

**ORIGINAL ARTICLE**

# A reciprocal, moderated mediation model of grit, engagement, and literacy achievement among dual language learners

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**Abstract**

This short-term longitudinal study asked (a) how and for whom socioemotional factors like grit and emotional engagement predict later literacy achievement; and (b) if there are reciprocal effects between literacy and these socioemotional factors. An autoregressive cross-lagged (ARCR) design included 3 time points over 4 months with an ethnic minority, dual language learner sample ( $n = 142$ ; 54% female; 75% Latina/o;  $M = 9.47$  years old). The procedure at each time point included teacher-reported student emotional engagement and adapted grit questionnaires in addition to a student literacy achievement performance task. A reciprocal model (i.e., socioemotional factors and literacy affect each other) was compared to direct (i.e., socioemotional factors impact literacy) and reverse (i.e., literacy impacts socioemotional factors) models. Results suggested that the reciprocal model fit better than the direct and reverse models. Within the reciprocal ARCR model, grit had a significant impact on later literacy achievement via the mediator of engagement and moderated by age. Findings hold implications for education discourse on reciprocal and indirect effects of grit on achievement among older elementary-aged dual language learners.

**KEYWORDS**

dual language learners, engagement, grit, literacy

## 1 | INTRODUCTION

Empirical support is clear that grit (i.e., 'perseverance and passion for long-term goals'; Duckworth, Peterson, Matthews, & Kelly, 2007, p. 1087) predicts later achievement among largely White youth and adults (e.g., Duckworth, 2016). In contrast, little grit research exists with younger or culturally and linguistically diverse students. In addition, research is needed on how and for whom socioemotional factors, like grit and emotional engagement, contribute to

achievement (e.g., Becker & Luthar, 2002; Durlak, Weissberg, Dymnicki, Taylor, & Schellinger, 2011), especially across age and with the outcome of literacy achievement among dual language learners (e.g., Taboada Barber & Gallagher, 2015). Although the link between grit and literacy achievement has not been examined, recent research has connected grit with motivation, including among Latina/o students (Eskreis-Winkler, Shulman, Beal, & Duckworth, 2014; Piña-Watson, López, Ojeda, & Rodríguez, 2015), and motivation has been found to predict elementary and middle school literacy achievement (see Guthrie, Wigfield, & You, 2012, for review). Indeed, students' motivation and engagement do predict literacy achievement, even after adjusting for previous literacy achievement (e.g., Meece, Wigfield, & Eccles, 1990), and among culturally and linguistically diverse elementary school students (e.g., Taboada, Tonks, Wigfield, & Guthrie, 2009). Grit, engagement, and achievement research merits an examination of mediation processes across age in addition to including academic outcomes like literacy achievement among culturally and linguistically diverse students.

The vast majority of research on socioemotional factors and achievement is typically among majority language speakers and has reported a directional effect from socioemotional factors onto achievement (e.g., Schonfeld et al., 2015). It may, however, be possible that the reverse is true—achievement could affect socioemotional processes like grit and emotional engagement rather than socioemotional affecting achievement (e.g., Pomerantz & Saxon, 2001). Another possibility is that reciprocal effects exist between socioemotional factors and achievement (e.g., Marsh, Martin, Yeung, & Craven, 2017; Roeser, Eccles, & Sameroff, 2000). Though other studies have reported the impact of grit and engagement on achievement (e.g., Duckworth & Quinn, 2009; Duckworth et al., 2007; Wigfield & Guthrie, 1997), none have explored the potential reciprocal relationship between grit and achievement.

Using a cross-lagged design over 3 time points across 4 months, this study examined (a) the directionality of effects between socioemotional factors (i.e., emotional engagement, grit) and literacy achievement; and (b) moderated mediation processes among grit, engagement, and literacy in a sample of dual language, largely Latina/o students. We operationalized socioemotional factors as beliefs, goals, attitudes, and skills used in managing emotions and behavior in a learning context (Domitrovich, Durlak, Staley, & Weissberg, 2017; Parke & Clarke-Stewart, 2011; Weissberg, Durlak, Domitrovich, & Gullotta, 2015).

## 2 | GRIT AND ENGAGEMENT

Grit and emotional engagement were selected for this study because we conceptualize both as falling under the umbrella of emotions, as explained below. They were also selected because emotional engagement has neither been examined as an outcome of grit nor as a mediator of grit's impact on achievement. In addition, we selected grit and engagement because they both play important roles in current education discourse, especially in the context of socioemotional learning, so understanding the process by which grit and engagement impact achievement may contribute to education discourse and practice.

Affect theory identified emotions as the root of social, emotional, and behavioral functioning, as in specific emotions like interest (Tomkins, 1963). Grit may overlap with emotional engagement in grit's 'consistency of interest' subscale, which can be conceptualized as grit's emotional component of passion or long-term interest (Duckworth, 2016). Indeed, a few recent articles have criticized the construct of grit as to whether or not it is unique from other forms of personality, and other forms of motivation and engagement, among high schoolers and young adults (Credé, Tynan, & Harms, 2016; Muenks, Wigfield, Yang, & O'Neal, 2016). Grit and emotional engagement, however, may not be one and the same given that only one of grit's two subscales is about interest. And, the construct of emotional engagement does not necessarily imply consistent, sustained interest, which is implied by grit's consistency of interest subscale; indeed, one can be emotionally engaged in one topic then emotionally engaged in a different topic minutes later. Therefore, one could have high emotional engagement but low grit. Grit also has the subscale of 'perseverance of effort' which we conceptualize as a unique behavioral and action-oriented perseverance component of grit (e.g., 'I finish whatever I begin in school'); in contrast, we view emotional engagement as primarily affective (e.g., 'When I'm in class, I feel good').

Although grit and motivation have been found to be correlated with each other (Eskreis-Winkler et al., 2014; Piña-Watson et al., 2015), we would argue that grit is also distinct from the motivation construct. Although grit's perseverance of effort is an element of motivation, consistency of interests is not. In addition, grit has been characterized by Duckworth and colleagues as a personality trait (i.e., 'how people behave, think, and feel') which is preceded by motivation (i.e., 'what people want') (Von Culin, Tsukayama, & Duckworth, 2014, p. 1). Grit can be further differentiated from motivation due to the longer time span over which grit operates (Duckworth & Eskreis-Winkler, 2013). In contrast, motivation can apply to short-term goals; grit is defined by 'the tendency to pursue long-term goals with passion and perseverance' (Von Culin et al., 2014, p. 2).

Von Culin et al. (2014) argue that engagement may contribute to grit, but they also propose that the reverse may be true: grit may contribute to engagement. The research to date on whether or not grit causes engagement, or vice versa, is limited because the only studies examining relations between grit/perseverance and engagement have been cross-sectional, so researchers were unable to test if grit affects engagement (Martin, 2011; Muenks et al., 2016; Wolters & Hussain, 2014). Viewed through the lens of flow theory (Shernoff & Csikszentmihalyi, 2009), engagement is the outcome of pursuing challenging goals with a high level of concentration and interest, a pursuit akin to how researchers describe grit. We argue that grit is more likely to engage students in their work, rather than the reverse, but there is no evidence yet to prove which effect is stronger. There is, however, evidence that motivation influences achievement via the mediator of engagement (e.g., Wigfield et al., 2015). Therefore, we test if grit impacts later achievement via the mediator of engagement in the context of an autoregressive cross-lagged (ARCR) model (see Methods for description of ARCR design). Given concerns about overlap between grit and engagement (e.g., Muenks et al., 2016), the ARCR design of this study controls for such overlap by testing Time 1 grit's prediction of Time 2 engagement, while controlling for Time 1 engagement, and Time 2 engagement's prediction of Time 3 literacy, while controlling for Time 2 grit.

### 3 | SOCIOEMOTIONAL FACTORS AND ACHIEVEMENT

#### 3.1 | Grit and achievement

In studies with primarily middle-income, high achieving, White adults and college students, grit has demonstrated weak, positive relations with GPA (Duckworth & Quinn, 2009; Duckworth et al., 2007), with similar relations in one study with African American and Latina/o high school students (Eskreis-Winkler et al., 2014). None of those studies, however, controlled for the same measure of Time 1 achievement when reporting grit's predictive strength of later achievement, therefore possibly overestimating grit's predictive value. It is possible that grit may have a cumulating effect over time, so the grit literature needs to examine grit across multiple ages, including childhood. To our knowledge, there are only two studies of students' grit in childhood, and these include high achieving 10–15 year olds (Duckworth & Quinn, 2009; Duckworth, Kirby, Tsukayama, Berstein, & Ericsson, 2010). Among diverse prep school students (58% White; 18% receiving free or reduced-price lunch; Duckworth & Quinn, 2009), grit predicted GPA 1 year later, without adjusting for previous GPA. These studies by Duckworth and colleagues were done with students who overlapped in age with the current study—the current study has third through fifth graders and these studies had fourth grade or older students. Given that these Duckworth studies were with high-achieving students and did not adjust for previous achievement, a longitudinal study of grit with a lower income, culturally and linguistically diverse sample is needed.

#### 3.2 | Engagement and achievement

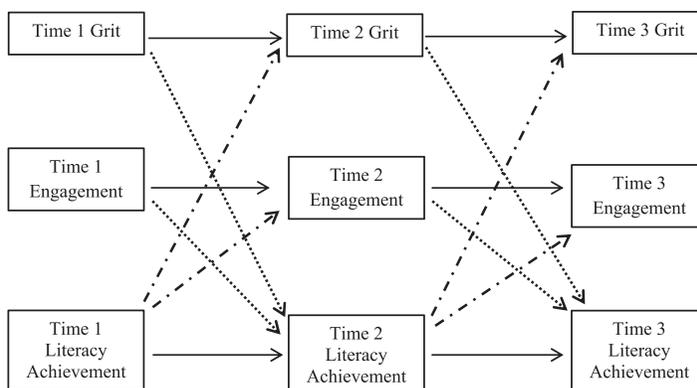
Engagement relates to academic achievement (e.g., Wigfield & Guthrie, 1997), including among Latina/o youth (Roche & Kuperminc, 2012). This study examined emotional engagement which is operationalized as 'the ways in which students react affectively to classroom activities' (Wigfield et al., 2015, p. 670). Most relevant to this study, emotional engagement has demonstrated positive relations with literacy achievement (Ladd & Dinella, 2009; Schiefele, Schaffner, Möller, & Wigfield, 2012; Taboada et al., 2009).

The relation between emotional engagement, namely interest in learning, and literacy may change with age. Research suggests that interest in reading (i.e., engagement in reading literacy) may decrease across the elementary school years (Wigfield et al., 1997). Grit may be a flexible trait (Duckworth, 2016) which 'crystallizes' or accumulates with age, especially across younger ages. Hence, grit's relation with achievement may also change with age. The relation between emotional engagement and literacy achievement may differ by age, in the context of a mediation model with grit impacting literacy achievement via engagement.

In sum, grit and engagement may impact literacy achievement. If, how, and for whom grit impacts literacy achievement is not clear. We expect grit to impact later literacy achievement via engagement and for the relation of engagement with achievement to differ by age among ethnic minority, dual language elementary students.

### 3.3 | Reciprocal effects between socioemotional factors and achievement

Reciprocal effects studies have revealed mutual effects among social development factors over time, including over a short-term time frame (e.g., Vecchione, Döring, Alessandri, Marsicano, & Bardi, 2016). Some researchers propose using a dynamic reciprocal effects model of socioemotional factors with achievement (e.g., Marsh et al., 2017) instead of a model that conceptualizes the relation of socioemotional factors with achievement from a static cause and effect perspective. Others have relied on a transactional model of development (Sameroff, 1975) to frame how reciprocal processes may occur between socioemotional factors and achievement during elementary school. Though much research indicates that socioemotional processes may lead to increased achievement (e.g., Durlak et al., 2011), the reverse may also be true—academic achievement has been related to an increase in prosocial outcomes (Miles & Stipek, 2006), such as social competence (Welsh, Parke, Widaman, & O'Neil, 2001) and emotional well-being (Roeser et al., 2000). Reading achievement was more likely to affect later behavioral engagement, rather than the reverse, in a cross-lagged study from preschool through elementary school (Guo, Sun, Breit-Smith, Morrison, & Connor, 2015). Another study, however, found that there was a reciprocal relation between reading achievement and effortful engagement over 3 years of elementary school (Hughes, Luo, Kwok, & Loyd, 2008). Perhaps, literacy achievement will affect the socioemotional factors in this study, given that how well dual language students do in English literacy achievement may affect how engaged or persevering they are in class. For instance, a dual language student may find literacy achievement frustrating, and such frustration might, in turn, affect the student's grit and emotional engagement in class. Indeed, literacy achievement may affect socioemotional processes among dual language learners (Gánadara, Rumberger, Maxwell-Jolly, & Callahan, 2003). Compared to directional (i.e., socioemotional affects achievement) or reverse models (i.e., achievement affects socioemotional), we expect a stronger fit of a reciprocal model (i.e., socioemotional affects achievement and achievement affects socioemotional) in this sample of ethnic minority, dual language learners (see Figure 1).



**FIGURE 1** Model 1 (M1) Directional Model: Socioemotional factors impact literacy (small, round dot arrows). Model 2 (M2) Reverse Model: Literacy impacts socioemotional factors (dash dot arrows). Model 3 (M3) Reciprocal Model: Literacy impacts socioemotional factors and socioemotional factors impact literacy (small, round dot arrows and dash dot arrows). Note that the solid, autoregressive arrows are included in all three models

### 3.4 | Literacy achievement among Latina/o dual language learners

According to the National Center for Education Statistics (2015), 4.6 million dual language learners were enrolled in kindergarten through 12th grade, representing about 9% of all students. An opportunity gap exists between ethnic minority, dual language learners, and White students (Carter, Welner, & Ladson-Billings, 2013). Systemic obstacles like under-resourced schools and poor quality dual language learner education, in addition to English as a second language at home, may make literacy achievement especially challenging for low-income, ethnic minority, dual language learners (e.g., Taboada Barber & Gallagher, 2015). English learners underperform non-English learners by 40 percentage points on fourth grade reading tests, a gap that has not improved since 2000; in the state in which this study's sample resides, 51% of English learners scored at or above basic level of reading in fourth grade, compared to 78% of students who were not English learners (Murphey, 2014).

The difference between the literacy outcomes of Latina/o elementary school students and their White peers, as derived from national tests, is also striking with only 21% of Latina/o fourth graders reading at a proficient level, compared to 46% of White fourth graders (National Center for Education Statistics, 2015); note that the majority of our ethnic minority sample is Latina/o. Twenty-five percent of U.S.-born Latina/o students who do not read at a proficient level in third grade do not graduate high school (National Longitudinal Surveys, 2000). As children enter the upper elementary grades, the vocabulary demand of their texts is more academic and domain-specific, which makes the role of vocabulary and reading comprehension essential (Cain, Oakhill, & Lemmon, 2004). Therefore, English reading decoding, fluency, and comprehension, which are the focus of this study, are especially important for upper elementary dual language students.

### 3.5 | Study hypotheses

We hypothesized that a reciprocal effects model would fit best (i.e., socioemotional factors and literacy achievement affecting each other) among ethnic minority, dual language learner students compared to a directional (i.e., socioemotional factors directly affecting later literacy) or reverse model (i.e., literacy affecting later socioemotional factors) (see reverse, direct, and reciprocal models depicted in Figure 1). Within the reciprocal model, we tested a moderated mediation model in which we expected grit to impact later literacy via the mediator of emotional engagement, with the effects of emotional engagement on literacy moderated by age.

## 4 | METHOD

### 4.1 | Sample

This sample included 142, largely Latina/o third, fourth, and fifth graders at a Title 1 suburban elementary school serving low-income students in the mid-Atlantic region of the United States. Table 1 details the demographics of this sample. The sample for this study was 54% female, an average age of 9.47 years old, and 75% Latina/o. The ethnicity of the remaining 25% included 14% Black and 8% Asian, in addition to 3% from other ethnic groups. Thirty-five percent of the sample was in third grade, 30% in fourth grade, and 35% in fifth grade. The school district did not give us permission to ask about immigrant generation or immigration status, countries of origin, or family income level, but the school-level statistics indicated that 95% of the students received free or reduced lunch. Only students who were dual language learners were included in this sample. In the literature, dual language learner operationalization ranges from more to less inclusive. For instance, the definition has ranged from less conservative operationalization like 'a child living in a household where at least one person older than 5 years speaks a non-English language' (Child Trends, 2014) to more conservative definitions. Using student and parent-report, we chose a more conservative, less inclusive operationalization and coded students as dual language learners if they spoke a language other than English with at least one parent. Note that our operationalization of dual language learner is different from the operationalization adopted by some school districts of dual language learners as students in two-language immersion schools. From the

TABLE 1 Demographics

Demographics	N	%
Child sex: Female	77	54
Age		
8 years	24	17
9 years	51	36
10 years	42	30
11 years	24	16
12 years	1	1
Grade level		
Third	50	35
Fourth	43	30
Fifth	49	35
Ethnicity		
Latina/o	106	75
Black	20	14
Asian	12	8
Other ethnic minority	4	3
White	0	0
Language spoken with at least one parent		
Spanish	89	63
French/Haitian Creole	11	8
Other (e.g., Vietnamese)	42	29

original sample of 149, we removed seven students who were not dual language learners. In sum, all of the students in this sample are dual language learners who have at least one parent who speaks a language other than English.

In this sample, 82% of students reported that a language other than English was the primary language spoken at home (Table 1). The remaining 18% reported English as the primary language spoken at home, in addition to speaking a language other than English with at least one parent at home. Note that there were no significant differences in average literacy scores at the 3 time points by English being the primary language spoken at home or not. Spanish was the language reported by 63% of the students as spoken with at least one parent, and an additional 13% spoke French/Haitian Creole with at least one parent and 29% spoke other languages with at least one parent (e.g., Vietnamese).

Nine teachers completed grit and engagement questionnaires for each of their participating students at each time point. Four fourth-grade, four fifth-grade, and one third-grade art teacher participated (1 male; 4 Black; 5 White). Each student's classroom teacher provided ratings for the fourth- and fifth-grade students. Third-grade teachers as a group declined participation in the study due to a demanding new workload for third-grade teachers, so the art teacher completed questionnaires on all third-grade participants. In the analysis section below, this study describes tests we conducted to rule out teacher cluster effects, and results suggested that there were no teacher cluster effects.

## 4.2 | Procedure

This study included variables collected at each of 3 time points over 4 months—teacher-reported emotional engagement and teacher-reported adapted grit in addition to a student performance literacy achievement task; these variables were part of a larger study (i.e., O'Neal, 2017, 2018; O'Neal et al., under review). Time 1 was collected from January to February 2014, Time 2 from March to April 2014, and Time 3 from May to June 2014. The time between Time 1 and 3 was nonequivalent between individual students. The mean number of days between Time 1 and 3 across students was 120 days, which is about 4 months; the standard deviation was 16 days.

All procedures were conducted with Institutional Review Board approval from the school district and researchers' university, including student assent and parent and teacher consents. Participants were recruited in Spanish and

English at a series of PTA meetings and via consent forms sent to parents. Of 256 students total in third through fifth grades at the school, the study sample represented a 55% recruitment rate. Comparisons of students who participated versus did not participate could not be conducted since nonparticipation was caused by failure to return consent forms, which included demographic information.

Given the dual language learner status of the students, we found that the method of reading the instructions and questions out loud, one-on-one to each student allowed us to best judge student comprehension of the questionnaire items, and promoted student comfort with asking clarification questions. Students with limited or no English language skills ( $n = 6$ ) were interviewed by Spanish-speaking researchers; one French-speaking student was interviewed by a French-speaking researcher. Each student also completed a 3-min reading performance task, after receiving one-on-one instructions from a graduate assistant. The reading task was administered in English regardless of language proficiency. At each time point, the teachers completed the engagement and adapted grit questionnaires online via Qualtrics.

### 4.3 | Measures

#### 4.3.1 | Grit

Teacher-reported student grit was assessed with an adaptation of the eight-item Short Grit Scale (Duckworth & Quinn, 2009). The original Short Grit Scale (Grit-S) was a self-report measure designed for youth or adult participants. Grit research has reported strong internal consistency, test-retest reliability, and convergent validity with similar measures like conscientiousness in youth and adult samples (e.g., Duckworth & Quinn, 2009).

The Grit-S scale item vocabulary and phrasing were adapted to improve comprehension of the Grit-S scale for this younger, limited English proficiency sample, and make it more relevant to the school context. For instance, we translated the original phrasing of the Grit-S item, 'I am a hard worker', into 'I am a hard worker in school'. We then adapted the student-reported grit items into teacher-reported grit items. Grit has two subscales—consistency of interests and perseverance of effort—which indicate a constant interest in a single goal (*consistency of interests*) and unwavering commitment to that goal (*perseverance of effort*) despite obstacles (Robertson-Kraft & Duckworth, 2013). Teachers rated how much four statements about the student's consistency of interests (e.g., 'This student often sets a goal but later chooses to pursue a different one'.) and four statements about perseverance of effort (e.g., 'The student finishes whatever s/he begins'.) described the student, on a 5-point scale (1 = *Not at all*, 5 = *Very much*). An adapted grit total score was created using an average of the eight items. For the purposes of parsimonious model testing and ease of comparison with other grit research, we employed the grit total summary score rather than the grit subscales as the predictor; the bivariate correlation between the grit subscales in this sample was high at .78. Teacher-reported adapted grit was selected as the grit indicator, not student-reported adapted grit, due to teacher-reported adapted grit's better internal consistency and stronger prediction of literacy achievement (O'Neal et al., under review). The teacher-reported grit alpha in this study was .92 at all 3 time points.

#### 4.3.2 | Emotional engagement

Emotional engagement was assessed using the five-item emotional engagement subscale of the Engagement versus Disaffection with Learning scale (EvsD; Skinner, Furrer, Marchand, & Kindermann, 2008); the items address student interest and enthusiasm in school (e.g., 'Class is fun'). Teacher-reported engagement items were the same as those which have been used with students in previous studies. Teachers rated the statements on a 5-point scale (1 = *Not at all*, 5 = *Very much*), and a mean score was calculated for the five items. The EvsD has shown adequate internal consistency in diverse elementary-aged samples. In this study, the teacher-reported emotional engagement alpha was .94 at Times 1 and 3, and .95 at Time 2.

#### 4.3.3 | Literacy achievement

Literacy achievement was assessed via an index score from the Test of Silent Reading Efficiency and Comprehension (TOSREC; Wagner, Torgesen, Rashotte, & Pearson, 2010) which is a performance task that assesses students' silent

reading fluency (speed), decoding (accuracy), and comprehension. Students have 3 min to read as many sentences as possible and decide if each is true or false. The TOSREC has excellent reliability and convergent validity with other measures of literacy such as the Woodcock-Johnson Tests of Academic Achievement (Kim, Wagner, & Foster, 2011).

#### 4.4 | Analyses

ARCR is useful for testing our first hypothesis comparing strength of directional, reverse, and reciprocal model effects, in addition to our second moderated mediation hypothesis (Selig & Little, 2012). ARCR models take advantage of multiple repeated measures on each variable across time and control for previous time points of all variables. We tested if there was a difference in model fit of a (1) reciprocal model including autoregressive and cross-lagged effects over 3 time points (M3 Reciprocal Model), with both a (2a) nested, directional model with socioemotional factors affecting achievement (M1 Directional Model), and a (2b) nested, reverse model with achievement affecting socioemotional factors (M2 Reverse Model) (see all three models depicted in Figure 1). We used maximum likelihood estimation (ML), with attrition of only two participants by Time 2. We expected that the reciprocal model would fit better than directional and reverse. Many fit indices were employed to evaluate model fit (Hu & Bentler, 1999)—Chi-square Statistic ( $\chi^2$ ), Akaike Information Criterion (AIC), Comparative Fit Index (CFI), Standardized Root Mean Squared Residual (SRMR), and for comparison of nested with the full, reciprocal model, we used  $\Delta\chi^2$  and  $\Delta\text{AIC}$ . To determine model fit, recommended CFI cutoff is greater than .95 and SRMR cutoff is less than .08 (Hu & Bentler, 1999). Given that directional and reverse models are not nested with each other, we compared AICs. Note that we have observed variables in our panel model, and factorial invariance across time cannot be tested in panel models with observed variables (Selig & Little, 2012).

Our second hypothesis tested the strength of a moderated mediation model, in the context of the reciprocal model. First we conducted a mediation analysis using Mplus indirect mediation testing with bootstrapping to determine if the relation between Time 1 (T1) grit and Time 3 (T3) literacy was mediated by Time 2 (T2) engagement, in the context of the reciprocal effects model. To test moderated mediation, we employed Preacher, Rucker, and Hayes' (2007) Model 3, which involves moderation of the path between the mediator and outcome, using the moderator of age. Structural equation modeling (SEM) analyses used Mplus and bootstrapping-tested significance with 10,000 sample replicates (Preacher, 2015). Hayes (2015) recently recommended the use of an index of moderated mediation instead of the traditional, but limited, interaction coefficient to determine moderated mediation significance. The index of moderated mediation is the product of regression coefficients—in our study, we test the product of the effect of grit on engagement (Path a) by the conditional effect of age on the relation between engagement and literacy (Path b). This product of regression coefficients is a slope which indicates the weight and size of the effect of the moderator on the indirect effect. Bootstrap confidence intervals of the product of coefficients are the recommended way to judge significance of the index, instead of the Sobel test (Hayes, 2015).

We argue that ARCR design allows shared variance between T1 grit and T2 engagement to be ruled out as a concern. We also offer statistical backing for the argument that grit and engagement may overlap somewhat but are largely two distinct constructs by doing a preliminary confirmatory factor analysis (CFA) that demonstrated adequate fit of the grit and engagement items loading onto separate grit and engagement constructs (RMSEA = .06, CFI = .97, SRMR = .04), with adequate loading magnitudes of .51 and higher onto their respective separate constructs. Indeed, the model with grit and engagement items loading onto separate grit and engagement constructs was a better fit than when the grit and engagement items were loaded onto one common construct (RMSEA = .11, CFI = .90, SRMR = .06).

Regarding teacher ratings, we needed to rule out construct-irrelevant variance due to potential differences in the way some teachers may have awarded scores (Kelcey, McGinn, & Hill, 2014). It is important to first test for clustering effects of differences among teacher raters on predictive paths prior to model testing (Asparouhov & Muthen, 2016). Therefore, we relied on Hayes' (2013) approach to two-level cluster effects testing with random effects to determine whether each path in our model differed by teachers who completed the teacher-report. There was no evidence of between-teacher variation in any of the ARCR model paths given that the between-teacher variance for each path was not significant (e.g., Path a variance: Estimate = .01(.14),  $p = .94$ ; Path b variance: Estimate = 1.51(31.01),  $p = .96$ ).

TABLE 2 Descriptives and correlations among grit, engagement, and literacy

	<u>1</u> T1	<u>2</u> T1	<u>3</u> T1	<u>4</u> T2	<u>5</u> T2	<u>6</u> T2	<u>7</u> T3	<u>8</u> T3	Mean (SD)
1. T1 Engagement	-	-	-	-	-	-	-	-	4.11 (.88)
2. T1 Grit	.76***	-	-	-	-	-	-	-	4.00 (.89)
3. T1 Literacy	.33***	.34***	-	-	-	-	-	-	84.65 (13.00)
4. T2 Engagement	.74***	.67***	.34***	-	-	-	-	-	4.06 (.89)
5. T2 Grit	.60***	.76***	.29**	.77***	-	-	-	-	3.93 (.98)
6. T2 Literacy	.28**	.30***	.71***	.31***	.23**	-	-	-	87.45 (14.63)
7. T3 Engagement	.75***	.62***	.28**	.78***	.64***	.27**	-	-	4.15 (.82)
8. T3 Grit	.61***	.75***	.39***	.77***	.85***	.29**	.77***	-	4.05 (.86)
9. T3 Literacy	.33***	.33***	.76***	.38***	.26*	.77***	.25**	.31***	86.14 (14.05)

Note.  $n = 142$ . T = Time; T1 was collected from January to February 2014, T2 from March to April 2014, and T3 from May to June 2014. Grit and engagement are teacher-reported, and literacy is a student-completed performance task.

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

## 5 | RESULTS

### 5.1 | Means and correlations

Although some studies have found that teachers tend to underestimate ethnic minority student ability (e.g., see meta-analysis by Tenenbaum & Ruck, 2007), teachers in this sample rated student engagement and grit a bit higher than levels reported in studies with student self-reported engagement and grit research among youth and adults (see Table 2). Student literacy achievement was low, at an average of 19th percentile at T3. The means of all variables at each time point can be found in the correlation table (Table 1). The grit, engagement, and literacy achievement constructs did not show significant growth over the period of observation (e.g., standardized estimate of latent growth in literacy achievement slope = .17[.17],  $p = .31$ , CI[-.16, .49]).

As expected, mediation path correlations were significant with T1 grit correlated with T2 engagement, which, in turn, was positively related to T3 literacy achievement. Although there was a strong bivariate correlation of T1 grit with T2 engagement ( $r = .67$ ), it was not too strong for mediation testing because our mediation model was in the context of an autoregressive, cross-lagged model in which T1 grit adjusted for (was set to correlate with) T1 engagement, and T2 engagement adjusted for T2 grit (see Analysis section).

### 5.2 | Model comparisons

The Mplus difference test results in Table 3 indicated that there was a significant difference between the reciprocal and direct models ( $\Delta\chi^2 = 37.57$ ,  $\Delta df = 8$ ,  $p < .001$ ,  $\Delta AIC = 31.58$ ) and the reciprocal and reverse models ( $\Delta\chi^2 = 38.46$ ,  $\Delta df = 8$ ,  $p < .001$ ,  $\Delta AIC = 28.49$ ). Results indicated that, as hypothesized, direct (SRMR = .12, CFI = .91) and reverse (SRMR = .11, CFI = .91) effects models did not fit the data as well as the reciprocal effects model (Table 3); the reciprocal model fit was adequate (SRMR = .04) or approaching adequate (CFI = .92). An informal comparison of the AICs of the direct (AIC = 4439.67) and reverse (AIC = 4436.58) models suggested that there was no difference between the two. The only significant cross-lagged path in the direct model was T2 engagement on T3 literacy, Estimate = 2.33 (.91),  $p < .05$ , and in the reverse model, the only significant path was T1 literacy on T2 engagement, Estimate = .01 (.004),  $p < .01$ . Within the reciprocal model, there was a significant direct effect of T2 engagement on T3 literacy, but no significant reverse effects of literacy on socioemotional factors (Figure 2).

**TABLE 3** Model fit comparison of directional (M1), reverse (M2), and reciprocal autoregressive cross-lagged models (M3), including mediation and moderated mediation results

Model	Model fit					Model comparisons				
	$\chi^2$	$\Delta df$	AIC	CFI	SRMR	Comparison	$\Delta\chi^2$	$\Delta df$	$p$	$\Delta AIC$
M1. Direct (SE impacts literacy)	84.50	17	4439.67	.913	.12	Direct vs. reciprocal	37.57	8	.00	31.58
M2. Reverse (literacy impacts SE)	83.45	17	4436.58	.914	.11	Reverse vs. reciprocal	38.46	8	.00	28.49
M3. Reciprocal (reciprocal model)	67.68	9	4408.09	.924	.04					
Mediation path tested in M3:	$\beta$	CI (95%) <sup>a</sup>	Moderated mediation path tested in M3:			$\beta$	CI (95%) <sup>a</sup>			
T1 Grit→ T2 Engagement→ T3 Literacy	.04*	(.01, .11)				.43*	(,04, 1.15)			

<sup>a</sup>Bootstrap-based confidence intervals.

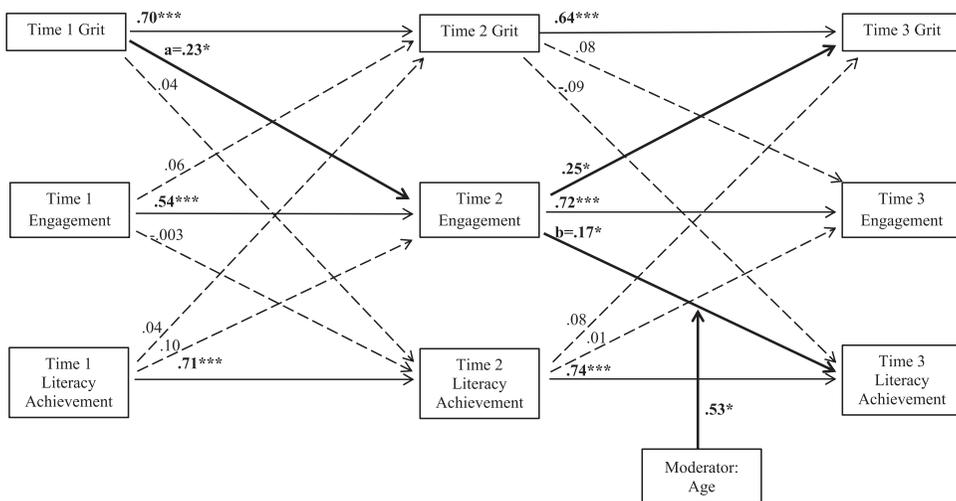
\* $p < .05$ .

### 5.3 | Mediation

Within the ARCR reciprocal model, the mediation model had adequate model fit and the estimate was significant for the indirect path from T1 grit to T3 literacy mediated by T2 emotional engagement,  $\beta = 1.68, p < .05, CI(.01, .12)$  (Table 3; Figure 2).

### 5.4 | Moderated mediation

Within the reciprocal ARCR reciprocal model, we tested moderated mediation using Preacher and colleagues' (2007) Model 3 in which a mediation model includes the moderation of Path b. Results in Table 3 and depicted in Figure 2 supported the hypothesis of moderated mediation—T1 grit to T3 literacy was mediated by T2 engagement and



**FIGURE 2** Results for moderated mediation in M3 Reciprocal Model: Autoregressive cross-lagged panel reciprocal model. Errors and correlations among all predictors within each time point (e.g., a correlation was set between T1 engagement and T1 grit) were included in analyses but not depicted in this figure. Bold lines are significant cross-lagged paths; dashed lines are not significant. \* $p < .05$ ; \*\*\* $p < .001$

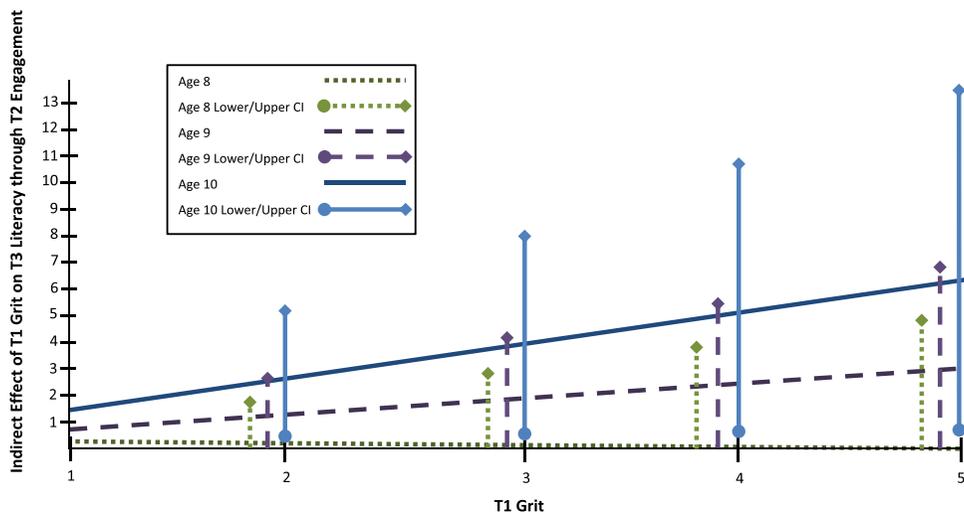


FIGURE 3 Stronger indirect effect of T1 grit on T3 literacy via T2 engagement for older students than younger students

moderated by age, with a significant, positive index of moderated mediation,  $B = .43$ ,  $p < .05$ ,  $CI (.04, 1.15)$ . Given that the index of moderated mediation—the slope of the line—is positive (Hayes, 2015), the indirect effect of grit on later literacy achievement through engagement increases with increasing age. Figure 3 depicts that there is a stronger indirect effect of T1 grit on T3 literacy through T2 engagement for older students than younger students.

Perhaps the significant moderation by age, in the context of mediation, was due to the construct-irrelevant variance of the third-grade art teacher reporting all of the third-grade students' grit and engagement, while the fourth- and fifth-grade students' grit and engagement were reported by their classroom teachers. To rule out the possibility of construct-irrelevant, grade-level reporting differences on Path b, we tested and confirmed that the moderated mediation results were still significant, and nearly the same magnitude, when we tested if the index of moderated mediation result remained significant when the grade clusters (i.e., grade dummy codes; McNeish & Stapleton, 2016) were added to the b path, Estimate =  $.45(.29)$ ,  $p < .05$ ,  $CI (.03, 1.21)$ .

There was a high bivariate correlation between T1 grit and T2 engagement, but the ARCR model allowed us to isolate the element of T1 grit, separate from T1 engagement, when predicting later T2 engagement (Path a), which controlled for T2 grit. Indeed, the lower beta weight of  $.23$  between T1 grit and T2 engagement in the ARCR moderated mediation model suggests that the relation between T1 grit and T2 engagement was not inflated when in an ARCR model. Therefore, we were able to rule out concerns about excessive overlap between teacher-reported grit and engagement in the moderated mediation model.

## 6 | DISCUSSION

This study advanced our knowledge of reciprocal and indirect processes between socioemotional factors (i.e., engagement and grit) and literacy achievement among culturally and linguistically diverse elementary school students. A reciprocal model (i.e., socioemotional factors affecting literacy achievement, and literacy achievement affecting socioemotional factors) fit better than either a directional (i.e., socioemotional affects literacy) or a reverse model (i.e., literacy affects socioemotional). Grit was a stronger predictor of later literacy achievement via the mediator of engagement among older, but not younger, elementary school students. This study offered a strong design for testing the mediating effect of engagement in accounting for the effect of grit on students' later literacy achievement because the ARCR design controlled not only for previous levels of the dependent variable but also for the previous level of the mediator. This is the first study, to our knowledge, examining how and for whom these constructs are related among low-income, ethnic minority, dual language learners.

The reciprocal model results can be framed in terms of mutual dependence between socioemotional factors and literacy achievement for dual language learners (e.g., Marsh et al., 2017). The results indicated that the reciprocal effects, as a whole, were important, but it should be noted that no single reciprocal effect drove the significantly stronger model fit of the reciprocal model compared to the direct and reverse models. Previous literacy achievement must play a role in later socioemotional processes and literacy for low-income dual language learners for whom learning English can be frustrating, and for whom much of the U.S. literacy education system has failed (Gánadara et al., 2003; National Academies of Sciences, Engineering, & Medicine, 2017). The reciprocal model had the strongest fit in this sample, and there was no difference between the fit of direct and reverse models. Often, in the U.S., educators tend to separate out the socioemotional from achievement, but these results echo voices that call for more integration of socioemotional with academic learning (Collaborative for Academic, Social, and Emotional Learning [CASEL], 2013) and for more research on culturally relevant classroom engagement (Gay, 2010) to improve literacy engagement and education of dual language learners.

Moderated mediation results identified how grit may impact emotional engagement and subsequent literacy achievement in school, with potential consequences for older elementary, culturally and linguistically diverse students. Engagement was a stronger mediator of the impact of grit on later literacy for older, rather than younger, students. These mediation results offer the new contribution that engagement plays a role in how grit leads to better achievement (e.g., Duckworth et al., 2010), which is a model that, to our knowledge, has never been tested. This result is similar to motivation models and previous research indicating that motivation may impact literacy achievement via engagement among elementary and middle school students (Wigfield et al., 2015).

This study found that engagement was a stronger mediator of the impact of grit on literacy achievement for older, rather than younger, elementary school students. Socioemotional processes involving emotional engagement and grit may, indeed, be important for older dual language, elementary school students' literacy achievement (Von Culin et al., 2014). Although the time frame was short (4 months), the strength of the indirect effect with age may indicate that older elementary students' personality characteristics are more likely to have 'crystallized' or accumulated over time, while younger students may be more variable in their personality characteristics. This crystallization of grit and engagement may strengthen the relations between these socioemotional factors and literacy with age. More research needs to examine how the relations of grit and engagement with achievement differ across childhood and diverse samples (Muenks et al., 2016). Nastasi, Varjas, Bernstein, and Jayasena (2000) recommend identifying processes unique to specific cultures and demographic groups rather than assuming a one-size-fits-all approach to intervention development. Thus, the moderated mediation results of this study may have culture-specific implications for future research on socioemotional and literacy achievement intervention development among dual language learners (e.g., Taboada Barber & Gallagher, 2015).

## 6.1 | Limitations

The short length of 4 months for this longitudinal study may be a concern because there was neither significant growth in literacy nor in grit and engagement over the 4-month time period. Such lack of growth may reflect a lack of developmental change in literacy achievement. This particular measure of literacy achievement, however, may also be unlikely to detect change in literacy achievement over such a short time. Note that the minimal, but non-significant, change observed when eyeballing the means over time may have been influenced by (a) routine variation caused by multiple testing; or (b) variability due to attrition; however, there was little attrition because only two participants dropped out over the course of the study. This short-term design is unlikely to be a serious flaw in this reciprocal, moderated mediation model given that our model testing was focused on how socioemotional factors are related to each other and later literacy achievement, and not on growth in grit, engagement, and literacy over time. An additional critique is that a short-term longitudinal design may not best capture the processes in this model. Short-term longitudinal studies, on the other hand, may be ideal for testing mediation models due to many variables having their strongest impact in a shorter time (Lerner & Lamb, 2015), but research should test the length of time necessary to detect possible effects of socioemotional factors on achievement, or vice versa.

Given the importance of a contextual, ecological model for the study of ethnic minority, dual language students, future studies need to also collect data on contextual factors which may impact engagement and subsequent literacy achievement (e.g., quantity and quality of English learner instruction; Ansari & Gershoff, 2015). This study had a sample with low literacy, which did not adequately represent the wide variation in academic English across most dual language learners in the general population. Future sampling designs should tap a more representative range of dual language literacy levels. Note that this study was conducted in the context of a larger study that included student-reported grit and engagement; such student-reported completion of grit/engagement measures could have potentially affected the student grit/engagement which teachers reported in this study. In addition, a larger sample would permit a more complex model to be tested; an ideal model would include more control factors which might be relevant (e.g., socioeconomic status; parent literacy levels). Also, given that acculturative experiences may differ by different Latina/o groups (Coll et al., 1996), we recommend that future research collects data regarding with which ethnic group the participants identify. It should be noted that the teachers in this sample reported engagement and grit levels that were a bit higher, on average, compared to student-reported grit levels in other studies; however our previous research has found that the average student-reported engagement and grit levels in this sample were about the same as reported in other studies (e.g., O'Neal et al., under review). It may be worth studying a sample with a wider range of teacher- and student-reported grit and engagement. Finally, there was a high zero order correlation between T1 grit and T2 engagement, but the ARCR model allowed us to isolate the element of T1 grit, separate from T1 engagement, when predicting later T2 engagement, controlling for T2 grit; the low beta weight between T1 grit and T2 engagement in the moderated mediation model suggested that the relation was not inflated when in an ARCR model.

## 7 | CONCLUSIONS

This study makes a contribution by identifying reciprocal effects between socioemotional factors and literacy achievement, in addition to how and for whom such processes may be significant. This study's results, however, are too preliminary for intervention development, so continued systematic model testing across demographic groups will be important given recent media attention to grit and premature recommendations for grit-related interventions for ethnic minority students despite there being little empirical base for such recommendations (e.g., Shechtman, DeBarger, Dornsife, Rosier, & Yarnall, 2013). Future socioemotional and literacy achievement research with low-income, culturally and linguistically diverse students may be useful to provide culturally-informed socioemotional targets for dual language learner literacy interventions.

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