Is Grit Enough? Personal Control is Necessary for Grit to Produce Increased Engagement and Performance

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Abstract

The personality trait *grit* has been linked to myriad positive consequences (Duckworth, 2016); however, little work has examined its potential limitations. We propose that grit will predict increased task engagement and performance when people have control over their outcomes, but not when they lack such control. In two studies (total $N = 307$), participants completed a cognitive task. We measured participants’ grit and manipulated whether they possessed control over the attainment of a desired outcome (i.e., entry into a drawing for a monetary prize). When participants had control over their drawing entry, those higher (vs. lower) in grit exhibited greater engagement, as indicated by cardiovascular (Study 1) and self-reported (Study 2) measures, as well as better performance (Study 2). In contrast, when participants lacked such control, grit was not associated with engagement or performance. The current work illustrates the importance of contextual factors in allowing grit to positively impact behavior.

*Keywords:* grit, performance, engagement, personal control, psychophysiology
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An increasingly popular strategy to improve the performance of employees and students is to increase their grit (e.g., Human Dimension Capabilities Development Task Force, 2015; Sparks, 2015). This movement is based on research demonstrating that grit, defined as perseverance and passion for long-term goals, is one key factor that helps people harness their full potential (Duckworth, 2016; Duckworth, Peterson, Matthews, & Kelly, 2007). Despite the increasing popularity of grit as an explanation for success, research has not yet investigated the degree to which the benefits of grit may hinge on a number of important individual or contextual factors (Credé, Tynan, & Harms, 2016). In the current research, we theorize that the degree of control people have over their outcomes moderates the benefits of grit. Specifically, we hypothesize that higher grit will be associated with enhanced task engagement and performance in contexts in which goal attainment is under individuals’ control, but not in contexts in which goal attainment is outside of their control.

People high in grit stay engaged for longer and achieve greater success than those low in grit (Duckworth et al., 2007; Duckworth & Quinn, 2009). For example, cadets higher in grit are more likely to complete the physically and emotionally demanding first summer at West Point Military Academy than their peers who are lower in grit (Duckworth et al., 2007). Similarly, despite enormous turnover rates, teachers in underprivileged school districts who are higher in grit are more likely to stay after their first year and to make academic gains with their students compared to teachers lower in
grit (Robertson-Kraft & Duckworth, 2014). Although the relationship between grit and success has been demonstrated in a variety of contexts, we theorize that individuals’ immediate situations or broad life conditions moderate grit’s benefits. For example, consider a working-class student whose parents require her to take care of her siblings and to work full-time to help support their family. These situational constraints disconnect the goal of attending college from the student’s efforts and hard work. In other words, her ability to attend college is outside of her control. As a result, the student’s level of grit may be unrelated to her engagement and performance in high school. Indeed, other scholars have recently argued that research on grit has not thoroughly explored the potential moderating role of situational factors (e.g., task characteristics, social norms, Credé et al., 2016; Ris, 2015). The present work is the first empirical examination of whether contextual constraints reduce grit’s benefits.

Here, we focus on degree of personal control as an important situational factor that affects whether grit is associated with task engagement and performance. Specifically, given that people high in grit deliberately work in pursuit of a goal (Bowman, Hill, Denson, & Bronkema, 2015; Eskreis-Winkler, Shulman, Beal, & Duckworth, 2014), we examine the effect of having or lacking control over goal attainment. We theorize that, although grit is an important resource that helps people persevere and achieve their goals despite obstacles, it may not lead people to do so when they lack personal control over their outcomes. Research on learned helplessness and personal control suggests that lacking control over one’s outcomes hinders pursuit of that goal (e.g., Dweck & Elliot, 1983; Seligman, Maier, & Geer, 1968). For example, lacking
control over environmental stressors can lead people to disengage from goal pursuit (Seligman et al., 1968). In addition, lack of perceived personal control is associated with low engagement and performance on cognitive tasks (Dweck & Elliot, 1983; Schmitz & Skinner, 1993). Therefore, we propose that when people lack personal control over goal attainment, their grit will no longer translate into enhanced engagement and performance.

**The Present Studies**

To examine our hypotheses, we conducted two experimental studies in which we assessed participants’ grit, manipulated whether participants had or lacked control over goal attainment, and, subsequently, measured their engagement in and performance on a cognitive task (i.e., an anagram task). To manipulate control over goal attainment, we gave participants in both studies the goal of gaining entry into a drawing for a $50 Amazon gift card. We chose a monetary prize because people value and are motivated by the possibility of attaining money (e.g., Lea & Webley, 2006; Stajkovic & Luthans, 2001) and monetary rewards have been shown to successfully motivate participants’ engagement in similar cognitive tasks (e.g., Major et al., 2002; Townsend, Major, Sawyer, & Mendes, 2010). We then used this primary goal as a basis for manipulating participants’ level of control. Specifically, we told participants their drawing entry was either based on their task performance (have control condition) or based on chance (lack control condition). In addition, given that high grit is theorized to be particularly beneficial in challenging situations when success seems unlikely (Duckworth et al., 2007), all participants were told that they had low odds of attaining the goal of gaining entry into the drawing. We used physiological (Study 1) and self-report (Studies 1 and 2)
measures of task engagement and a behavioral measure of performance (i.e., number of anagrams correctly solved; Studies 1 and 2). We predicted that grit would be positively associated with engagement and performance when participants had control, but not when they lacked control, over their goal attainment.

**Study 1**

**Method**

**Participants.** 161 undergraduate students (40% women, $M_{age} = 20.80$) at a private West Coast University participated for course credit. Sample size was determined via power analysis. Given the absence of previous research on moderators of grit and that social psychological studies find small to medium effect sizes on average (Richard, Bond, & Stokes-Zoota, 2003), we chose an anticipated effect size between small and medium ($f^2 = .10$). Aiming for 80% power and allowing for six predictors (three covariates, two main effects, and one interaction, see *Analysis plan* below for details), our target sample size was 143. Due to the possibility of lost data or unscorable cardiovascular data, we aimed to recruit between 160 and 170 participants and stopped data collection when the term ended. Eleven people did not complete the grit scale, two people did not complete the performance task, and one person did not complete the measure of self-reported engagement, yielding a final sample of 147 participants (39% women, $M_{age} = 20.80$).

**Procedure.**

**Pretest.** Before coming to the laboratory, participants completed an online questionnaire that included a measure of grit.
Physiological set-up and cover story. Participants came to the laboratory individually for an hour-long study on internship skills and physiological responses during evaluative tasks. Upon arrival, participants completed a screening questionnaire to assure they met the physiological inclusion criteria (see Physiological screening questionnaire below). After attaching the cardiovascular sensors to participants, the experimenter left the room and recorded participants’ cardiovascular responses for 5 minutes (i.e., resting baseline).

Experimental manipulation. Next, the experimenter told participants they would have a one-in-six chance to be entered into a drawing for a $50 Amazon gift card. We manipulated whether participants had or lacked control over their entry. Participants randomly assigned to the have control condition \((n = 72)\) learned that their entry into the drawing was based on their performance, such that they would gain entry by scoring in the top 6th of participants on at least one of two tasks. Participants randomly assigned to the lack control condition \((n = 75)\) learned that their entry into the drawing was based on chance, such that they would gain entry by having a die land on a specific number on at least one of two rolls.

Initial task and feedback. The experimenter then gave participants an idea generation task.\(^1\) Participants believed that this initial task, or the accompanying die roll, represented their first opportunity to gain entry into the drawing. However, given that grit is theorized to be particularly beneficial when success is unlikely (Duckworth et al.,

\(^1\) The data from this task are reported in Townsend, Truong, and Smalllets (in preparation). See the Supplementary Materials for more information.
2007), the true purpose of this task was to indicate to participants that they were unlikely to attain the goal of gaining entry into the drawing. To communicate their low chances of success, all participants learned that they had not gained entry into the first of two drawings and, therefore, had only one remaining opportunity to gain entry. Specifically, in the have control condition, the experimenter told participants they did not perform well enough for drawing entry. In the lack control condition, the experimenter told participants that the die did not land on the number required for drawing entry. Because drawing entry for participants in the have control condition was contingent on their performance, telling participants that they did not perform well enough to be entered into the drawing constituted negative performance feedback. To control for the experience of receiving negative performance feedback across conditions, we also gave negative feedback to participants in the lack control condition. Specifically, experimenters told participants in both conditions: “I evaluated your responses and you actually didn’t do that well; you only scored better than 50% of other students.” Thus, participants across conditions were given negative feedback about their performance and learned that they had failed to attain the primary goal of being entered into the drawing, the reason for which varied by condition.

**Anagram task and responses.** Next, the experimenter explained that participants would complete a cognitive ability task and that they had one, final opportunity to gain entry into the drawing. To reinforce the manipulation, participants in the have control condition were reminded that their performance on the task would determine their entry, whereas participants in the lack control condition were reminded that the roll of a die
would determine their entry.² Participants were then given 5 minutes to complete the anagram task, during which the experimenter recorded their physiological responses.

**Self-report questionnaire.** Following the task, participants completed a questionnaire that included a measure of self-reported task engagement, a manipulation check, and demographic questions.

**Measures.** We describe the measures below and provide a complete list of items in the Supplementary Materials.

**Grit.** Participants reported their level of grit using the 12-item Grit Scale (Duckworth et al., 2007) on a scale from 1 (not at all true) to 7 (extremely true), \( M = 4.53, \ SD = .77, \alpha = .77. \)

**Physiological screening questionnaire.** Participants were not allowed to participate in Study 1 if they replied “yes” to any of the following three items: “Do you have a pacemaker?” “Do you believe you might be pregnant?” and “In the past 6 months have you taken medicine that would affect your cardiovascular system (e.g., beta-blockers)?” In addition, participants reported their height and weight, which we used to calculate body-mass index (BMI). BMI is an important control variable for cardiovascular variables (e.g., Molfino et al., 2009).

**Physiological engagement (RSA).** Our primary measure of task engagement was respiratory sinus arrhythmia (RSA), a measure of autonomic nervous system reactivity.

² To further reinforce the manipulation, participants in the have control condition were given a choice among three folders (all containing the same task) and a choice to use a blue or black pen, because making choices leads to perceptions of control (Langer & Rodin, 1976). In the lack control condition, participants watched the experimenter choose their folder and pen.
RSA is an index of heart rate variability, or the variation in time between heart beats during a respiratory cycle (Porges, 1995). We specifically examined RSA reactivity, or change in RSA from baseline during a task. Research shows that decreased RSA reactivity is an indicator of increased attention or mental effort (Muhtadie, Koslov, Akinola, & Mendes, 2015; Tattersall & Hockey, 1995) and is correlated with better performance on cognitive tasks (Duscheck, Muckenthaler, Werner, & Reyes del Paso, 2009).

We measured RSA using noninvasive cardiac measures following established guidelines (Sherwood et al., 1990). Experimenters attached participants to an ECG100C electrocardiogram (ECG) amplifier manufactured and sold by Biopac Systems, Inc. (Goleta, California). We used a Modified Lead II electrode configuration and ECG signals were recorded and stored on a computer with Biopac Acqknowledge 3.9.2. We edited and ensembled the ECG data using Mindware Systems (Layfeyette, OH) using techniques from previously published cardiovascular research, including ensemble averaging in 60s intervals (Berntson et al., 1997; Kelsey et al., 1998; Kelsey & Guethlein, 1990). We measured RSA for 5 minutes during the resting baseline period and for 5 minutes during the anagram task. To calculate RSA reactivity, we subtracted participants’ RSA during the last minute of baseline from their RSA during each of the 5 minutes of the anagram task. Because we are interested in engagement during the entire cognitive task, we then created a composite by averaging these 5 reactivity values. Lower values

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3 Participants were also connected to a NICO100C impedance cardiogram and a Vasotrac (Model APM205A) blood pressure monitor as part of a different project (Townsend, Truong, & Smallets, in preparation).
reflect greater engagement.

**Performance.** Participants were instructed to unscramble 20 moderate-difficulty anagrams, a common test of verbal reasoning. For example, participants were presented with the word “charm” which would be unscrambled to “march.” We measured performance as the number of correctly solved anagrams, $M = 6.68$, $SD = 2.68$, range: 0–14.

**Self-reported engagement.** Participants reported their level of task engagement by indicating their agreement with one author-generated item on a scale from 1 (strongly disagree) to 7 (strongly agree), $M = 5.45$, $SD = 1.29$. The item is, “I tried my hardest on the second task.”

**Exploratory measures.** To investigate whether there were differences in the overall experience of the study based on condition, participants reported their positive and negative affect, and evaluations of the anagram task and experimenter. To investigate whether grit would be positively related to general perceptions of control across conditions, participants also reported their perceptions of control in their lives and in the broad study situation (i.e., not only over their entry into the drawing). Given the exploratory nature of these measures and the lack of significant interactive results, we report them in the Supplementary Materials.

**Manipulation check.** Participants completed two items to ensure the manipulation was successful: “My performance on the tasks influenced my chances of being entered in the drawing for the $50 gift card,” and “My chances of being entered in the drawing for $50 is based on chance” ($0 = no, 1 = yes$).
**Demographics.** Participants reported their gender and whether they were born in the U.S. along with other demographic items.

**Results and Discussion**

**Manipulation check.** Chi-square analyses indicated that the manipulation was successful: 89% of participants in the have control condition reported that their entry into the drawing was based on their performance, compared to 20% of those in the lack control condition, $\chi^2(1, N = 147) = 69.20$, $r = .69$, 95% confidence interval (CI) = [0.59, 0.76], $p < .001$. Similarly, 82% of participants in the lack control condition reported that their entry into the drawing was based on chance, compared to 20% of participants in the have control condition, $\chi^2(1, N = 147) = 63.14$, $r = .66$, CI = [0.55, 0.74], $p < .001$.

Importantly, our results hold when we exclude people who failed the manipulation check (see the Supplementary Materials for these analyses). Below, we report analyses using the full sample to maintain greater power.

**Analysis plan.** To test our hypotheses, we conducted moderated regression analyses (see Table 1). We entered covariates on Step 1, grit (mean-centered) and condition (0 = lack control, 1 = have control) on Step 2, and the grit by condition interaction on Step 3. For all regressions, we controlled for whether participants were born in the U.S. (0 = not born in the U.S., 1 = born in the U.S.) because research indicates that people from the U.S., an independent (vs. interdependent) cultural context, desire personal control over their outcomes (e.g., Kim & Markus, 1999; Markus & Conner, 2013). For the RSA regression, we also controlled for the effect of participants’ BMI (mean-centered) and gender (0 = female, 1 = male), because they significantly influence
Heart rate variability (e.g., Molfino et al., 2009; Umetani, Singer, McCraty, & Atkinson, 1998). Degrees of freedom vary among analyses because some participants’ RSA data were unscorable and two participants did not provide their height and weight to calculate BMI. Across studies, for the interaction effects, we report \( \Delta R^2 \) as the effect size with the corresponding 90% confidence intervals (CIs; in brackets; Smithson, 2001), and for all main effects and simple slopes, we report \( b \) as the effect size with the corresponding 95% CIs.

**Physiological engagement.** There was neither a main effect of grit nor condition on participants’ RSA reactivity. Consistent with our predictions, there was a significant grit by condition interaction on RSA reactivity, \( F(6, 128) = 2.26, b = -0.39, \Delta R^2 = 0.04, \) CI = [0.00, 0.14], \( p = .028 \) (See Figure 1). Specifically, among participants in the have control condition, higher grit was associated with significantly lower RSA reactivity, indicating greater task engagement, \( b = -0.30, \) CI = [-0.56, -0.04], \( p = .024 \). However, in the lack control condition, grit was not associated with RSA reactivity, \( b = 0.09, \) CI = [-0.14, 0.32], \( p = .437 \). Thus, participants higher in grit were more engaged than those lower in grit, but only when they believed they had control over their goal attainment. In addition, among participants high in grit, those in the have control condition exhibited significantly lower RSA reactivity, indicating greater engagement, than those in the lack control condition, \( b = -0.47, \) CI = [-0.85, -0.09], \( p = .015 \). Among participants low in grit, there was no difference in RSA reactivity between conditions, \( b = 0.14, \) CI = [-0.24, 0.52], \( p = .474 \). These results provide initial support for our hypothesis that degree of
personal control over goal attainment moderates the relationship between grit and task engagement.

**Performance.** There was neither a main effect of grit nor condition on performance. In addition, contrary to our predictions, the grit by condition interaction on participants’ performance was also not significant, $F(4, 142) = 1.99, b = 0.32, \Delta R^2 = 0.00, CI = [0.00, 0.10], p = .580$. We speculate that this null result was due to too little time allotted to complete the anagram task. We limited participants’ time on the anagram task to 5 minutes due to time constraints of the study and because 5 minutes is generally a sufficient amount of time to elicit differences in cardiovascular responses (e.g., Allen, Blascovich, & Mendes, 2002; Eliezer, Major, & Mendes, 2010; Townsend et al., 2010). However, 5 minutes may not have been enough time to capture significant differences in performance.

**Self-reported engagement.** There was not a main effect of condition on our secondary measure of task engagement. In addition, contrary to our predictions, there was not a significant grit by condition interaction on self-reported engagement, $F(4, 142) = 1.02, b = 0.08, \Delta R^2 = 0.00, CI = [0.00, 0.06], p = .789$. However, there was a marginal main effect of grit, such that higher grit was associated with greater self-reported engagement, $F(3, 143) = 1.34, b = 0.24, CI = [-0.04, 0.51], p = .093$. We speculate that the limited reliability of this single-item measure of engagement may have contributed to the nonsignificant interaction effect.

**Exploratory analysis.** Although we did not find our predicted direct effect of grit, moderated by condition, on performance, research indicates that greater task
engagement leads to better performance (e.g., Duscheck et al., 2009). Therefore, we tested whether higher grit had a positive effect on performance through decreased RSA reactivity (i.e., increased engagement), and whether this was conditional on having control (vs. lacking control) over goal attainment. Specifically, we conducted a moderated mediation analysis using Hayes’ (2013) PROCESS macro for SPSS 23 (Model 8) with 10,000 bootstrap resamples. Participants’ RSA reactivity was the mediator between grit and performance and condition served as the moderator of both the indirect path from grit through RSA reactivity and the direct path from grit to performance. We also included the covariates used in our RSA reactivity analyses.

We found support for the mediating role of RSA reactivity, \( b = .219, SE_{\text{boot}} = .150 \), 95% CI = [.005, .643]. Specifically, in the have control condition, there was a significant indirect effect such that participants higher in grit showed lower RSA reactivity (greater engagement), which led to better performance on the anagram task, \( b = .169, SE_{\text{boot}} = .120 \), CI = [.002, .505]. Conversely, in the lack control condition, the indirect effect of grit on performance through RSA reactivity was not significant, \( b = -.051, SE_{\text{boot}} = .073 \), CI = [-.259, .051]. This exploratory result indicates that level of grit and degree of control over goal attainment do indeed interact, at least indirectly, to influence participants’ performance.

**Study 2**

In Study 2, we expanded on Study 1 in two important ways. First, because we suspected that 5 minutes was not long enough to produce performance differences, we gave participants 10 minutes to complete the anagram task. Second, because we were
concerned about the reliability of a single item measure of task engagement, we created a more reliable, multi-item measure. In addition, given that people who are high in grit are able to maintain engagement in their pursuits over time (Duckworth, 2016), we measured consistency of interest as another benefit of grit.

**Method**

**Participants.** 168 U.S. born undergraduate students (49% women, M<sub>age</sub> = 20.43)<sup>4</sup> at a private West Coast University participated for course credit. Sample size was determined based on our findings in Study 1. In Study 1, we found a small to medium effect size of our overall model on engagement ($f^2 = .106$), so we aimed to recruit a similar number of participants in Study 2 (i.e., between 160 and 170). Six people did not complete the grit scale and two people did not complete the measure of self-reported engagement, yielding a final sample of 160 participants (50% women, M<sub>age</sub> = 20.41). Given that we only have three predictors in Study 2 (the main effects of grit and condition and their interaction), power analysis with the Study 1 effect size shows that our final sample size ($N = 160$) provides greater power than Study 1 (i.e., 94% power).

**Procedure.**

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<sup>4</sup> Given that being born in the U.S. significantly influenced performance in Study 1 and because previous research indicates that personal control is especially important for people born in the U.S., we initially ran enough participants to investigate whether being born in the U.S. influenced our results ($N = 198$). Indeed, we found three-way interactions of grit (mean-centered), condition, and being born in the U.S. on task performance and engagement. In the current work, we are not interested in cross-cultural variation in our effects, so we subsequently recruited only U.S. born participants and report our results for Study 2 excluding non-U.S. born participants. See the Supplementary Materials for more information.
**Pretest.** Before coming to the laboratory, participants completed an online questionnaire that included a measure of grit.

**Cover story and experimental manipulation.** Similar to Study 1, upon arrival to the laboratory, participants learned that they would complete a study on internship skills and they would have a one-in-six chance to be entered into a drawing for a $50 Amazon gift card. The manipulation of control was nearly identical to Study 1. In the have control condition, experimenters told participants \((n = 81)\) that their entry into the drawing was determined by their performance on one task. In the lack control condition, experimenters told participants \((n = 79)\) that their entry into the drawing was determined by one roll of a die.

There were three important procedural differences between Studies 1 and 2. First, we did not measure participants’ RSA reactivity in Study 2 and, therefore, participants were not attached to physiological sensors. Second, participants only completed one task in Study 2 and therefore did not receive negative feedback. However, because we still wanted participants to believe their success was unlikely, the experimenter emphasized to participants, “the odds of gaining entry into the drawing are extremely low.” Third, we gave participants 10 minutes, instead of 5 minutes, to complete the anagram task.

**Anagram task.** Experimenters instructed participants to work on the same anagram task as Study 1 for up to 10 minutes. Nine participants \((6\%)\) stopped working before the 10 minutes expired. We include these participants in the analyses to maintain greater power, but excluding them does not change our results.
**Self-report questionnaire.** Following the anagram task, participants completed a questionnaire that included measures of self-reported task engagement, consistency of interest, a manipulation check, and demographic questions.⁵

**Measures.** We describe the measures below and provide a complete list of items in the Supplementary Materials.

**Grit.** Participants reported their level of grit using the 18-item Short Grit Scale (Duckworth & Quinn, 2009) on a scale from 1 (*not at all true*) to 5 (*very true*), $M = 3.38$, $SD = .51$, $\alpha = .69$.

**Performance.** Participants completed the same anagram task as Study 1. We measured performance as the number of correctly solved anagrams, $M = 9.08$, $SD = 3.39$, range: 2-18.

**Self-reported engagement.** Participants reported their level of task engagement by indicating their agreement with six author-generated items on a scale from 1 (*strongly disagree*) to 7 (*strongly agree*), $M = 5.97$, $SD = .93$, $\alpha = .78$. An example item is, “I was fully engaged in the task.”

**Consistency of interest.** Participants reported their consistency of interest in anagram tasks using three author-generated items on a scale from 1 (*strongly disagree*) to 7 (*strongly agree*), $M = 3.05$, $SD = 1.29$, $\alpha = .79$. An example item is, “I am interested in word puzzles.”

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⁵ We also asked participants whether it was their first time completing an anagram task as a potential covariate. Analyses controlling for this item indicate it did not impact our results. See the Supplementary Materials for more information.
Manipulation check. Participants completed the same manipulation check as Study 1.

Demographics. Participants reported various demographic items.

Results and Discussion

Manipulation check. Chi-square analyses indicated that the manipulation was successful: 88% of participants in the have control condition reported that their drawing entry was based on their performance, compared to 3% of those in the lack control condition, $\chi^2(1, N = 157) = 113.91, r = .85, CI = [0.80, 0.89], p < .001$. Similarly, 99% of participants in the lack control condition reported that their drawing entry was based on chance, compared to 24% of participants in the have control condition, $\chi^2(1, N = 157) = 92.24, r = .76, CI = [0.69, 0.82], p < .001$. As in Study 1, our results hold when we exclude people who failed the manipulation check (see the Supplementary Materials for these analyses). Below, we report our results including the full sample to maintain greater power.

Analysis plan. To test our hypotheses, we conducted moderated regression analyses in which we entered grit (mean-centered) and condition (0 = lack control, 1 = have control) on Step 1 and their interaction on Step 2. See Table 2 for our full results.

Performance. There was a significant main effect of grit on performance, $F(2, 157) = 3.11, b = 1.25, CI = [0.39, 2.12], p = .018$, but not a significant main effect of condition. Consistent with our predictions, the grit by condition interaction on performance was significant, $F(3, 156) = 3.60, b = 2.18, \Delta R^2 = 0.03, CI = [0.01, 0.12], p = .037$ (See Figure 2). Specifically, among participants in the have control condition,
higher grit was associated with significantly better performance, \( b = 2.42, \ CI = [0.92, 3.92], p = .002 \). However, grit was not associated with performance among participants in the lack control condition, \( b = 0.24, \ CI = [-0.93, 1.40], p = .736 \). Thus, participants higher in grit performed better than those lower in grit, but only when they believed they had control over their goal attainment. When participants were given 10 minutes to complete the anagram task in Study 2 versus 5 minutes as in Study 1, we found support for our performance prediction. In addition, among participants high in grit, those in the have control condition exhibited significantly better performance than those in the lack control condition, \( b = 1.57, \ CI = [0.10, 3.05], p = .037 \). Among participants low in grit, there was no difference in performance between conditions, \( b = -0.66, \ CI = [-2.12, 0.81], p = .379 \).

**Self-reported engagement.** Neither the main effect of grit nor condition on self-reported task engagement was significant. Consistent with our predictions, the grit by condition interaction on self-reported engagement was significant, \( F(3, 156) = 2.34, b = 0.66, \Delta R^2 = 0.03, \ CI = [0.00, 0.09], p = .022 \) (See Figure 3). Specifically, mirroring the performance results, among participants in the have control condition, higher grit was associated with significantly higher engagement, \( b = 0.52, \ CI = [0.11, 0.94], p = .014 \). However, grit was not associated with engagement among participants in the lack control condition, \( b = -0.14, \ CI = [-0.46, 0.18], p = .479 \). Thus, when using a measure of self-reported engagement that was presumably more reliable than the single-item measure used in Study 1, we found further evidence that participants higher in grit were more engaged than those lower in grit, but only when their believed they had control over goal attainment. In addition, among participants high in grit, those in the have control
condition exhibited marginally more engagement than those in the lack control condition, $b = 0.35$, CI = [-0.06, 0.76], $p = .091$. Among participants low in grit, there was no difference in engagement between conditions, $b = -0.32$, CI = [-0.73, 0.08], $p = .119$.

**Consistency of interest.** We found a significant main effect of grit on consistency of interest, $F (2, 157) = 4.45$, $b = 0.58$, CI = [0.26, 0.91], $p = .004$, but not a significant main effect of condition. Consistent with our predictions, the grit by condition interaction on consistency of interest was significant, $F (3, 156) = 4.93$, $b = 0.92$, $\Delta R^2 = 0.03$, CI = [0.02, 0.15], $p = .019$ (See Figure 4). Specifically, mirroring the results for performance and engagement, among participants in the have control condition, those with higher grit reported significantly more consistent interest in anagram tasks than those with lower grit, $b = 1.08$, CI = [0.52, 1.64], $p < .001$. However, among participants in the lack control condition, grit was not associated with consistency of interest, $b = 0.16$, CI = [-0.28, 0.59], $p = .559$. Thus, participants higher in grit reported more consistent interest in anagrams than those lower in grit, but only when they believed that they had control over their goal attainment. In addition, among participants high in grit, those in the have control condition reported significantly more consistent interest than those in the lack control condition, $b = 0.58$, CI = [0.03, 1.14], $p = .040$. Among participants low in grit, there was no difference in consistency of interest between conditions, $b = -0.36$, CI = [-

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6 In an exploratory analysis, we tested for moderated mediation as in Study 1 using self-reported task engagement as the mediator. We find evidence for an indirect effect of grit on performance through engagement among participants in the have control condition. However, this effect should be interpreted with caution because engagement was measured after the task, meaning that there is not a clear one-way causal sequence among these variables. See the Supplementary Materials for results.
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0.91, 0.19], \( p = .199 \).

**General Discussion**

Grit has been touted as a panacea for underachievement (Del Giudice, 2014). Although grit is certainly an important resource, our work suggests that it is not always enough to predict success. Across two studies, we find that when people have control over their goal attainment, grit is positively associated with task engagement (Studies 1 and 2) and performance (Study 2), but that when people lack such control, grit is not associated with either benefit.

Although our predictions were only partially supported in Study 1, we believe this was due to lower reliability of our engagement measure and time limitations on the task. In Study 2, we created a more reliable measure of self-reported engagement and gave participants more time to complete the anagram task, which we believe allowed us to find support for our predictions. Our confidence in our conclusions is strengthened by converging evidence across psychophysiological and self-report measures of engagement, as well as by our exploratory analyses in Study 1 showing an indirect effect of the grit by condition interaction on performance through engagement.

Our work makes clear theoretical and practical contributions to a growing body of research documenting the performance benefits of non-cognitive factors such as grit or resilience. Theoretically, our results suggest that the presence of such non-cognitive factors, like grit, is not always enough to predict enhanced engagement and performance. Instead, these traits are only helpful when people perceive goal attainment as within their personal control, rather than due to external factors outside of their control. Practically,
our work suggests the potential risks of focusing on the benefits of grit without also fully considering the potential situational constraints that limit the influence of non-cognitive factors on behavior. For example, in environments where people lack control, efforts to increase performance by increasing grit may be ineffective. In sum, we suggest that before trying to increase grit among employees and students, it may be essential for managers and teachers to first ensure that their constituents believe they have personal control over the types of behaviors that would help them to attain desired outcomes, such as compensation, grades, and promotions.

**Limitations and Future Directions**

One potential limitation of the current studies is that participants were told that attainment of their goal was unlikely. We gave participants low odds of success because grit is particularly helpful in situations in which success is difficult or uncertain (Duckworth et al., 2007). It is possible that if participants learned that most people gain entry into the drawing, those high in grit may have exhibited similarly high levels of engagement and performance in both the have control and lack control conditions. Additional research is needed to examine whether control over goal attainment moderates the benefits of grit when goal attainment is considered likely.

A second potential limitation of this work is our use of entry into a drawing for a $50 gift card as participants’ salient goal, given that it was a lower order goal, not freely chosen by participants. Importantly, previous research supports our belief that the goal of being entered into the drawing was salient and compelling (e.g., Major et al., 2002; Townsend et al., 2010), and that grit leads to meaningful differences in persistence and
engagement in lower-order, short-term tasks (Lucas, Gratch, Cheng, & Marsella, 2015). However, grit theorizing has generally focused on grit predicting outcomes for superordinate, freely chosen, and long-term goals (Duckworth & Gross, 2014). Future research is needed to examine whether personal control moderates grits’ benefits in the pursuit of superordinate, long-term goals.

**Conclusion**

Grit is a robust indicator of success in many domains (Duckworth, 2016). Consistent with this suggestion, the current studies find that grit leads to benefits in the form of enhanced task engagement and performance when goal attainment is based on individuals’ efforts. However, our work also suggests the importance of considering how contextual factors limit grit’s benefits. More specifically, we find that grit does not confer the benefits of engagement and performance when individuals do not have control over their goal attainment. As the movement to cultivate grit in order to maximize individual potential progresses, workplaces and schools must work to ensure that their employees and students have control over their outcomes.
References


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### Table 1

**Moderated Regression Results for Study 1**

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>Step 1: Covariate(s)</th>
<th>Step 2: Main effects</th>
<th>Step 3: Interaction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Overall Step</td>
<td>Overall Step</td>
<td>Grit</td>
</tr>
<tr>
<td></td>
<td>$\Delta R^2$</td>
<td>$df$</td>
<td>$F$</td>
</tr>
<tr>
<td>RSA Reactivity</td>
<td>.045</td>
<td>3, 131</td>
<td>2.06</td>
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<tr>
<td>Performance</td>
<td>.045</td>
<td>1, 145</td>
<td>6.85*</td>
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<tr>
<td>SR Engagement</td>
<td>.000</td>
<td>1, 145</td>
<td>0.02</td>
</tr>
</tbody>
</table>

*Note.* RSA = respiratory sinus arrhythmia. SR = self-reported. Results of moderated regressions in Study 1 with gender (0 = female, 1 = male), BMI (mean-centered), and being born in the U.S. (0 = not born in the U.S., 1 = born in the U.S.) entered on Step 1 for RSA reactivity and being born in the U.S. entered on Step 1 for performance and self-reported engagement, grit (mean-centered) and condition (0 = lack control, 1 = have control) on Step 2, and their interaction on Step 3.

$^+$ $p < .10$, $^*$ $p < .05$. 
Table 2

*Moderated Regression Results for Study 2*

<table>
<thead>
<tr>
<th>Dependent Variables</th>
<th>Overall Step</th>
<th>Grit</th>
<th>Condition</th>
<th>Overall Step</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\Delta R^2$</td>
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<td>$F$</td>
<td>$b$</td>
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<tr>
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<tr>
<td>Con. of Interest</td>
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<td>4.45*</td>
<td>.584</td>
</tr>
</tbody>
</table>

*Note. SR = self-reported, Con. = Consistency. Results of moderated regressions in Study 2 with grit (mean-centered) and condition (0 = lack control, 1 = have control) entered on Step 1 and their interaction on Step 2.*

* $p < .05$, ** $p < .01$. 
Figure 1. RSA reactivity as a function of grit and condition in Study 1. Lower values reflect lower RSA reactivity and therefore greater engagement in the anagram task.

“High” and “low” grit represented as ± 1 SD from the mean.
Figure 2. Performance as a function of grit and condition in Study 2. Higher values reflect more anagrams correctly solved and therefore better performance. “High” and “low” grit represented as ± 1 SD from the mean.
Figure 3. Self-reported engagement as a function of grit and condition in Study 2. Higher values reflect greater engagement in the anagram task. “High” and “low” grit represented as ± 1 SD from the mean.
Figure 4. Consistency of interest in anagrams as a function of grit and condition in Study 2. Higher values reflect more consistent interest in anagram tasks. “High” and “low” grit represented as ± 1 SD from the mean.