Predictors of grit: A multilevel model examination of demographics and school experiences

Dana Linnell Wanzer [a]

Claremont Graduate University

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Abstract

Much of the research on grit has examined its predictive validity toward academic success; however, little research has treated grit as an outcome. This study uses multilevel modeling to examine how student-level demographics, school-level demographics, and students' experiences in school predict grit. Results demonstrate that students' experiences in school—including school engagement, relationships with adults and peers, and school culture—and self-reported GPA were most strongly related to grit, ethnicity was weakly related to grit, and gender and school demographics did not significantly relate to grit. Implications of this research on the potential malleability of grit are discussed.

Keywords: grit, school experiences, engagement

Predicting individual and school differences in grit using multilevel modeling

Educators and parents are invested in the academic performance of youth and are constantly seeking strategies to improve academic performance, such as GPA, test scores, and persistence in education through college and beyond. One area that has gained traction in recent years is how non-cognitive factors—including academic behaviors, perseverance, mindsets, learning strategies, and social skills (Farrington et al., 2012)—relate to and improve academic performance. Academic perseverance—which can include grit, self-control, and persistence in academic tasks—has especially received ample focus in the research literature as a promising strategy to improve academic performance and has been shown to improve academic behaviors, performance, and success. Thus, many educators and parents are interested in strategies to influence academic perseverance and other non-cognitive factors to thereby improve academic performance. This first requires examining the malleability—or capacity for change—within non-cognitive factors to determine whether they can be influenced by interventions.

However, the extent to which academic perseverance is malleable is questionable and largely depends on the conceptualization of perseverance used. Grit is one popular conceptualization of perseverance that has gained traction in academia and schools. The original concept of grit was defined as consistent across time and context (Duckworth et al., 2007). Grit, in this case, is much like a personality trait, and as a result it has been found to be highly correlated with the Big Five trait of conscientiousness ($\rho = .84$; Credé, Tynan, & Harms, 2016). While the Big Five display some degree of malleability across the lifespan (Mike, Harris, Roberts, & Jackson, 2015)—and are especially malleable in youth when grit is most commonly assessed (Briley & Tucker-Drob, 2014)—they are largely considered to be fixed traits such that interventions or the environment cannot change them much.

At the same time, grit has also been conceptualized as a malleable construct that can be cultivated and improved (Duckworth, 2016), however grit may be more malleable in certain situations than others (Farrington et al., 2012). For instance, *academic* perseverance has been shown to be more malleable than perseverance in general and significant evidence demonstrates that academic perseverance differs across different academic tasks and under different conditions (Farrington et al., 2012). Thus, while grit may not be malleable in a larger sense of the term, grit in certain situations—like in school when persisting at academic tasks—has the capacity to be cultivated.

In support of this hypothesis, some research suggests that much of the differences in grit may be attributable to the school environment (Farrington et al., 2012). Grit has been shown to be positively correlated with school motivation ($r = .49$), perceived peer support ($r = .42$), perceived teacher support ($r = .38$), and perceived school safety ($r = .15$; Eskreis-Winkler, Shulman, Beal, & Duckworth, 2014). Research has also suggested two environmental characteristics necessary to promote grit, such as having the opportunity to take on long-term goals that one feels worthy of pursuit and having a rigorous and supportive learning environment to help them pursue these goals (Shechtman, DeBarger, Dornsife, Rosier, & Harnall, 2013). Others suggest the school and classroom environment improve students' perseverance by influencing their academic mindsets (e.g., growth mindset or academic motivation) or their learning strategies (e.g., metacognition or self-regulation; Farrington et al., 2012). However, while the school environment, and especially students' experiences in their school, have been found to be related to student levels of grit, no research has examined how school contextual factors—including the size, poverty status, charter status, or location—can also affect grit.

Other research has examined how differences in grit broadly defined can be attributed to student characteristics. For instance, females and Black students have demonstrated higher levels of grit, Hispanic students have demonstrated lower levels of grit, and receipt of free or reduced priced lunch has not been demonstrated to be related to grit (Eskreis-Winkler et al., 2014). However, differences in grit across ethnicity and gender are typically small in effect size (Credé et al., 2016) lending support that the school environment is more important in predicting differences in grit.

The research thus far on individual differences in grit suggest that grit—in the context of academic perseverance—may be a malleable construct in that school environment factors can influence grit. If grit is indeed a malleable construct, examining what predicts grit is a useful first step in determining what factors may be most influential to change for future intervention studies. Thus, the purpose of this study is to examine how student characteristics (i.e., ethnicity, gender, GPA), school characteristics (i.e., school size, level, poverty status, charter status, location), and school environment (e.g., school culture) relates to grit and which factors are most important in predicting individual differences in grit. Based on previous research, the school environment should be strongly related to differences in grit and student characteristics will be less strongly related to grit. As there is no previous research on how school characteristics relate to grit, it is hypothesized that they will also be less strongly related to grit than the school environment

Methods

Participants

Data was received from the Overall School Experience Survey provided by YouthTruth, a nonprofit that partners with schools and other educational organizations to provide survey

instruments and tailored advisory services. YouthTruth is a national nonprofit that operates with grant support and fee-for-service revenue with interested schools. As such, YouthTruth surveys are not a fully national representative sample.

Data provided included all middle and high school youth they had surveyed since 2007, comprising 219,069 students in 484 schools mostly in the United States. The grit scale was an optional add-on that schools could choose to include in YouthTruth's Overall School Experience Survey, and so only 59,236 students across 154 schools had grit data. Missing data analyses on these students with grit data revealed that many students did not report whether they had free or reduced lunch (57% of students with missing data) and thus this variable was not included in analyses. After removing cases with missing data, there remained 45,626 students across 145 schools (77% of cases with grit data). Table 1 describes the sample of students, and the schools they attended, that had no missing data and were used in subsequent analyses. Majority of these students were in the United States, with 28.0% from California, 21.3% from North Carolina, 36% from Texas, and 12.7% from other states; a further 829 (1.8%) students were from Singapore and retained in analyses as removing them did not significantly alter any of the results presented below.

Measures

Three sets of measures from the Overall School Experience Survey were used in the analyses: student demographics, school demographics, and school experience factors. Student-level demographics offered in the survey included grade level, gender (e.g., male, female, other identification, prefer not to say), race and ethnicity (e.g., White, Black or African American, American Indian or Alaska Native, Asian, Native Hawaiian or other Pacific Islander, Hispanic/Latino, Other, Prefer not to say), whether or not they receive free or reduced priced

lunch, and self-reported GPA (e.g., Mostly As, Mostly Bs, Mostly Cs, Mostly Ds or below, Don't know, Prefer not to say). However, students were not required to answer any questions they did not wish to answer, which resulted in missing data across all the variables, mostly for receipt of free or reduced priced lunch which was not included in analyses. Grade level was not included in the analyses as school level was included as a school-level demographic variable. Furthermore, two ethnicities (i.e., American Indian or Alaska Native, Native Hawaiian or other Pacific Islander) were only endorsed by less than 2% of students and thus were not included as an examined variable.

School-level demographics were collected by school administrators and reported as dummy coded values. Variables included school level (i.e., middle or high school), high poverty status (i.e., 70% or more of a schools' students received free or reduced priced lunch), the size of the school (i.e., large schools had more than 1,200 high school students or 800 middle school students), the size of the city (i.e., large city schools were located in an urbanized area and in a principal city with a population of 250,000 or more), and the type of school (i.e., charter or non-charter school).

The main portion of the Overall School Experience Survey is the six school experience factors. Student engagement describes the degree to which students perceive themselves as engaged with their school and their education; middle school students responded to three of the six engagement items that high school students responded to. Relationships with teachers describes the degree to which students feel they receive support and personal attention from their teachers. Relationships with peers describes the degree to which students have supportive, collaborative relationships with their classmates. School culture describes the degree to which students believe that their school fosters a culture of respect and fairness; middle and high school

students responded to three of the same questions but the fourth item differed slightly between middle school students (i.e., "I think my classmates want to do well in class.") and high school students (i.e., "Most students in this school want to do well in class."). Two factors (i.e., academic rigor, college and career readiness) were not included in the analyses as there were large amounts of missing data on these factors (i.e. 28% missing academic rigor, 9% missing college and career readiness). Lastly, grit was assessed using the 8-item Short Grit Scale developed by Duckworth and Quinn (2009).

Previously established Cronbach's alphas for middle school and high school are provided in Table 2 (YouthTruth, 2013). Cronbach's alphas were not provided for grit, but a recent meta-analysis showed grit has a strong internal consistency of .79 (Credé, Tynan, & Harms, 2016). As is typical, the Cronbach's alphas for middle school youth were slightly lower than those of the high school youth but all were sufficiently high. Data were provided to the researcher in aggregate form, including the grit scale; therefore, Cronbach's alphas could not be calculated for the analyzed sample and grit could not be analyzed separately by its two subscales of persistence and consistency of effort.

Procedures

Surveys were administered in a two-week survey window online or on paper and in English or in Spanish; however, the data did not provide information on which language the survey was administered. Most surveys were administered online. If students took the survey online, YouthTruth provided a set of student login codes that the school distributes to anonymize data. Schools then planned a survey administration schedule to administer the survey to all

students.[1] Schools were encouraged to meet a minimum response rate of 60% and average response rates range from 70-84%. Deidentified data was provided to the researcher with student and school demographic information as well as mean scores on all school experience factors and grit.

Analytic Procedures

First, the school experience scales were grand mean centered to aid in interpretation of coefficients in the multilevel models. All multilevel analyses were conducted with the lme4 package in R (Bates, Maechler, Bolker, & Walker, 2015). Multilevel models were applied to account for the clustering at the school level. Multilevel modeling was selected for the present study because the data (students nested within schools) and research questions (that both student-level and school-level factors predict grit) are multilevel in nature (Gelman & Hill, 2007). Simple regression analyses are unable to account for the non-independence of observations such that students from the same schools are likely to have correlated errors (Gelman & Hill, 2007).

A total of eight models were tested with 45,626 students (level 1) nested in 145 schools (level 2). The first was the null model (i.e., the unconditional model) which was used to calculate the intra-class correlation (ICC) and served as a baseline for comparing model fit (i.e., Akaike information criterion [AIC] values) and between-school and within-school variance explained. The second, third, and fourth models examined student-level demographics, school-level demographics, and the combination of demographics, respectively. The fifth model examined the school experience factors and the sixth and seventh models examined school experience factors in conjunction with student-level and school-level demographics, respectively. Last, the eighth model (i.e., the full model) examined all three sets of explanatory variables in tandem.

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[1] More information can be found on YouthTruth's website: http://www.youthtruthsurvey.org/wp-

Each model was compared by the AIC values as not all models were nested. Furthermore, between-school and within-school variance explained was calculated for each model as:

$$v_{explained} = \frac{v_{null} - v_n}{v_{null}} \; x \; 100$$

where v is the school or individual level variance, $null$ is the null model, and n indicates the non-null model that is compared to the null model.

Results

Descriptive Analyses

First, descriptive analyses were performed to look at the distribution of grit and how grit differed across the other variables individually. As shown in Figure 1, there was large variability in grit scores among students, but very low variability among schools.

Grit was next analyzed across all student- and school-level predictors (see Table 3) and school experience factors (see Table 4). Although there were statistically significant differences across gender, self-reported GPA, ethnicity, school type, school size, school level, and city size, the effect sizes were small and ranging from a Cohen's $d = .026$ to $.124$. All four student experience factors were positive and moderately correlated with grit. The strongest correlation was between grit and engagement ($r = .362$, $p < .001$), followed by relationships with adults ($r = .317$, $p < .001$), relationships with peers ($r = .275$, $p < .001$), and lastly by school culture ($r = .216$, $p < .001$).

Multilevel Modeling Analyses

Table 5 shows the results of the multilevel analyses. As shown in Model 0, the ICC of .0195 indicates that only 1.95% of student-level variation in grit can be predicted by school.

This low ICC indicates that grit relates to the level-1 (i.e., student-level) factors and not the level-2 (i.e., school-level) factors. With such low variance accounted for at level 2, it may be deemed acceptable to proceed with simple hierarchical regressions; however, some argue that even when the ICC approaches zero, multi-level modeling might still be essential (Nezlek, 2008). Furthermore, multilevel modes would reduce to a simple hierarchical regression if there were no correlated errors at the school-level, but is able to capitalize on even small levels of error correlations between students within schools.

Models 1, 2, and 3 examined student- and school-level demographics as predictors of grit. In these three models, Black, Multi-Racial, White, and self-reported GPAs were significant student-level predictors while only large schools were a significant school-level predictor of grit. Aside from small changes in coefficient values, Black, Multi-Racial, and White students had relatively higher levels of grit than students of other ethnicities, respectively; students with higher reported grades had higher levels of grit; and students not at large schools had higher levels of grit. The relative lack of significant school-level demographics can be explained by the low ICC value.

Model 4 examined only school experience factors as predictors of grit. Model comparisons using AIC values indicate this model was a better fitting model than models 1, 2, and 3. All four school experience factors were significant predictors of grit. Higher levels of student engagement, relationships with adults, and relationships with peers were related to higher levels of grit while lower levels of school culture were related to higher levels of grit.

Models 5 and 6 examined school experience factors in conjunction with student-level and school-level demographics, respectively, and model 7 examined all three sets of predictors in tandem. Standardized beta weights and their 95% confidence intervals are provided in Figure 2.

Results indicate that school experience factors continue to be strong predictors of grit. Student-level demographics changed slightly such that Asian students had significantly lower levels of grit than non-Asian students when examined in conjunction with school experience factors. The only school-level demographic predictor—large schools—became non-significant when examined in conjunction with school experience factors.

Model comparisons using AIC values indicate that model 5, which included only student-level demographics and school experience factors, was the best fitting model. Results indicate that the set of predictors in model 6 explains 57.93% of the between-school variance and 15.55% of the within-school variance in grit. Overall, student engagement was the strongest predictor of grit ($B = .194, SE = .005$) followed by relationships with adults ($B = .120, SE = .005$) and relationships with peers ($B = .090, SE = .005$). Self-reported GPA was the next strongest predictor ($B = .061, SE = .004$) followed by Black ($B = .045, SE = .013$), Multi-Racial ($B = .042, SE = .012$), and school culture ($B = -.036, SE = .005$). Asian ($B = -.035, SE = .015$) and White ($B = .025, SE = .011$) were weaker predictors of grit. All other predictors were not statistically significant.

Comparisons between model 3 (student- and school-level demographics) and the full model indicate that school experience factors explain an additional 36.97% of between-school variance and an additional 12.59% of within-school variance over and beyond that of student-level and school-level demographics. Conversely, comparisons between model 4 (school experiences only) and the full model demonstrate that student-level and school-level demographics only explain an additional 3.23% of between-school variance and an additional 0.62% of within-school variance.

Discussion

Results support previous research suggesting that while student characteristics demonstrate individual differences in grit, the school environment plays a more important role in determining grit levels (Farrington et al., 2012). In terms of student characteristics, ethnicity and student GPA were significant predictors of grit while gender was not related to grit. Results for ethnicity were mixed: Black, Multi-Racial, and White students had higher grit scores than non-Black, non-Multi-Racial, or non-White students, respectively; Asian students had lower grit scores than non-Asian students only after accounting for school experience factors; and Hispanic students did not differ from non-Hispanic students in grit. However, the effect sizes of ethnicity were very small; this aligns with previous research suggesting weak correlations between ethnicity and grit, though gender has also been found to be related to grit which this research does not support (Credé et al., 2016; Eskreis-Winker et al., 2014). Students with higher self-reported GPAs had higher levels of grit than students with lower self-reported grades which mirrors previous research finding moderate correlations between the two (Credé et al., 2016).

In terms of school environment, the only school demographic that was related to grit was that students in large schools reported lower grit than students in smaller schools; however, this effect disappeared after taking into consideration school experience factors. School experience factors were the strongest factors that predicted grit, with student engagement having the strongest relationship with grit. This aligns with previous research showing grit to be moderately correlated with school motivation, peer support, teacher support, and school safety (Eskreis-Winker et al., 2014). However, while student engagement, relationships with teachers, and relationships with peers were all strongly *positively* related to grit, school culture was *negatively* related to grit when all four school experience factors were combined in the model. This is

despite simple student-level and school-level correlations demonstrating moderately strong positive correlations between grit and school culture (see Table 4). This suggests that school culture plays an important role in predicting grit after controlling for other school experience factors; specifically, although school culture is positively correlated with grit, the part of school culture that is independent of the other school experience factors is negatively correlated with grit. This could also be interpreted that students with lower school experience factors and lower grit need higher school cultures to improve grit levels.

Overall, school experience factors were more important than student characteristics in predicting grit and school characteristics had no relationships with grit. School experience factors explained an additional 36.9% of between-school and 12.5% of within-school variance over and beyond that of student-level and school-level demographics whereas demographics only explained an additional 2.7% of between-school and 0.6% of within-school variance over and beyond that of school experience factors. However, even though school experience factors were extremely important, they were only important at the student-level. The low ICC value and the variation between schools was not significant enough to warrant random slopes in models. For instance, the random slopes variances for the four school experience factors ranged from .004 to .007 and the correlations between the random slopes and random intercepts were all close to zero. Thus, what is most important is students' perceptions of their school experiences rather than overall school climate. This study supports previous research that has shown that students within the same schools do not have the same experiences and depend on individual perceptions of the school climate more so than overall school climate (Ozer, 2017).

This implies that future grit interventions should focus on the individual's perceptions of the environment person and that school-wide interventions may not have as large an effect on

grit. This supports current work being conducted on grit interventions. Some interventions that have been conducted include having participants (a) think and act like people they thought were "gritty" and (b) become a "grit mentor" and asking participants to help others improve their grit, could improve levels of grit (Eskreis-Winkler, 2015). Despite the lack of studies examining predictors of grit, Duckworth acknowledges that they are "just beginning to explore the psychological antecedents of grit" by examining such factors as optimistic explanatory style and growth mindset (Duckworth & Eskreis-Winkler, 2013).

Limitations and Future Directions

Despite results demonstrating the importance of students' perceptions of the school environment in predicting levels of grit, there are some limitations to this study. First, the data are cross-sectional and causality nor directionality can be determined from these results. In particular, self-reported GPA was examined as a predictor of grit whereas the majority of the literature examines how grit predicts GPA and other measures of success. Furthermore, previous research examining relationships between grit and other factors tend to find stronger relationships when they are measured concurrently than when they are measured longitudinally which warrants future longitudinal studies (Farrington et al., 2012). Second, all student-level data is self-reported and all issues related to self-report methodology (e.g., honesty, introspective ability, understanding, issues with rating scales, response bias, social desirability) could have affected the data. For instance, students' knowledge of their academic performance may influence their responses to the grit scale and vice-versa. Third, all scales were provided as scale scores and item-level data was not provided. This meant that the sub-scales of grit (i.e., perseverance and consistency of interest) could not be analyzed separately.

Future studies should examine other potential predictors of grit. For instance, previous research suggests that academic mindsets and learning strategies are strong predictors of grit and warrant examination (Farrington et al., 2012). Furthermore, this study was unable to analyze data for the two subscales of grit; future studies should attempt to reproduce these findings with the two subscales. Future directions can also include creating interventions based on these results, such as influencing student engagement in school as an intervention to promote higher grit. Finally, the significance of ethnicity as a predictor should be examined further; measurement invariance of the grit scale could be analyzed to determine whether students of different ethnicities are understanding the items in the same manner.

Conclusion

Overall, these results suggest that school experiences are strongly related to grit. The malleability of school experiences—such as peer and teacher relationships, school culture, and student engagement—suggest that grit may also be amenable to change and thus also more malleable than a personality trait might suggest. The strong effects of school experiences, particularly at the student-level rather than school-level, suggest the perceived environment is playing a significant role above and beyond student- and school-level demographics. Thus, future intervention studies can and should be explored to promote grit to improve academic performance and future life success.

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Table 1. *Descriptive Data*

Student Demographics (*n* = 45,626)	Frequency	Percent
Female	23,353	51.2%
American Indian	301	0.7%
Asian	3274	7.2%
Black	5,377	11.8%
Hispanic	13,808	30.3%
Multi-Racial	6,066	13.3%
Pacific Islander	210	0.5%
White	13,596	29.8%
Self-Reported GPA	*M* = 3.26	*SD* = .78
School Demographics (*n* = 145)	**Frequency**	**Percent**
High School	92	63.4%
Charter	24	16.6%
High Poverty	34	23.4%
Large City	32	22.1%
Large Size	28	19.3%
Student Experience Factors (*n* = 45,626)	**M**	**SD**
Student Engagement	3.58	.75
Relationships with Teachers	3.47	.79
Relationships with Peers	3.45	.71
School Culture	3.22	.83
Grit	**3.49**	**.63**

Table 2. Internal Consistency for School Experience Factors across School Level

Factor	Cronbach's Alphas	
	Middle School	High School
Student Engagement	.66	.82
Relationships with Teachers	.81	.86
Relationships with Peers	.71	.74
School Culture	.68	.78

Table 3. Differences in Grit Across Student- and School-Level Factors

Variable	Statistic	Effect Size	Group 1:	M (SD)	Group 2:	M (SD)
Gender	$t\,(45,\,624) = 5.06$, $p < .001$	$d = .048$	Female:	3.50 (.61)	Male:	3.47 (.66)
Ethnicity	$F\,(3,\,45,622) = 24.01$, $p < .001$	$\eta^2 = .002$	Black:	3.53 (.71)	Hispanic:	3.45 (.64)
		$(d = .090)$	White:	3.50 (.60)	Other:	3.49 (.63)
School Type	$t\,(45,624) = 7.41$, $p < .001$	$d = .124$	Charter:	3.56 (.65)	Public:	3.48 (.63)
School Size	$t\,(45,624) = 5.36$, $p < .001$	$d = .050$	Large:	3.47 (.61)	Small:	3.50 (.65)
School Level	$t\,(45,624) = 2.51$, $p = .012$	$d = .026$	Middle:	3.50 (.64)	High:	3.48 (.63)
Poverty Status	$t\,(45,624) = .39$, $p = .698$	$d = .005$	High:	3.48 (.69)	Low:	3.49 (.62)
City Size	$t\,(45,624) = 3.85$, $p < .001$	$d = .051$	Large:	3.51 (.66)	Small:	3.48 (.63)

Table 4. Table of School-Level (*n* = 145) and Student-Level (*n* = 45,626) Correlations

	Grit	Student Demographics							School Demographics					School Experiences			
		Female	Asian	Black	Hispanic	Multi-Racial	White	Grades	High School	Charter School	High Poverty	Large City	Large School	Engage	Culture	Peers	Adult
Grit		.024**	-.002	.025**	-.034**	.013**	.018**	.170**	-.012*	.035**	-.002	.018**	-.025**	.362**	.216**	.275**	.317**
Female	-.027		.000	.004	.012**	.003	.008	.121**	.001	.001	.001	-.002	-.007	.052**	-.047**	-.035**	-.024**
Asian	-.123	.003		-.102**	-.183**	-.109**	-.181**	.152**	-.078**	-.058**	-.093**	-.051**	.096**	.031**	.094**	.049**	.038**
Black	.279**	.092	-.207*		-.241**	-.143**	-.238**	-.084**	.051**	.212**	.142**	.194**	-.031**	.030**	-.093**	-.003	-.037**
Hispanic	-.113	-.111	-.173*	-.310**		-.258**	-.429**	-.124**	-.038**	-.006	.230**	.037**	-.059**	.028**	.067**	.007	-.012**
Multi-Racial	.126	.006	.202*	-.002	-.252**		-.255**	.024**	-.021**	.033**	-.045**	-.005	.021**	-.025**	-.036**	-.004	-.017**
White	-.069	.006	-.138	-.363**	-.609**	-.097		.084**	.097**	-.126**	-.240**	-.130**	-.011*	-.039**	-.026**	-.018**	.041**
Grades	.141	-.034	.358**	-.157	-.169*	.228**	.081		-.101**	-.017**	-.097**	-.050**	.012**	.248**	.138**	.180**	.207**
High School	-.078	.040	-.194*	.005	-.139	-.040	.286**	-.331**		-.068**	-.193**	-.153**	.081**	-.057**	-.129**	-.043**	-.070**
Charter School	.162	-.081	-.143	.492**	-.089	.173*	-.261**	-.066	-.163		.233**	.556**	-.276**	.069**	.064**	.088**	.087**
High Poverty	-.002	-.026	-.118	.392**	.188*	-.115	-.412**	-.145	-.256**	.323**		.402**	-.105**	.033**	-.010*	-.018**	-.015**
Large City	.116	-.001	-.052	.463**	.015	.047	-.359**	-.155	-.149	.568**	.451**		-.324**	.043**	.025**	.032**	.045**
Large School	-.224**	-.060	.154	-.084	-.027	.096	-.003	.184*	-.028	-.171*	.018	-.218**		-.072**	-.110**	-.077**	-.079**
Engagement	.611**	.097	-.060	.102	-.008	.101	-.095	-.068	.019	.040	-.111	.105	-.354**		.546**	.514**	.609**
Culture	.450**	.086	.108	-.211*	.013	.088	.047	-.029	-.031	-.066	-.236**	-.059	-.342**	.843**		.504**	.616**
Peers	.530**	-.045	.129	.020	.057	.120	-.154	.493**	-.145	.137	-.051	.125	-.188*	.480**	.383**		.488**
Adult	.544**	.007	-.051	-.098	-.078	.121	.107	-.082	.044	.036	-.204*	.021	-.327**	.877**	.901**	.387**	

Note: Values on the lower diagonal are school-level correlations and values on the upper diagonal are student-level correlations. Furthermore, items are grouped together into the following categories: grit, student-level demographics, school-level demographics, and school experience factors.

** Correlation is significant at *p* < .01 (2-tailed).

* Correlation is significant at *p* < .05 (2-tailed).

Table 5. Multilevel Model Results

|	0	1	2	3	4	5	6	7
	Null Model	**Student**	**School**	**Demographics**	**Experiences**	**Student and Experiences**	**School and Experiences**	**Full Model**
AIC	87297.8	85931.9	87294.1	85925.3	79865.3	79540.6	79873.5	79546.1
Random Intercept	.0078	.0072	.0068	.0061	.0035	.0033	.0034	.0032
Residual Variance	.3947	.3830	.3947	.3830	.3357	.3333	.3357	.3333
ICC	.0195	.0185	.0170	.0157	.0102	.0098	.0102	.0095
Between-School Variance		8.21%	12.95%	22.23%	55.97%	57.93%	56.11%	59.20%
Within-School Variance		2.96%	0%	2.96%	14.93%	15.55%	14.93%	15.55%
Intercept	3.514 (.001) *	3.020 (.018) *	3.526 (.017) *	3.013 (.023) *	3.485 (.006) *	3.269 (.017) *	3.474 (.013) *	3.250 (.020) *
Student Demographics								
Female		.002 (.006)		.002 (.006)		.009 (.006)		.009 (.006)
Asian		-.022 (.016)		-.022 (.016)		-.035 (.015) *		-.034 (.015) *
Black		.091 (.014) *		.088 (.014) *		.045 (.013) *		.042 (.013) *
Hispanic		.020 (.008)		.019 (.012)		-.009 (.011)		-.010 (.011)
Multi-Racial		.045 (.013) *		.044 (.013) *		.042 (.012) *		.042 (.012) *
White		.038 (.012) *		.038 (.012) *		.025 (.011) *		.026 (.011) *
GPA		.142 (.004) *		.143 (.004) *		.061 (.004) *		.061 (.004) *
School Demographics								
High School			-.009 (.018)	.014 (.017)			.006 (.014)	.014 (.013)
Charter			.045 (.029)	.030 (.028)			.018 (.022)	.027 (.016)
High Poverty			-.016 (.022)	.007 (.021)			.012 (.016)	.000 (.020)
Large City			.011 (.027)	.018 (.026)			-.005 (.021)	.018 (.026)
Large School			-.048 (.020) *	-.055 (.019) *			.007 (.015)	.004 (.014)
School Experiences								
Engagement					.209 (.005) *	.194 (.005) *	.208 (.005) *	.194 (.005) *
Culture					-.046 (.005) *	-.036 (.005) *	-.046 (.005) *	-.036 (.005) *
Peers					.094 (.005) *	.090 (.005) *	.094 (.005) *	.090 (.005) *
Adult					.130 (.005) *	.120 (.005) *	.127 (.005) *	.120 (.005) *
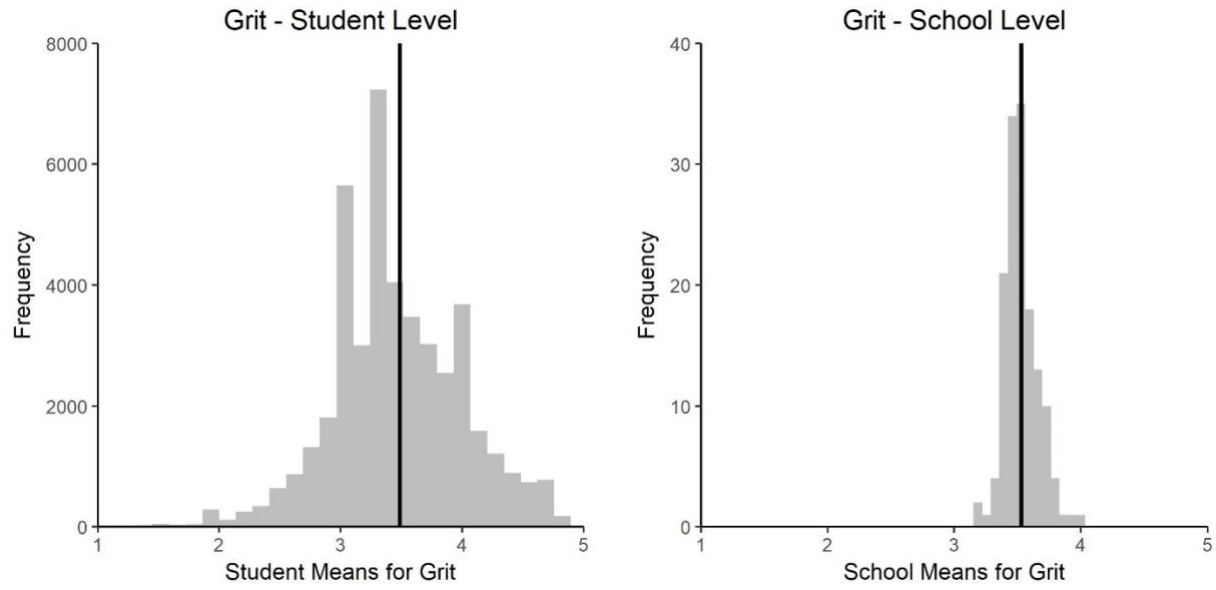
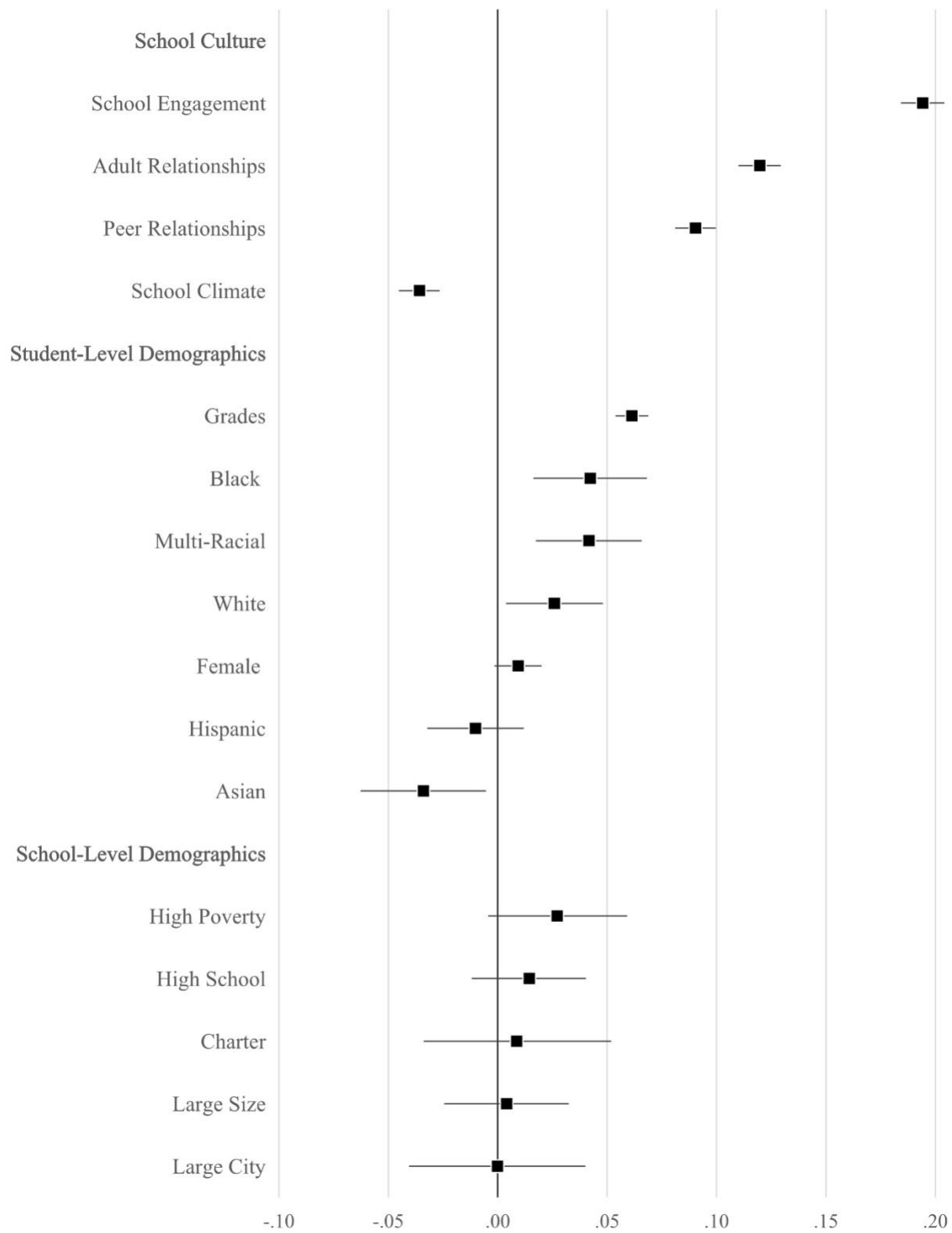*Figure 1.* Histograms and means of grit across students and schools

Figure 2. Beta estimates and confidence intervals for all School Experience, Student-level demographic, and School-level demographic variables (Full Model: Model 7).