# Psychometric Properties of the Academic Grit Scale

University of Kentucky
College of Education

Joanne P. Rojas, MA, Joseph A. Reser, Ellen L. Usher, PhD, & Michael D. Toland, PhD

P20 Motivation & Learning Lab

## What is grit?

- Grit is the passion and perseverance to pursue long-term goals (Duckworth & Seligman, 2007). The stamina to stick with something over a long period of time should correlate with other important educational measures such as self-regulation and self-efficacy in academic pursuits.
- Grit is a better predictor of academic achievement than IQ alone (Duckworth & Quinn, 2009).
- Self-regulation, self-discipline, goal-orientation, and other constructs related to grit can be taught and tend to evolve over time (Peterson & Seligman, 2004).
- Girls score higher than boys in measures of self-discipline and the ability to delay gratification (Duckworth 2007; Silverman 2003).

## Purpose of the Study

- To investigate the psychometric properties of items designed to assess academic grit among upper elementary and middle school students.
- To validate grit as a correlate of self-efficacy and self-regulation in math and reading.
- To examine correlations between scores on grit and students' perceptions of their relative ability, effort, and enjoyment in math and reading.
- To determine whether score differences exist in measures of grit by gender and race/ethnicity.

## Method

### *Participants*

Participants in the study were 2,426 students (49.9% female) in Grades 4-8. Participants were sampled from seven public schools, four middle and three elementary, in a mid-sized city in the Southeastern region of the United States. Of the participants, 7.8% were in fourth grade, 6.8% in fifth grade, 32.1% of students in sixth grade, 32.9% in seventh, and 20.2% in eighth grade. School-reported demographic information showed that students were 52% Caucasian, 30% African American, 9% Hispanic, 3% Asian American, and 4% identify as biracial/other (2% were not reported).

### *Measures*

Participants completed two surveys, one related to math and the other to reading. The surveys included the following measures, which were used in this study.

- *Grit* was measured using an adaptation of the Grit scale developed by Duckworth (2007). Items were modified to simplify the vocabulary and to render more user-friendly wording for a younger audience. Responses were on a scale ranging from 1 (*definitely false)* to 6 (*definitely true*).
- *Self-efficacy* in math and reading were assessed on domain-specific questionnaires. General self-efficacy for the subject matter (e.g., "How confident are you in your abilities in (math/reading)?") was assessed on a scale from 1 (*not at all confident)* to 6 (*completely confident)*. Self-efficacy for self-regulated learning skills (e.g., "How well can you (read/do math work) when there are other interesting things to do?") was assessed on a scale from 1 (*not very well at all)* to 6 (*very well)*. Both scales are adapted from Bandura (2006).
- Students' perceptions of their relative ability, effort, and enjoyment in math and reading were assessed by single items; for example, "Compared to other kids in your class, how much do you like (math/reading)?. Responses indicated whether the student enjoyed the subject *less than*, *the same as*, or *more than other kids* on a scale from 1 to 3.

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Table 1
*Descriptive Statistics for all Study Variables*

| Variable | *N* | *Mean/ Median* | *SD* | Range |
|---|---|---|---|---|
| Grit | 2,421 | 4.62 | .89 | 1-6 |
| Self-Efficacy in Math | 2,422 | 4.68 | 1.14 | 1-6 |
| Self-Regulation in Math | 2,420 | 4.47 | 1.06 | 1-6 |
| Self-Efficacy in Reading | 2,426 | 4.93 | 1.02 | 1-6 |
| Self-Regulation in Reading | 2,426 | 4.56 | 1.06 | 1-6 |
| Relative Ability in Math | 2,418 | 2 | -- | 1-3 |
| Relative Effort in Math | 2,417 | 2 | -- | 1-3 |
| Relative Enjoyment in Math | 2,416 | 2 | -- | 1-3 |
| Relative Ability in Reading | 2,420 | 2 | -- | 1-3 |
| Relative Effort in Reading | 2,420 | 2 | -- | 1-3 |
| Relative Enjoyment in Reading | 2,419 | 2 | -- | 1-3 |

*Note.* Means are for multi-item scales, medians are for relative ratings.

## Analyses and Results

### *Reliability and Factor Analysis*

- Responses to items assessing grit, self-efficacy, and self-regulation in reading and in math were in the acceptable range of internal consistency (see Table 1).
- Previous research has indicated a two-factor grit scale. We conducted exploratory factor analysis to test whether two factors best suited our data.
- Common factor analysis on the Pearson correlations among grit items indicated that the first factor had an eigenvalue of 4.439 and a second factor had an eigenvalue of 1.023. Only two items (1 & 9), both negatively worded, loaded on the second factor. We considered this an artifact of the reversely coded items.
- According to Gorsuch (1983) as long as the eigenvalue of the first factor is at least three times the value of the second highest eigenvalue, the scale can be assumed to be unidimensional.
- A one factor solution was therefore selected, and the grit scale was treated as unidimensional (see Table 2).

Table 2
*Pattern Loadings for Items Measuring Grit*

| Item | | Pattern Loading |
|---|---|---|
| 1 | If a task is hard, I give up easily. | .45 |
| 2 | Whenever I do something, I put all my effort into it. | .67 |
| 3 | I keep at my homework until I am done with it. | .63 |
| 4 | Once I make a plan, I stick to it. | .63 |
| 5 | Once I make a commitment, I keep it. | .60 |
| 6 | I am a hard worker. | .70 |
| 7 | I keep trying even after I fail. | .69 |
| 8 | I keep working at something new even when it's hard. | .75 |
| 9 | When I have responsibilities for school, I don't always do them. | .37 |
| 10 | I get things done that need to be done, even when I don't feel like doing them. | .65 |

Table 3
*Pearson Correlations and Sample Reliabilities for Multi-Item Scales*

| Variable | *1* | *2* | *3* | *4* | *5* |
|---|---|---|---|---|---|
| 1. Grit | .85 | | | | |
| 2. Self-Efficacy in Math | .41* | .92 | | | |
| 3. Self-Regulation in Math | .52* | .78* | .91 | | |
| 4. Self-Efficacy in Reading | .54* | .38* | .40* | .91 | |
| 5. Self-Regulation in Reading | .60* | .35* | .51* | .74* | .90 |

Note. Main diagonal contains Cronbach's α.
*$p$ < .01

Table 4
*Polyserial and Polychoric Correlations*

| Variable | *1* | *2* | *3* | *4* | *5* | *6* | *7* |
|---|---|---|---|---|---|---|---|
| 1. Grit | -- | | | | | | |
| 2. Relative Ability in Math | .28* | -- | | | | | |
| 3. Relative Effort in Math | .34* | .31* | -- | | | | |
| 4. Relative Enjoyment in Math | .29* | .59* | .35* | -- | | | |
| 5. Relative Ability in Reading | .30* | .23* | .15* | .02 | -- | | |
| 6. Relative Effort in Reading | .48* | .19* | .47* | .22* | .31* | -- | |
| 7. Relative Enjoyment in Reading | .37* | .12* | .17* | .15* | .58* | .38* | -- |

Note. Polyserial correlations are those between grit scores with relative measures ratings (the first column), and the polychoric correlations are the correlations among all relative measures ratings (the remainder of the matrix).
*$p$ < .01

### *Correlations with Grit*

- Grit scores were positively related to self-efficacy and self-regulation scores in both reading and math (see Table 3).
- A polyserial correlation between grit scores and scores from six relative measures of ability, effort, and enjoyment in math and reading showed all significant positive correlations. The polychoric correlations among all scores from the six relative measures were statistically significant except that between perceived relative enjoyment in math and relative ability in reading (see Table 4).

### *Group Differences*

- Girls reported higher grit than boys, $F(1, 2{,}400) = 13.44$, $p < .001$.
- There were no statistically significant differences in grit scores by race/ethnicity, $F(4, 1{,}719) = 1.97$, $p = .10$.

## Key Findings and Conclusions

- There is evidence for the reliability and validity of scores from the grit scale among public school students from Grades 4-8.
- Grit is positively correlated with other motivation measures.
- Girls are higher in scores on grit than boys.
- Future research should examine the predictive ability of grit among typical public school samples.
- Educational interventions to promote perseverance among students should be developed and tested.

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For more information, please contact Joanne Rojas, joanne.rojas@uky.edu