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How Firm Are the Foundations of Mindset Theory?  
The Claims Appear Stronger than the Evidence

<sup>1</sup>Alexander P. Burgoyne, <sup>1</sup>David Z. Hambrick, & <sup>2</sup>Brooke N. Macnamara

<sup>1</sup>Michigan State University, <sup>2</sup>Case Western Reserve University

Corresponding author:

Brooke N. Macnamara

Department of Psychological Sciences

Case Western Reserve University

[brooke.macnamara@case.edu](mailto:brooke.macnamara@case.edu)

## Abstract

Mindset refers to people's beliefs about whether attributes are malleable (*growth mindset*) or unchangeable (*fixed mindset*). Proponents of mindset have made bold claims about mindset's importance. For example, mindset is described as having "profound" effects on motivation and achievement, creating different "psychological worlds" for people, and forming the "core" of people's "meaning systems." We examined the evidentiary strength of six key premises of mindset theory in 438 participants, reasoning that strongly worded claims should be supported by equally strong evidence. However, most premises had no support. All associations were significantly weaker than  $r = .20$ . Other achievement motivation constructs, such as self-efficacy and need for achievement, correlate much more strongly with presumed associates of mindset. The strongest association with mindset ( $r = -.12$ ) was *opposite* the predicted direction. The results suggest that the foundations of mindset theory are not firm, and that bold claims about mindset appear to be overstated.

*Keywords:* mindset theory, implicit theories, growth mindset, fixed mindset, achievement

## How Firm Are the Foundations of Mindset Theory?

### The Claims Appear Stronger than the Evidence

There is currently a great deal of scientific interest in *mindset* (i.e., *implicit theories*). Mindset refers to people's beliefs about the nature of personal attributes, such as intelligence. People who hold *growth mindsets* (i.e., incremental theorists) believe attributes are malleable, whereas those who hold *fixed mindsets* (i.e., entity theorists) believe attributes are unchangeable (Dweck, 2006). According to Dweck (2006), "the view you adopt for yourself profoundly affects the way you lead your life" (p. 6). The rationale is that mindsets form the "core" of people's meaning systems, bringing together goals, beliefs, and behaviors to shape people's thoughts and actions (Dweck & Yeager, 2019).

The presumed importance of mindset rests on several theoretical premises. Many of these premises are concisely summarized by Rattan, Savani, Chugh, and Dweck (2015) in their call to make funding mindset research a "national education priority" (p. 723); they state, "students with growth mindsets seek to learn and develop their abilities, and thus pursue challenges, value effort, and are resilient to setbacks; in contrast, students with fixed mindsets avoid challenges (which could reveal "permanent" deficiencies), dislike effort (which they think signals low ability), and give up more easily when facing setbacks" (p. 722). The goal of this study was to test six of these key premises of mindset theory.

#### **Premise 1: People with Growth Mindsets Hold Learning Goals**

Rattan et al. (2015) stated, "students with growth mindsets seek to learn and develop their abilities" (p. 722). Indeed, according to Dweck and Yeager (2019), mindset theory was developed to explain why some people care more about *improving* their ability (i.e., learning goals) whereas others care more about *proving* their ability (i.e., performance goals). As Dweck

(2009) explained, people with growth mindsets “care first and foremost about learning” and “the cardinal rule is: Learn, learn, learn!” (p. 4). Thus, mindset should predict learning goal orientation, such that people with more of a growth mindset endorse learning goals more than people with less of a growth mindset.

### **Premise 2: People with Fixed Mindsets Hold Performance Goals**

Dweck (2000) stated,

Believing that your qualities are carved in stone—the fixed mindset—creates an urgency to prove yourself over and over....I’ve seen so many people with this *one consuming goal* of proving themselves—in the classroom, in their careers, and in their relationships. *Every* situation calls for a confirmation of their intelligence, personality, or character (p. 6, emphasis added).

Additionally, Dweck (2009) explained, people with fixed mindsets “have to look good at all times” and “the cardinal rule is: Look talented at all costs” (p. 4). Thus, mindset should predict performance goal orientation, such that people with more of a fixed mindset endorse performance goals more than people with less of a fixed mindset.

### **Premise 3: People with Fixed Mindsets Hold Performance-Avoidance Goals**

Burnette, O’Boyle, VanEpps, Pollack, and Finkel (2013) stated, “although entity theorists prioritize performance goals more than incremental theorists do, we suggest that this difference is especially strong for performance-avoidance goals.” (p. 660). Dweck (2002) has also described how people with fixed mindsets supposedly avoid performing tasks if they might fail: “Even some of the most talented college students with the fixed view, when we ask them, have told us plainly: ‘If I knew I wasn’t going to do well at a task, I probably wouldn’t do it even if I might learn a lot from it’” (p. 30). Thus, mindset should predict performance-avoidance goal

orientation, such that people with more of a fixed mindset endorse performance-avoidance goals more than people with less of a fixed mindset.

**Premise 4: People with Fixed Mindsets Believe That Talent Alone—Without Effort—Creates Success**

Dweck (2009) claimed, “Those with a fixed mindset believe that if you have natural talent, you shouldn’t need much effort” (p. 2). Also, as stated on Dweck’s website, people with fixed mindsets “believe that talent alone creates success—without effort” (<https://mindsetonline.com/whatisit/about/>). Thus, mindset should predict agreement with the statement “Talent alone—without effort—creates success,” such that people with more of a fixed mindset agree with this statement more than people with less of a fixed mindset.

**Premise 5: People with Growth Mindsets Persist to Overcome Challenge**

Rattan et al. (2015) explained, “students with growth mindsets...pursue challenges...and are resilient to setbacks; in contrast, students with fixed mindsets avoid challenges...and give up more easily when facing setbacks” (p. 722). Indeed, mindset has been described as “a theory of challenge-seeking and resilience” (Dweck & Yeager, 2019, p. 482). According to Dweck (2006), “perseverance and resilience [are] produced by a growth mindset” (p. 12). Likewise, the for-profit mindset-intervention company Mindset Works (co-founded by Dweck) explains on their website: “Children with a growth mindset persist in the face of challenges” (<https://www.mindsetworks.com/parents/>). Thus, mindset should predict endorsement of statements about persisting to overcome a challenge, such that people with more of a growth mindset endorse these statements more than people with less of a growth mindset.

**Premise 6: People with Growth Mindsets Are More Resilient Following Failure**

According to Yeager and Dweck (2012), mindsets “appear to create different psychological worlds for students: one that promotes resilience and one that does not” (p. 304). Boaler (2013) further explained, “The implications of this mindset are profound—students with a growth mindset work and learn more effectively, displaying a desire for challenge and resilience in the face of failure” (p. 143). By contrast, individuals with fixed mindsets are “devastated by setbacks” (Dweck, 2008). Thus, mindset should predict performance following failure, such that people with more of a growth mindset perform better following failure than people with less of a growth mindset. These results should also hold after controlling for ability.

**Prior Evidence for Premises**

The available evidence suggests that these claims are overstated. For example, despite the claim that people with growth mindsets care first and foremost about learning (Premise 1), a recent meta-analysis found the correlation between mindset and learning goal orientation was only  $\bar{r} = .19$  (Burnette et al., 2013). For comparison, other personality constructs correlate much more strongly with learning goal orientation: self-efficacy ( $\bar{r} = .56$ ); need for achievement ( $\bar{r} = .38$ ); openness to experience ( $\bar{r} = .34$ ) (Payne, Youngcourt, & Beaubien, 2007). Burnette et al.’s meta-analysis also revealed weak evidence for Premises 2 and 3: mindset only correlated  $\bar{r} = -.15$  with performance goal orientation and  $\bar{r} = -.18$  with performance-avoidance goal orientation. For comparison, Payne et al.’s meta-analysis (2007) found that self-efficacy correlated  $\bar{r} = -.47$  with performance-avoidance goal orientation. Referring to mindset, Payne et al. (2007) concluded that “the effect sizes were very small, providing little evidence for Dweck’s (1986) view that implicit theories are the primary underlying antecedent of GO [goal orientation]” (p. 140).

We could find no evidence that people with fixed mindsets believe that talent without effort creates success (Premise 4). Some studies have examined the relationship between mindset and persisting to overcome a challenge (Premise 5). For example, Robins and Pals (2002) found that mindset correlated .48 with a response to challenge scale in college students, and Brown (2009) found that mindset correlated .22 with persistence on a challenging task in children. However, while the implication is that persistence on an experimental task translates into real-world behavior, most studies do not test mindset's relationship with persistence towards a real-world challenging goal that is important to the individual.

Few studies have examined the relationship between one's naturally-held mindset and resilience to failure (Premise 6). Rather, studies that examined resilience to failure by "helpless" and "mastery-oriented" children (with no measures of mindset; e.g., Diener & Dweck, 1978) or after manipulating praise (Mueller & Dweck, 1998) have been interpreted as evidence of mindset's relationship with resilience (see e.g., Dweck & Leggett, 1988; Good, Rattan, & Dweck, 2012). However, Li & Bates (2019) directly tested this relationship. In one sample, they found no association between mindset and performance following failure. In another sample, they found that students with *fixed mindsets* performed better than students with growth mindsets following failure.

### **Present Study**

Proponents of mindset theory have made bold claims about the importance of mindset. Dweck herself has stated multiple times that mindset has "profound" effects on motivation and achievement (Dweck, 2006; Dweck, 2008). This is not to say that every claim about mindset implies strong effects or that none are more nuanced. However, strong claims about mindset appear often enough that they warrant evidence.

The goal of the present study was to test the *strength of the evidence* for these claims. Therefore, we evaluated mindset theory's predicted associations against the mean effect size found in social psychological research,  $r = .20$  (see Effect Size Benchmarks below). We also compare effects of mindset to effects of other achievement motivation constructs.

To preview the results, the claims appear much stronger than the evidence. Only two relationships were statistically significant in the predicted direction. In all cases, mindset's effects were significantly weaker than  $r = .20$ . The strongest association ( $r = -.12$ ) was in the *opposite* direction predicted by mindset theory. That is, *fixed mindset* was associated with better test performance following failure feedback (Premise 6).

### Method

All hypotheses, planned sample sizes, sampling plan, and the data collection stopping rule were pre-registered at

[https://osf.io/gkwrw/?view\\_only=4b7cfdd7d6b9459ca9714f204678daa5](https://osf.io/gkwrw/?view_only=4b7cfdd7d6b9459ca9714f204678daa5) and

[https://osf.io/32bxf/?view\\_only=add1e240ab57496096680e66be1f2aae](https://osf.io/32bxf/?view_only=add1e240ab57496096680e66be1f2aae). Materials and

Supplemental Materials are available at

[https://osf.io/buazk/?view\\_only=36f87228fc0a4773a859f0681219e66f](https://osf.io/buazk/?view_only=36f87228fc0a4773a859f0681219e66f). The Institutional Review

Boards of Case Western Reserve University and Michigan State University approved this study.

### Effect Size Benchmarks

For each premise, we tested the prediction made by mindset theory. The analyses and pattern of results that would support each premise was pre-registered at

[https://osf.io/gkwrw/?view\\_only=4b7cfdd7d6b9459ca9714f204678daa5](https://osf.io/gkwrw/?view_only=4b7cfdd7d6b9459ca9714f204678daa5) and

[https://osf.io/32bxf/?view\\_only=add1e240ab57496096680e66be1f2aae](https://osf.io/32bxf/?view_only=add1e240ab57496096680e66be1f2aae).

The criterion for robust evidence supporting claims about mindset was determined as follows: significant, standardized regression coefficients,  $\beta_s \geq |.20|$ , in the direction predicted by mindset theory. We tested whether  $\beta_s$  were significantly smaller than  $|.20|$  via inferiority tests (Lakens, Scheel, & Isager, 2018).

We chose to test against  $\beta = .20$  (i.e.,  $r = .20$ ) for two reasons. First, statistical significance alone is insufficient to corroborate a theory or establish a meaningful empirical finding (Cohen, 1994; Lykken, 1968). Second, the strength of a psychological theory should be evaluated, at least in part, by its explanatory power: the effect size (Shäfer & Schwarz, 2019). In particular, strongly worded claims should be supported by equally strong evidence. As such, effects described as *profound* should at least meet the mean effect size in social psychological research,  $r \approx .20$  (Richard, Bond Jr., & Stokes-Zoota, 2003). In addition to using this benchmark, we contextualize mindset's effect sizes alongside other constructs in the same research area. The purpose of these contrasts is to illustrate how effects of mindset compare to effects within the field of social psychology in general and the achievement motivation literature in particular.

### **Participants**

According to G\*Power (Faul, Erdfelder, Lang, & Buchner, 2007), a minimum of 73 participants was needed to observe at least a  $\Delta R^2 = .13$  effect size (G\*Power's medium-sized effect benchmark based on Cohen's (1988) convention; we initially planned to test against medium-sized effects, see Supplemental Material) in a hierarchical regression analysis (our most complex analysis) at .90 power. Our pre-registered stopping rule for data collection was to run 146 participants (i.e.,  $73*2$ ), or to continue collecting data until the end of the semester, whichever occurred second.

A total of 438 undergraduate students from Case Western Reserve University ( $n = 102$ ) and Michigan State University ( $n = 336$ ) participated in the study in exchange for partial course credit or extra credit. Our power to detect significant effects of  $\beta \geq |.20|$  was .99 for all analyses.

### Measures

**Mindset of Intelligence.** Dweck's (2000) Implicit Theories of Intelligence Questionnaire was used to measure mindset. Participants responded to 8 items using a 5-point Likert scale, rating the degree to which they agreed or disagreed with statements such as "*You can always substantially change how intelligent you are.*" Higher scores on this measure correspond to more of a growth mindset, reflecting the belief that intelligence is malleable. Lower scores correspond to more of a fixed mindset, reflecting the belief that intelligence is relatively stable.

**Goal Orientation.** An adapted version of Elliot and Church's (1997) Goal Orientation Questionnaire was used to measure goal orientation. Participants responded to 16 items using a 5-point Likert scale, rating the degree to which they agreed or disagreed with learning goal statements such as "*I want to learn as much as possible,*" performance-approach goal statements such as "*I strive to demonstrate my ability relative to others,*" and performance-avoidance goal statements such as "*I worry about the possibility of performing poorly.*" Higher scores correspond to greater endorsement of each goal orientation.

**Belief in Talent vs. Effort.** Participants responded to 3 items using a 5-point Likert scale, rating the degree to which they agreed or disagreed with the following statements: 1) Belief in Talent Alone: "*Talent alone—without effort—creates success.*" 2) Belief in Talent and Effort: "*Both talent and effort are needed for success.*" And 3) Belief in Effort Alone: "*Effort alone—without talent—creates success.*" Higher scores correspond to stronger agreement with these statements.

**Response to Challenge.** Participants were asked to think about a current important and challenging goal in their life. They rated how important this goal was to them, how challenging this goal was, and how confident they were in their ability to achieve it. Next, participants responded to 4 items using a 5-point Likert scale, rating how likely they were to persist at working towards this goal in the face of challenge. The 4 items consisted of the following statements: 1) *“I am working hard to accomplish this goal and overcome this challenge.”* 2) *“When this goal or challenge has proven difficult, I have worked harder to accomplish it.”* 3) *“When this goal or challenge has proven difficult, I have taken a break from working toward this goal”* (reverse scored). And 4) *“If confronted with potential failure, I will stop trying to accomplish this goal”* (reverse scored). A Response to Challenge score was computed by taking the mean response to the 4 items.

**Cognitive Ability.** We created a composite variable representing cognitive ability by averaging standardized scores (i.e.,  $z$  scores) on the Cattell Culture Fair Test 4 and Letter Sets.

***Cattell Culture Fair Test 4.*** Participants were presented with a target geometric design with one or two dots located in it. Participants were to select from five other geometric designs the response option that would allow them to place the dots in an analogous location as in the target design. Participants were given 2.5 minutes to complete 10 items (Cattell & Cattell, 1949). The outcome measure was the number correct.

***Letter Sets.*** Participants were presented with five sets of four letters (e.g., ABCD) arranged in a row, and attempted to choose the set that did not follow the same pattern as the other four. Participants were given 5 minutes to complete 20 items (Ekstrom, French, Harmon, & Derman, 1976). The outcome measure was the number correct.

**Raven’s Advanced Progressive Matrices Challenge Test.** Participants were presented with a set of patterns with the lower-right portion missing. Participants attempted to choose the portion that best completed the pattern from a set of options (Raven, Raven, & Court, 1998). The outcome measure was the number correct.

In the challenge portion of this task (i.e., Part 1), participants were given 2.5 minutes to complete 4 challenging Raven’s items (items 36, 35, 34, and 33, in that order). After 2.5 minutes, they were given honest feedback on their performance on the first 4 items, in the form of bold, red text (e.g., “Your accuracy was 0% on this first set”). In the test portion of this task (i.e., Part 2), participants were given 7.5 minutes to complete 14 less-challenging Raven’s items (odd numbered items 5-31, presented in order of increasing difficulty). The outcome measure was the number correct.

### **Procedure**

First, participants completed the following questionnaires, listed in order of administration: Mindset of Intelligence, Goal Orientation, Response to Challenge, and Belief in Talent vs. Effort. Next, participants completed the Cattell Culture Fair Test 4, Letter Sets, and the Raven’s Advanced Progressive Matrices Challenge Test.

### **Results**

Data are openly available at:  
[https://osf.io/buazk/?view\\_only=36f87228fc0a4773a859f0681219e66f](https://osf.io/buazk/?view_only=36f87228fc0a4773a859f0681219e66f). No participants met our exclusion criteria. Thus, no participants were excluded from any analyses. Results from exploratory analyses are presented in the Supplemental Materials. Descriptive statistics are presented in Table 1. Correlations are presented in Table 2.

Table 1  
*Descriptive Statistics (N = 438)*

	<i>M</i>	<i>SD</i>	Reliability	
Mindset	3.68	0.77	$\alpha$	.92
Learning Goals	4.13	0.55	$\alpha$	.73
Performance Goals	3.73	0.63	$\alpha$	.83
Performance-Avoidance Goals	3.91	0.71	$\alpha$	.71
Belief in Talent Alone	1.81	0.94	-	N/A
Response to Challenge	3.96	0.64	$\alpha$	.69
Cattell Test 4	5.11	1.59	<i>r</i>	.53
Letter Sets	9.85	2.90	<i>r</i>	.84
Raven's Challenge (Part 1)	0.34	0.55	-	N/A
Raven's Test (Part 2)	7.39	2.65	<i>r</i>	.66

*Note.*  $\alpha$  = Cronbach's alpha. Cronbach's alpha is used as the measure of reliability for the untimed, Likert scale questionnaires. *r* = split-half reliability (odd/even) with Spearman-Brown corrections. Split-half reliability is used for progressively difficult and timed tasks. N/A = reliability could not be computed for a single-item measure, and is not computed for the experimental manipulation.

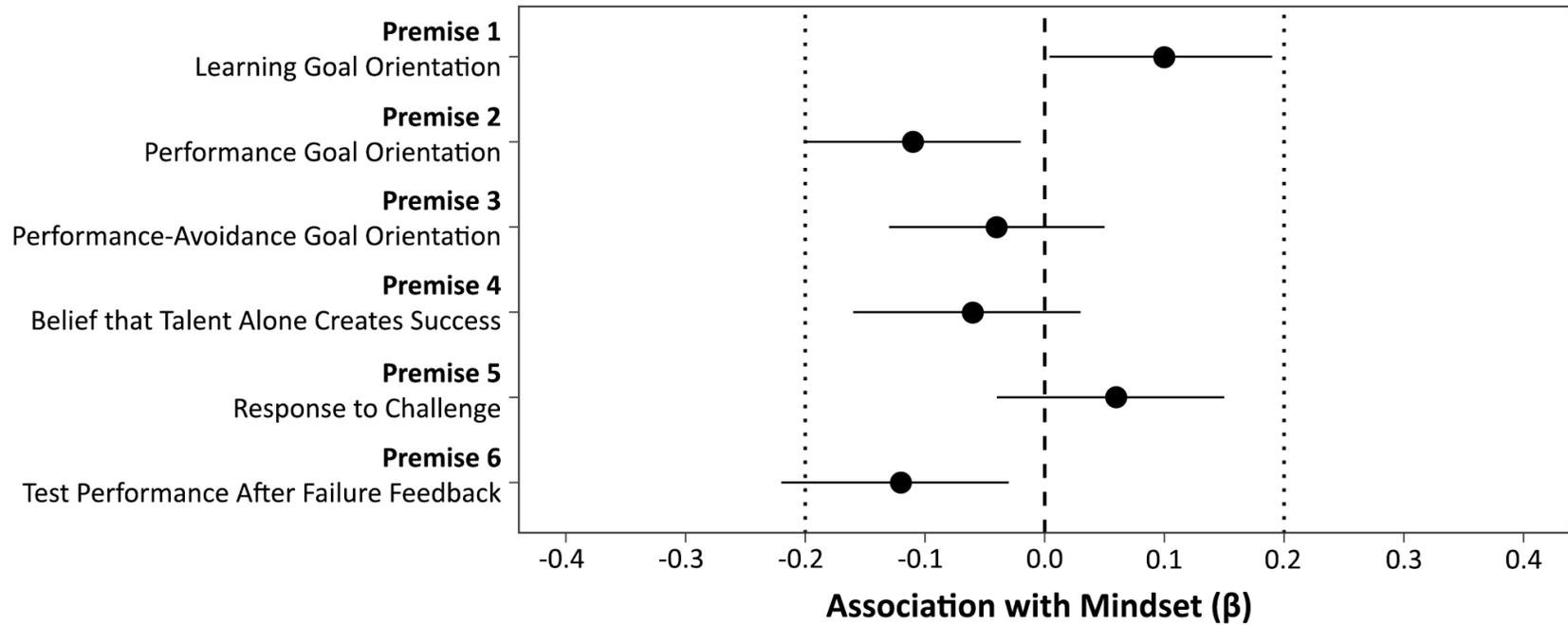
Table 2  
*Correlations for Personality and Cognitive Ability Measures (N = 438)*

	1.	2.	3.	4.	5.	6.	7.	8.
1. Mindset	---							
2. Learning Goals	<b>.10</b>	---						
3. Performance Goals	<b>-.11</b>	<b>.16</b>	---					
4. Perf.-Avoidance Goals	-.04	.05	<b>.78</b>	---				
5. Belief in Talent Alone	-.06	-.09	.06	.04	---			
6. Response to Challenge	.06	<b>.33</b>	.06	<b>-.10</b>	-.09	---		
7. Cattell Test 4	<b>-.10</b>	-.02	-.07	<b>-.11</b>	-.07	-.03	---	
8. Letter Sets	<b>-.11</b>	.03	.03	-.01	-.06	-.05	<b>.21</b>	---
9. Raven's Test (Part 2)	<b>-.12</b>	.01	<b>-.10</b>	<b>-.11</b>	<b>-.21</b>	-.03	<b>.36</b>	<b>.40</b>

*Note.* Bolded correlations are statistically significant at  $p < .05$ . Perf.-Avoidance Goals = Performance-Avoidance Goals.

Higher scores on the mindset measure indicate more of a growth mindset; thus, statistically significant positive effects indicate an association between growth mindset and another measure. By contrast, statistically significant negative effects indicate an association between fixed mindset and another measure.

Each analysis was conducted to test a different hypothesis. Thus, there were no alpha adjustments. A summary of the evidence can be found in Figure 1. Scatterplots are presented in Figure 2.



**Figure 1.** Forest plot depicting associations of mindset with measures hypothesized to relate to mindset. Error bars are 95% CIs. All effects were significantly weaker than .20 in the predicted direction. The effect for Premise 6 was in the *opposite* direction predicted by mindset theory.

**Testing Premise 1: People with Growth Mindsets Hold Learning Goals**

If people with growth mindsets hold learning goals, we should find a positive association between mindset and learning goal orientation. Regression analysis revealed that mindset significantly predicted learning goal orientation,  $\beta = .10$ , 95% CI [.004, .19],  $t = 2.05$ ,  $p = .041$ , however, an inferiority test indicated that the association was significantly weaker than  $\beta = .20$ ,  $p = .015$ .

**Testing Premise 2: People with Fixed Mindsets Hold Performance Goals**

If people with fixed mindsets hold performance goals, we should find a negative association between mindset and performance goal orientation. Regression analysis indicated that fixed mindset significantly predicted performance goal orientation,  $\beta = -.11$ , 95% CI [-.20, -.02],  $t = -2.29$ ,  $p = .022$ , however, an inferiority test indicated that the association was significantly weaker than  $\beta = -.20$ ,  $p = .026$ .

**Testing Premise 3: People with Fixed Mindsets Hold Performance-Avoidance Goals**

If people with fixed mindsets hold performance-avoidance goals, we should find a negative association between mindset and performance-avoidance goal orientation. Regression analysis indicated that mindset did not significantly predict holding performance-avoidance goals,  $\beta = -.04$ , 95% CI [-.13, .05],  $t = -0.82$ ,  $p = .414$ . An inferiority test indicated that the association between mindset and performance-avoidance goal orientation was significantly weaker than  $\beta = -.20$ ,  $p < .001$ .

**Testing Premise 4: People with Fixed Mindsets Believe That Talent Alone—Without Effort—Creates Success**

If people with fixed mindsets believe that talent alone—without effort—creates success, we should find a negative association between mindset and agreement with the statement “talent

alone–without effort–creates success.” Regression analysis revealed that fixed mindset did not significantly predict the belief that talent alone is responsible for success,  $\beta = -.06$ , 95% CI [-.16, .03],  $t = -1.28$ ,  $p = .201$ . An inferiority test indicated that the association between fixed mindset and the belief that talent alone creates success was significantly weaker than  $\beta = -.20$ ,  $p = .002$ .

### **Testing Premise 5: People with Growth Mindsets Persist to Overcome Challenges**

If people with growth mindsets persist to overcome challenges, we should find a positive association between mindset and agreement with statements about persisting to overcome challenges. Regression analysis indicated that growth mindset did not significantly predict agreement with persisting to overcome a challenge,  $\beta = .06$ , 95% CI [-.04, .15],  $t = 1.17$ ,  $p = .242$ . An inferiority test indicated that the association between growth mindset and persistence in the face of challenge was significantly weaker than  $\beta = .20$ ,  $p = .001$ .

### **Testing Premise 6: People with Growth Mindsets Are More Resilient Following Failure**

If people with growth mindsets are more resilient following failure, we should find a positive association between mindset and performance on a task after receiving failure feedback.

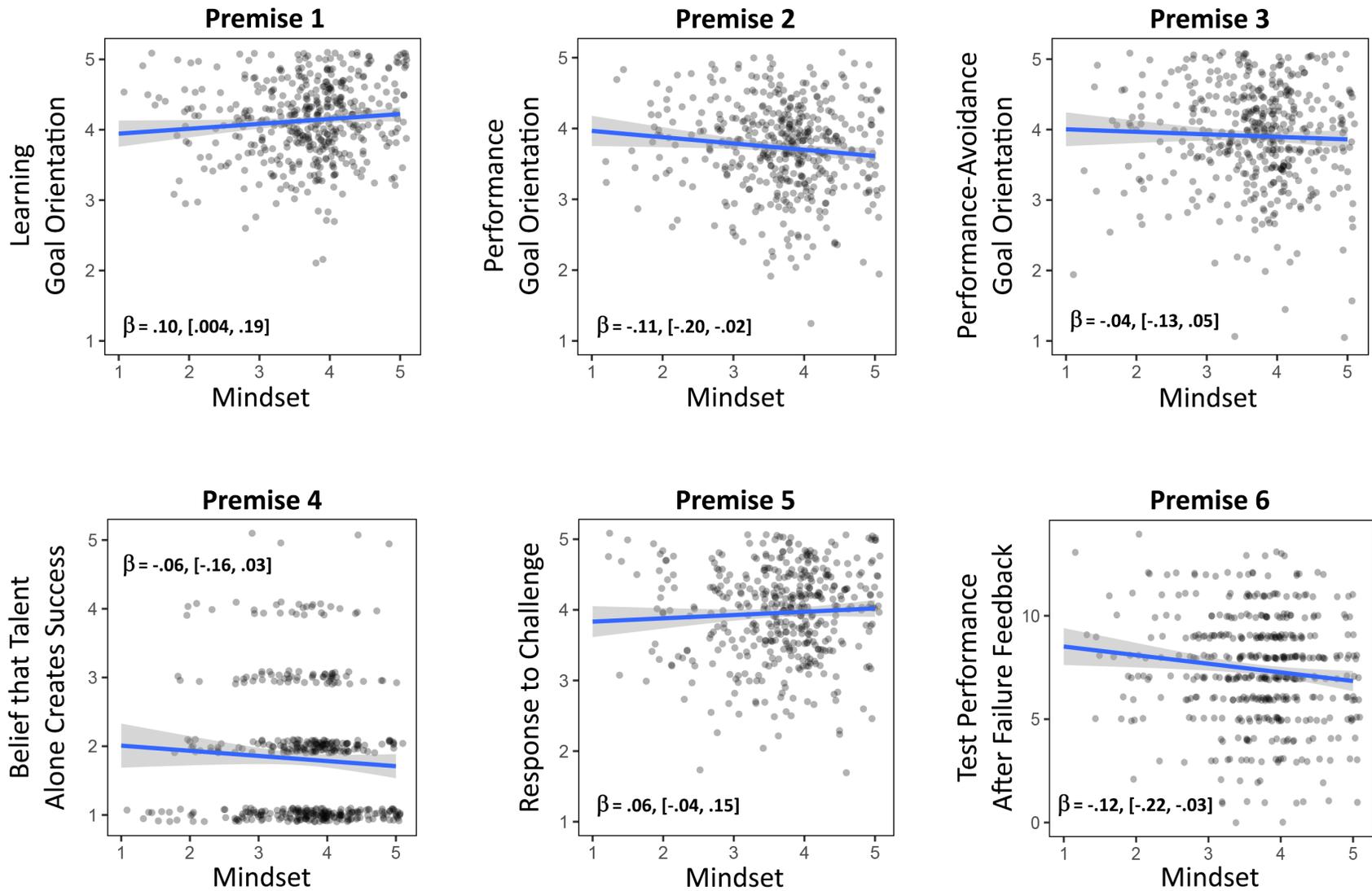
The mean score on Part 1 of the Raven’s Matrices Test (i.e., the failure manipulation), was  $M = 0.34$  ( $SD = .55$ ) problems correct out of four. No participant correctly answered the four items. Thus, all participants received failure messages presented in bold red text.

Having experienced failure, does mindset predict which participants “bounce back” and which are “devastated by setbacks” on Part 2 of the test? Indeed, mindset significantly predicted performance on Part 2 of the test, but in the *opposite* direction predicted by mindset theory,  $\beta = -.12$ , 95% CI [-.22, -.03],  $t = -2.56$ ,  $p = .011$ . That is, students with more of a fixed mindset outperformed students with more of a growth mindset (see Figures 1 and 2). An inferiority test

indicated that the association between growth mindset and performance following failure feedback was significantly weaker than  $\beta = .20, p < .001$ .

Next, we conducted hierarchical regression analyses to investigate whether mindset predicted performance on Part 2 of the Raven's Matrices Test after controlling for cognitive ability. In Step 1 of the models we entered the cognitive ability composite variable. In Step 2 we added mindset.

The overall model accounted for 24.1% of the variance in performance in Part 2 of the Raven's Matrices Test,  $F(2, 435) = 69.099, p < .001$ . The effect of cognitive ability was significant ( $\beta = .48, 95\% \text{ CI } [.40, .56], r_{\text{semi-partial}} = .48, t = 11.39, p < .001$ ), whereas the effect of mindset was not significant ( $\beta = -.06, 95\% \text{ CI } [-.14, .03], r_{\text{semi-partial}} = -.05, t = -1.31, p = .190$ ). The change in  $R^2$  from Step 1 to Step 2 was not statistically significant,  $\Delta R^2 = .003, p = .190$ .



**Figure 2.** Scatterplots depicting relationships between mindset (higher scores = more of a growth mindset) and measures hypothesized to relate to mindset. Data points have been made semi-transparent and jittered slightly for readability. Confidence bands are 95% CIs.

### Discussion

Mindset is a popular construct in psychological research and educational practice (Moreau, Macnamara, & Hambrick, 2018). Often, the language used to describe the importance of mindset is bold. Such claims have led to vast amounts of funding devoted to mindset research and a proliferation of growth mindset interventions (Sisk, Burgoyne, Sun, Butler, & Macnamara, 2018).

We empirically tested six key premises of mindset theory. We found that the strength of the claims appears to outweigh the strength of the evidence. That is, in all cases, mindset's effects were significantly weaker than the average effect size found in social psychological research. Only two of the six associations with mindset were statistically significant in the predicted direction. The strongest association ( $r = -.12$ ) was in the *opposite* direction predicted by mindset theory. That is, *fixed mindset* was associated with better test performance following failure feedback. This result is consistent with Li and Bates' (2019) findings.

Although we did not find robust support for mindset theory's premises in terms of *statistical significance*, some might argue that small associations have *practical significance*. However, without robust evidence that associations are nonzero, as is the case with half the premises tested, there is no evidence of practical significance. Furthermore, other personality constructs may have greater practical significance than mindset. For instance, one reason mindset is presumed to be important is because of its relationship with learning goal orientation. We found that mindset accounted for 1% of learning goal orientation variance. By comparison, a meta-analysis found that self-esteem, need for achievement, and general self-efficacy explained 10%, 14%, and 31% of learning goal orientation variance, respectively (Payne et al., 2007).

Therefore, mindset may not be “the core of meaning systems” (p. 483) as Dweck and Yeager (2019) recently claimed.

Proponents of mindset theory have made efforts to promote mindset interventions and shape education policy (see, e.g., Rattan et al., 2015). However, the results of this investigation and others suggest that the theoretical basis for these programs may not be sound. Time and money spent on mindset-related programs diverts resources from other programs with potentially greater effects and stronger theoretical underpinnings (e.g., curricula, teacher training, self-efficacy programs). Therefore, practitioners might reconsider the value of mindset in their work.

### **Conclusion**

We tested several key premises of mindset theory. The premises were not well-supported. Only two of six associations were statistically significant in the predicted direction. All effects of mindset were significantly weaker than the average effect size found in social psychology, and diminutive relative to other constructs in the achievement motivation literature. Furthermore, the largest effect ( $r = -.12$ ) was in the *opposite* direction predicted by mindset theory. This research suggests that the foundations of mindset theory are not firm, and in turn calls into question many assumptions made about the importance of mindset. Given the public spotlight on mindset, it may be prudent for mindset researchers to temper strongly-worded claims.

### **Author Contributions**

A. P. Burgoyne and B. N. Macnamara developed the study concept. A. P. Burgoyne and B. N. Macnamara designed the study with input from D. Z. Hambrick. A. P. Burgoyne developed the study materials with input from B. N. Macnamara. Testing and data collection were performed in the laboratories of D. Z. Hambrick and B. N. Macnamara. A. P. Burgoyne and B. N. Macnamara

performed the data analysis and interpretation. A. P. Burgoyne drafted the manuscript, and B. N. Macnamara and D. Z. Hambrick provided critical revisions. All authors approved the final version of the manuscript for submission.

### **Open Practices Statement**

All hypotheses, planned sample sizes, sample plan, data collection stopping rule, and confirmatory analyses were formally pre-registered at

[https://osf.io/gkwrw/?view\\_only=4b7cfdd7d6b9459ca9714f204678daa5](https://osf.io/gkwrw/?view_only=4b7cfdd7d6b9459ca9714f204678daa5) and

[https://osf.io/32bxf/?view\\_only=add1e240ab57496096680e66be1f2aae](https://osf.io/32bxf/?view_only=add1e240ab57496096680e66be1f2aae). Materials that are not copyrighted are openly available at

[https://osf.io/buazk/?view\\_only=36f87228fc0a4773a859f0681219e66f](https://osf.io/buazk/?view_only=36f87228fc0a4773a859f0681219e66f). Data are openly available at [https://osf.io/buazk/?view\\_only=36f87228fc0a4773a859f0681219e66f](https://osf.io/buazk/?view_only=36f87228fc0a4773a859f0681219e66f).

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