectives become more aligned with age. Regardless, more research is needed to establish whose report is most valid – students' self-report on their own grit or teachers' observation-based report. In the meantime, educators, policymakers, and school psychologists should be mindful that students and teachers may conceptualize grit differently, along with the fact that observers cannot possibly see all instances in which children exercise grit.

Unique Contribution of Grit-PE and Grit-CI Subscales

As hypothesized, grit-PE had more significant relations with literacy than grit-CI. It is important to consider this result in the context of recent research on grit, which

generally suggests that grit-PE drives the grit scale's associations with school achievement. For example, a recent panel analysis of grit and primary school achievement (i.e., school grades; Jiang et al., 2019) examined cross-lagged relations between grit and achievement; then between grit-PE and achievement; and lastly between grit-CI and achievement. The cross-lagged effects existed for overall grit, but this was due to grit-PE. Relations between grit-CI and achievement were all non-significant. One implication is that grit-PE's predictive strength is diluted when it is combined with grit-CI in an overall grit score. Like the results of this dissertation, Jiang and colleagues (2019) echo a meta-analytic study (Credé et al., 2016) which found that grit-PE drove relations between student achievement and overall grit and that grit-CI contributed little to the measure's predictive value. In other studies of direct effects, only grit-PE predicted college GPA (Chang, 2014) and high school grades (Muenks, et al., 2017). The different contributions of grit-PE and grit-CI have implications for future research on grit. Grit is considered a unique construct because it merges two pre-existing socioemotional constructs (perseverance and consistency of interest over time). Yet, if the grit-CI measure is ineffectual (Credé et al., 2016), why use it at all?

The answer may be that the lack of relations with grit-CI is a measurement problem, not a theoretical one. Conceptually, grit-CI remains important and has theoretical support. Based on a hierarchical goal framework, grit-CI provides the consistent interest needed to pursue a goal over long spans of time, thereby distinguishing grit from related constructs like self-control, which measures people's pursuit of short, lower-level goals (Duckworth & Gross, 2014). In other words, the current grit-CI measure may be useless among children but if the theory is correct, the grit-CI measure

may simply need refinement. Others have observed that grit-CI is not well operationalized in the Grit-S (see Table 1 for items), whose items do not quite capture whether one remains consistently committed to a goal over time (Riley, 2016). Accordingly, new research is testing the psychometric properties of reworded and domain-specific grit scales among children (Clark & Malecki, 2019) and adults (Cormier, Dunn, & Dunn, 2019). Items may also need to be improved so that other observers (e.g., teachers, parents) could differentiate between grit-PE and grit-CI behaviors better. This dissertation supports the need to continue refining grit measurement. Until then, it is best for educators to refrain from using either the grit-PE or grit-CI as a measure for program evaluation or individual diagnosis (Duckworth & Yeager, 2016).

It is also possible that grit-CI would be a more meaningful predictor/outcome in other contexts. New studies of domain-specific grit provide further evidence that grit and its subscales function differently between contexts (Cormier et al., 2019). This dissertation took place in the context of elementary school, where young children may have few opportunities to select goals they are passionate about and pursue them long-term. It is possible that outside of school, elementary students have more opportunities to develop – and report on – their grit-CI. Associations with grit's subscales may have been different if this study used non-academic outcomes tapping into young students' extracurricular activities, family commitments, adaptability in the face of challenges, or social relationships. Future research may also benefit from a qualitative approach, such as by talking with children about areas outside of class where they are successful and how that impacts their motivation.

Cross-lagged Relations between Subgroups

A third major finding concerns whether cross-lagged relations between grit subscales and literacy differ across demographic groups. According to my hypothesis, cross-lagged relations were similar for all groups: gender (male, female), age (younger, older), and language status (DLL and non-DLL). To my knowledge, this is the first study to examine multi-group, cross-lagged phenomena between grit and academic outcomes. Yet, results are not surprising in light of other short-term, cross-lagged analyses in elementary school (e.g., Guay et al., 2003; Guo et al., 2015) that also failed to find broad group differences. For example, Guo and colleagues (2015) found no difference in the pattern of relations between reading achievement and behavioral engagement between low- and middle/high-SES students. This study provides initial support for the generalizability of cross-lagged grit-literacy relations for several demographic groups. Potential reasons for this are presently described.

Gender, age, and language status. The literature is mixed in terms of socioemotional differences between males and females, and the implications for achievement. While some research suggests differences (e.g., self-discipline, Duckworth & Seligman, 2006), a substantial number of studies indicate that slight gender differences are not statistically significant and are not responsible for differences in achievement (e.g., Hansford & Hattie, 1982; Bembenutty & Karabenick, 1998). To date, there are few multi-group, autoregressive cross-lagged studies on gender and elementary school achievement; those that exist, however, also suggest no gender difference in the association between social factors and achievement (e.g., Hong, Yoo, You, & Wu, 2010).

This may be because prior achievement is so predictive of future outcomes (social or academic) regardless of gender.

Cross-lagged models were also consistent between younger and older students. On the one hand, this is not surprising given the narrow age range of participants (8-11 years old). Yet even within four or five years, meaningful developmental differences occur, including for grit (Muenks et al., 2017; Pintrich & Zusho, 2002). Results are similar to those of other multi-group analyses assessing developmental differences. For example, the overall model of grit and engagement predicting literacy achievement was the same for older and younger students (Riley, 2016). Similarly, Guay, Marsh, and Biovin (2003) used a multi-group cross-lagged panel analysis to examine the mutual effects of academic self-concept and achievement, and whether the model varied across age groups. Despite the developmental hypothesis that models would vary with age, patterns remained similar across 2nd, 3rd, and 4th grade. Findings such as these hold practical implications for future work on early interventions. Results of previous socioemotional studies among children indicated that socioemotional skill development is a worthwhile investment in their future achievement (Durlak et al., 2011). Once reverse relations are accounted for, however, research suggests that educators should aim to simultaneously improve both socioemotional skills and early achievement to support growth in both constructs (Guay et al., 2003; Valentine & DuBois, 2005). Of course, more research is necessary given the limited cross-lagged, reciprocal effects studies. Along with other autoregressive, cross-lagged analyses in elementary school (O'Neal et al., 2018), this dissertation clarifies that both grit and literacy constructs matter.

Lastly, the cross-lagged model was similar for DLL and non-DLL students, when controlling for race and ethnicity. One other study using this study's Title 1 school sample has conducted cross-lagged analyses with dual language learners using grit and literacy (O'Neal, et al., 2018), but it did not include monolingual students or multi-group analyses. The current study strove to formally test the relevance of grit subscales for both DLL and non-DLL literacy, answering a call from past research (Durlak et al., 2011). Results indicate that the association between grit and literacy is relevant both for DLL and non-DLL students. The lack of overall model differences is striking in light of the literacy achievement gap between DLL and non-DLL students in my sample. The implication is that it is most effective to focus on bolstering language skills among students who struggle with literacy, rather than selecting students for intervention based on categorical factors, such as whether or not they are dual language learners.

Social justice lens. Critiques of grit research became most glaring when it grew in popularity as a potential protective factor for economically disadvantaged students (Baldwin, 2016) and as a means for addressing achievement gaps (Shechtman et al., 2013). These results help refute the deficit-focused claim that achievement gaps stem from a lack of character skills like grit. Beyond the claim's discriminatory overtones (Turiel et al., 2016), the results of this dissertation suggest that it is inaccurate. Initial evidence from this study, along with others (e.g., O'Neal, et al., 2018; Jiang, et al., 2019), indicates that grit does not develop in a silo. Rather, it is shaped by students' prior successes, and presumably, the opportunities afforded them. This approach reinforces the need to keep constructs like grit in perspective. Failing to do so risks "blaming the victim," especially for students in devalued, marginalized, or low-income groups. Of

note, this dissertation focused on grit-literacy relations rather than examining latent means, or whether demographic groups varied in their mean level of grit. Rather than targeting individual demographic groups, educators must aim to foster a school climate and support system (Au, 2013) that facilitates interest in class material (Cambria & Guthrie, 2010; Guthrie et al., 2012); they must tailor assignments so students can develop a sense of mastery (Rosenfield, 2013); recognize students' challenges outside the classroom (Nathan, 2017); and teach students strategies for persisting after failure (Dweck, 1975; Dweck, 2014). An inclusive approach may be most likely to support achievement – and simultaneously, grit.

Limitations

In studying socioemotional factors, one must not confuse individual-level factors with environmental ones (Turiel et al., 2016). Environmental factors often translate into children's access to opportunity (or lack thereof) and confrontation with systemic inequities. Certain variables are useful proxies for understanding students' access to educational opportunities, such as maternal education or economic status, but I did not have access to that information for this sample. However, I was able to control for factors like race and ethnicity and enrollment in a Highly Gifted Program (which may itself represent cultural inequities or access to opportunity; Grantham & Ford, 2003). Future research should continue taking a multi-group approach and controlling for factors like race and ethnicity while examining the effects of contextual factors on the relations between socioemotional skills and literacy for diverse students. Doing so may decrease the risk of confusing individual characteristics with systemic inequities (Baldwin, 2016; Nathan, 2017).

In this vein, the study's use measure of DLL status presented several limitations. The school district did not allow inquiries into participants' family income or immigration status ("Plyler v. Doe," 457 US 202, 1982). My lab, therefore, sought a proxy for immigrant/dual-language status. Students were classified as dual language learners if they spoke a non-English language at home with at least one parent (Park et al., 2018). In the nascent field of DLL studies, this is a relatively stringent definition. Though not ideal, the use of proxy information is relatively common in the research on dual language learners (Hammer et al., 2014). Future studies on dual language learners should seek measures that can gauge students' generational status, acculturation, amount of exposure to each language, and cultural background. They should also seek to clarify the nature of students' language exposure, such as by coding the percent of time that they spoke each language with a parent.

Second, the sample contained an overlap between DLL status and ethnicity. To a lesser extent, DLL status and SES may have also been confounded, based on my knowledge of the participating schools and their school-wide enrollment in social programs such as Free and Reduced Meals. Had I discovered group differences, it would have been impossible to know whether these differences were driven by income, culture, or other contextual factors for which I did not control. National data suggest that such confounds exist across American public schools (Musu-Gillete et al., 2016; National Center for Education Statistics, 2016; Traub et al., 2016). This reality – both about my sample and of American students more broadly – limits inferences that can be made about grit-literacy associations among DLL versus non-DLL students. This reality also reinforces the need to address students' access to educational opportunities. There are no

simple answers for addressing the inequalities caused by years of accumulated wealth/poverty and advantage/discrimination (Traub et al., 2016). Yet, as stated above, results indicate that educators can begin by bolstering literacy supports for students and providing engaging, relevant material known to improve learning outcomes (Au, 2013). In this study, along with many others, literacy scores remained relatively stable across several months; in other words, students with low literacy skills are unlikely to improve without a dual language curriculum or good instruction (Aram, 2005; Au, 2013). While it is important to understand how individual-level factors function, cross-lagged relations between grit and literacy suggest that it may also be important to address structural barriers that hinder children's access to high-quality education.

The allure of socioemotional research is partially due to people's interest predicting long-term outcomes for students (e.g., Durlak, et al., 2011; Tough, 2013), especially when skills and outcomes are tested over several points in time (e.g., Hughes, et al., 2008). Yet, the short-term nature of this longitudinal study limited my ability to test grit's relations with literacy achievement over an extended period. It is possible that adding a third time point would reveal a different pattern in grit-literacy relations. Children's TOSREC literacy score at Time 1 was likely influenced by their prior grit; a third time point may have revealed an inflection point that is not present in the current data.

Along with additional time points, future studies should strive for longer periods of time between data collection. More time may have strengthened the effects between grit and literacy by decreasing the shared variance between grit and literacy measures. Specifically, the small window of time between data collection might have diminished

grit's predictive power and magnified the autoregressive effects. More time may also have allowed for more change in students' grit and literacy levels as they naturally develop throughout the school year. This is particularly the case for the TOSREC literacy measure, which was designed to gauge student progress over seasonal benchmarks (Wagner et al., 2010) rather than the three- or 4-months spans in the present study. Future short-term, longitudinal research may consider other measures of literacy achievement, such as Curriculum Based Assessments, which are designed to measure small amounts of growth over short periods of time.

Lastly, only rating scale data was used to assess the conceptually nuanced construct of grit. On the one hand, social and cognitive psychology suggest that self-report and teacher-report are advantageous, as they are well-suited for gauging internal states (such as grit) and people are relatively likely to communicate their true opinions (Fiske & Taylor, 2016). Still, "no measure is perfect" (Duckworth & Yeager, 2015, p. 237), and rating scales have known threats to validity. These include the assumption that respondents will (a) accurately understanding the questionnaire items, (b) integrate their memories about a behavior into discrete summary judgments, and (c) overcome an ego-centric perspective or misinterpretations of observed behavior, which may both color one's judgments (Duckworth & Yeager, 2015). Fortunately, this study had the benefit of using both student- and teacher-reported grit. The inclusion of multiple raters is more likely to provide a valid picture (Fredricks & McColskey, 2012) of grit (Duckworth et al., 2007). Supplementary CFA analyses were conducted with student- and teacher-report separately, and it indicated that broad findings were similar to when reporters were combined in the same model. Path analyses might have varied between respondents,

particularly for multi-group analyses. Future research on performance-based measures of grit is encouraged so that research may include multiple forms of grit measurement beyond questionnaires.

Conclusions

The way children think and feel can affect their school performance; the way they perform can also affect how they think and feel (Valentine & DuBois, 2005). This study found that a cross-lagged analysis was most appropriate for examining grit-literacy relations, implying that grit and literacy mutually affect one another. Within the cross-lagged panel model, the path between early literacy and later grit-PE was significant, suggesting that literacy achievement may lead children to develop perseverance of effort, in the context of cross-lagged effects. Relations held even after accounting for autoregressive effects, including prior literacy. Multi-group analyses indicated that reciprocal effects were evident in all subgroups.

Results build on past research on grit by clarifying the bidirectional associations between grit and the domain-specific outcome of literacy achievement. Practically, they reaffirm the need to include socioemotional skills training in school curricula (Durlak et al., 2011) but to simultaneously prioritize early literacy development among children. By providing high-quality supports that enhance children's literacy, educators may ultimately support students' grit. Longer-term studies are recommended to improve researchers' understanding of the temporal relations between grit and literacy, for children at large and among individual student groups.

Appendix

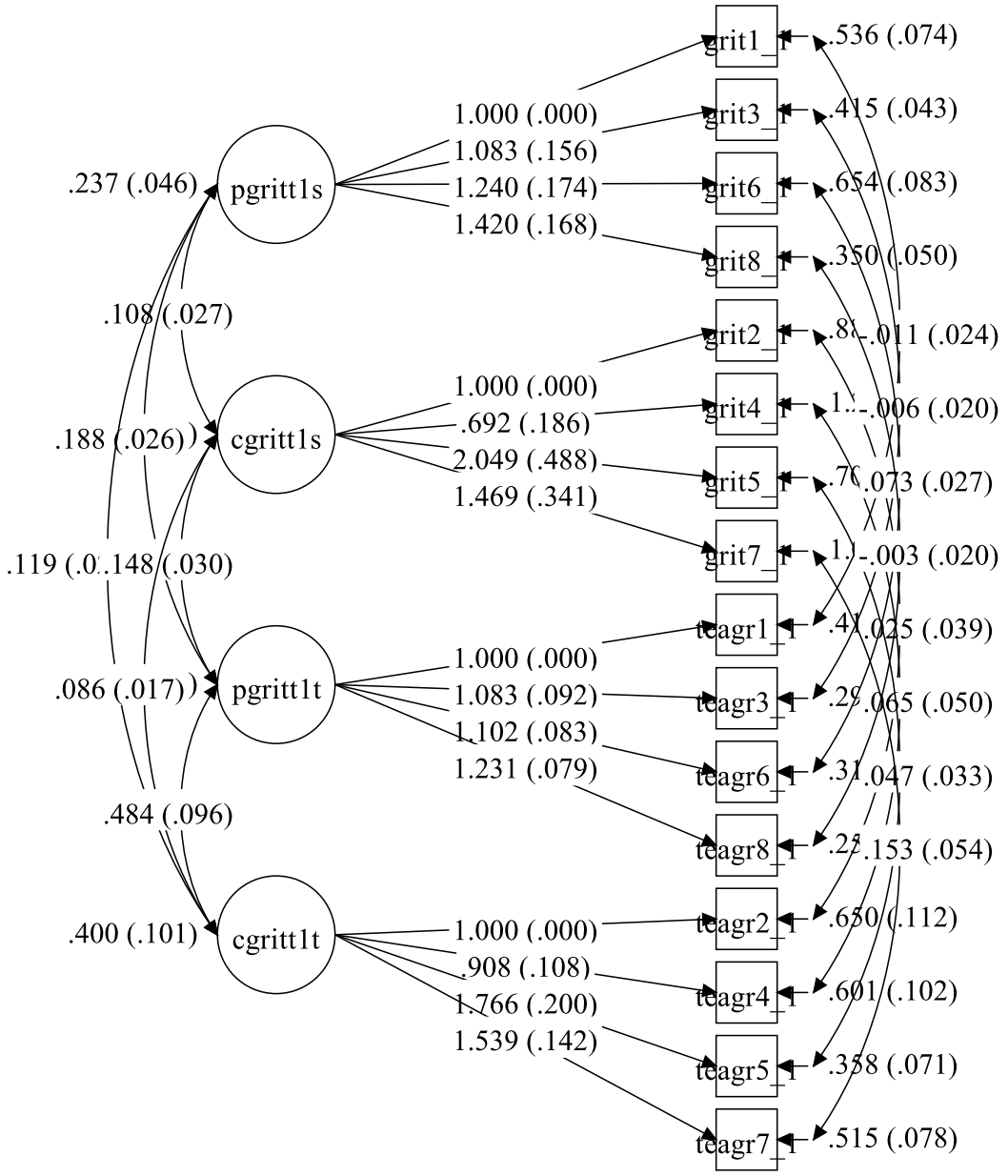

Figure 6a. Inter-correlations within Time 1

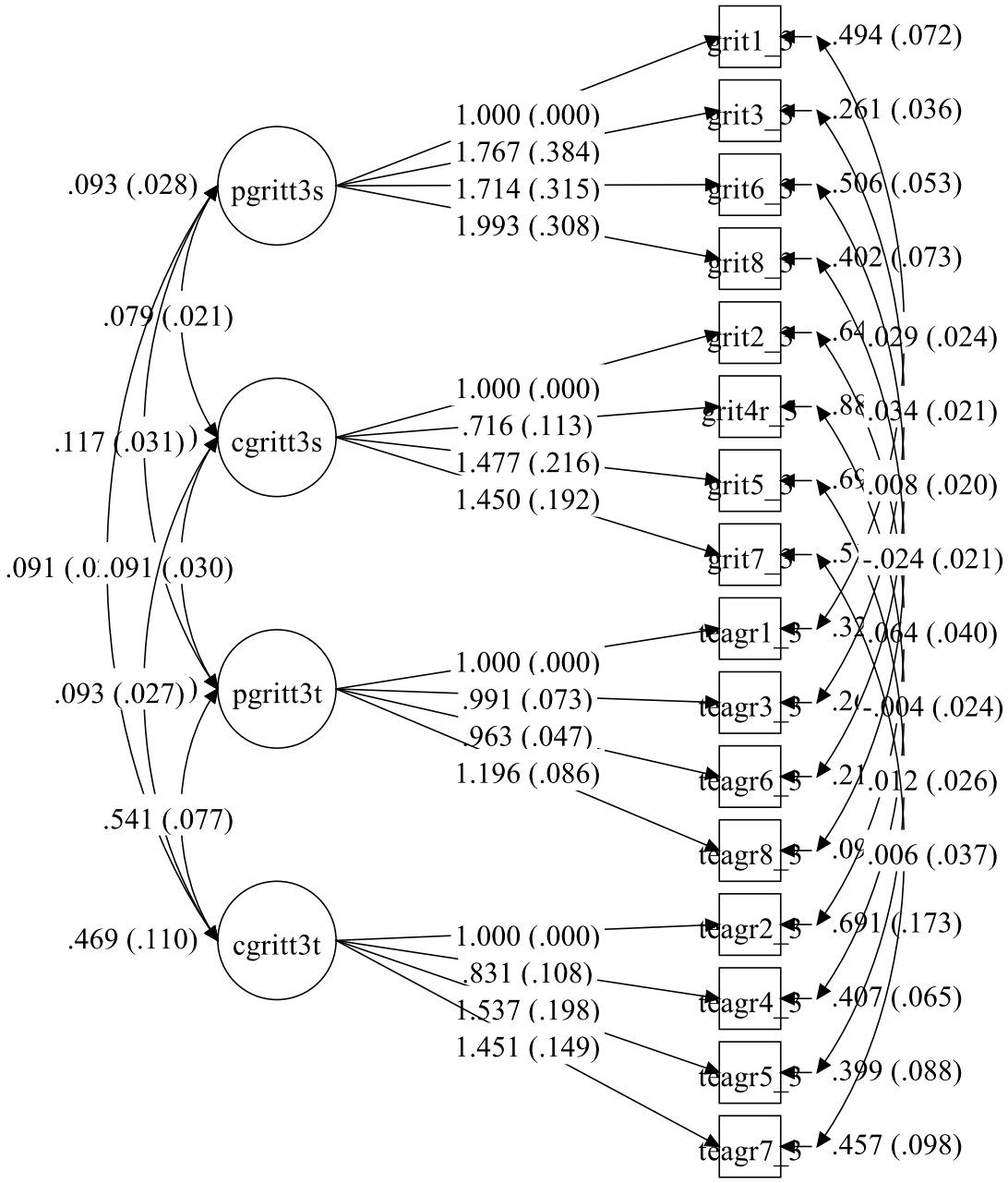

Figure 6b. Inter-correlations within Time 2

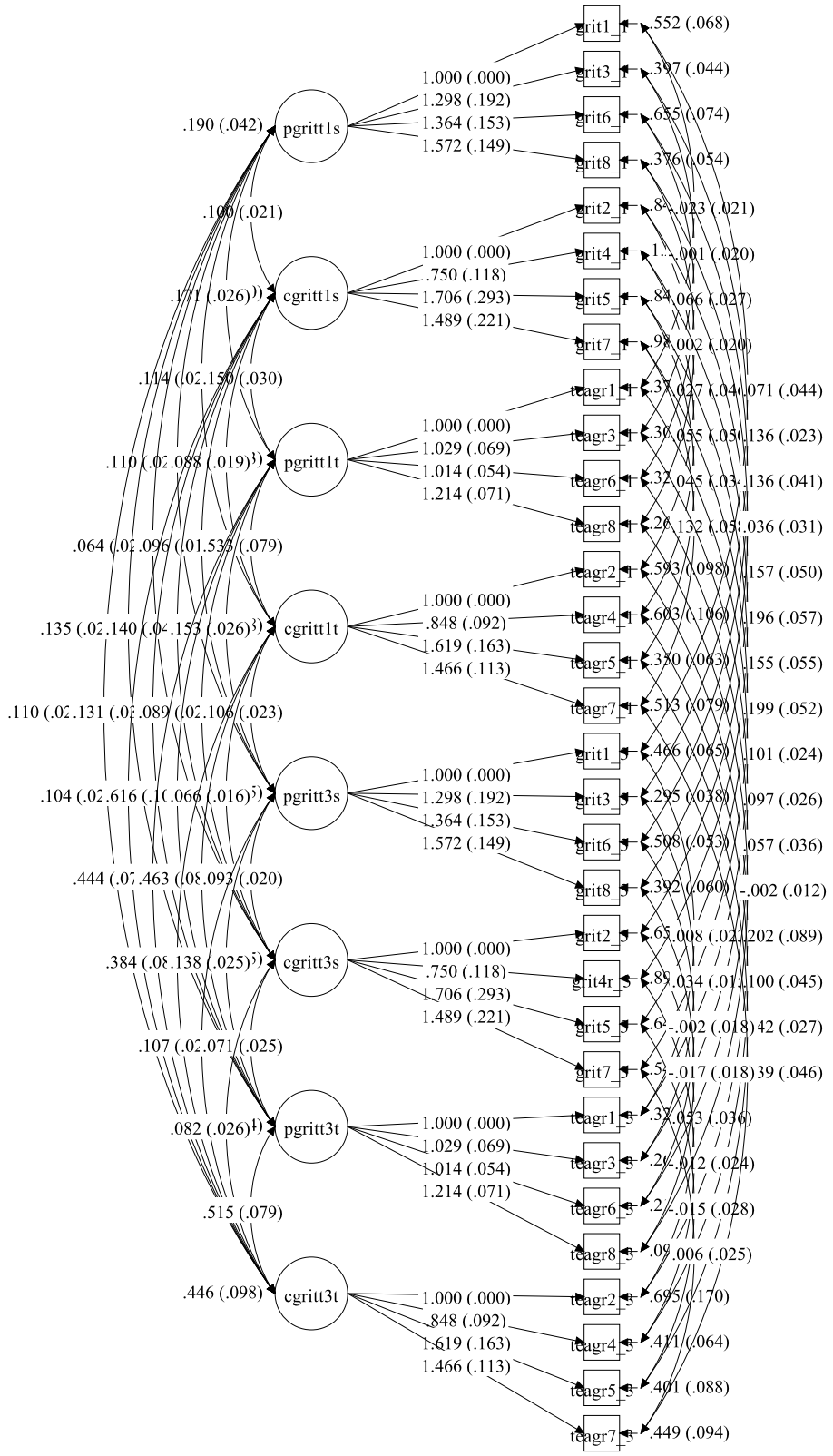

Figure 6c. Inter-correlations between time points.

Table 11a

Unstandardized Cross-Lagged Paths for Younger and Older Students

	Younger	Older
Paths	Estimates (SE)	Estimates (SE)
Grit-PE Student T1 →		
Grit-PE Student T2;	0.52 (0.06)***	0.57 (0.15)***
TOSREC T2	-0.09 (2.90)	3.24 (2.13)
Grit-CI Student T1 →		
Grit-CI Student T2;	0.42 (0.14)**	0.70 (0.14)***
TOSREC T2	-0.95 (2.09)	-0.72 (2.21)
Grit-PE Teacher T1 →		
Grit-PE Teacher T2;	0.70 (0.08)***	0.82 (0.04)***
TOSREC T2	3.41 (2.74)	2.56 (4.26)
Grit-CI Teacher T1 →		
Grit-CI Teacher T2;	0.67 (0.09)***	0.79 (0.07)***
TOSREC T2	-3.99 (2.47)	-0.88 (5.44)
TOSREC T1 →		
TOSREC T2;	0.81 (0.04)***	0.73 (0.05)***
Grit-PE Student T2;	0.01 (0.00)***	0.00 (0.00)**
Grit-CI Student T2;	0.00 (0.00)	0.00 (0.00)
Grit-PE Teacher T2;	0.00 (0.00)	0.00 (0.00)
Grit-CI Teacher T2	0.00 (0.00)	0.00 (0.00)

* $p < 0.05$
** $p < 0.01$
*** $p < 0.001$
Note: Along with classroom clusters, control variables included age, gender, race and ethnicity, participation in a Highly Gifted Program, and group vs. individual administration.

Table 11b

Unstandardized Cross-Lagged Paths for Male and Female

	Male	Female
Paths	Estimates (SE)	Estimates (SE)
Grit-PE Student T1 →		
Grit-PE Student T2;	0.52 (.11)***	0.59 (0.10)***
TOSREC T2	-0.87 (2.44)	4.41 (2.93)
Grit-CI Student T1 →		
Grit-CI Student T2;	0.63 (.11)***	0.48 (0.14)***
TOSREC T2	-1.22 (3.35)	-0.96 (2.46)
Grit-PE Teacher T1 →		
Grit-PE Teacher T2;	0.85 (.04)***	0.70 (0.05)***
TOSREC T2	5.15 (3.39)	0.66 (3.90)
Grit-CI Teacher T1 →		
Grit-CI Teacher T2;	0.81 (.07)***	0.69 (0.08)***
TOSREC T2	-4.62 (3.94)	1.23 (5.22)
TOSREC T1 →		
TOSREC T2;	0.79 (0.04)***	0.75 (0.07)***
Grit-PE Student T2;	0.00 (0.00)**	0.01 (0.00)**
Grit-CI Student T2;	0.00 (0.00)	0.00 (0.00)
Grit-PE Teacher T2;	0.00 (0.00)	0.00 (0.00)
Grit-CI Teacher T2	0.00 (0.00)	0.00 (0.00)

* $p < 0.05$
** $p < 0.01$
*** $p < 0.001$
Note: Along with classroom clusters, control variables included age, gender, race and ethnicity, participation in a Highly Gifted Program, and group vs. individual administration.

Table 11c

Cross-Lagged Paths for DLL and Non-DLL

	DLL	Non-DLL
Paths	Estimates (SE)	Estimates (SE)
Grit-PE Student T1 →		
Grit-PE Student T2;	0.45 (0.09)***	0.68 (0.15)***
TOSREC T2	1.17 (1.82)	7.11 (3.13)*
Grit-CI Student T1 →		
Grit-CI Student T2;	0.47 (0.16)**	0.64 (0.13)***
TOSREC T2	0.70 (1.62)	-7.25 (4.22)
Grit-PE Teacher T1 →		
Grit-PE Teacher T2;	0.83 (0.07)***	0.67 (0.10)***
TOSREC T2	3.80 (2.55)	4.88 (5.08)
Grit-CI Teacher T1 →		
Grit-CI Teacher T2;	0.75 (0.06)***	0.74 (0.10)***
TOSREC T2	-2.95 (2.64)	-1.98 (6.24)
TOSREC T1 →		
TOSREC T2;	0.73 (0.06)***	0.74 (0.05)***
Grit-PE Student T2;	0.01 (0.00)**	0.01 (0.00)*
Grit-CI Student T2;	0.00 (0.00)	0.00 (0.00)
Grit-PE Teacher T2;	0.00 (0.00)	0.00 (0.00)
Grit-CI Teacher T2	0.00 (0.00)	0.00 (0.00)

* $p < 0.05$
** $p < 0.01$
*** $p < 0.001$
Note: Along with classroom clusters, control variables included age, gender, race and ethnicity, participation in a Highly Gifted Program, and group vs. individual administration.

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