*Research Article*

# How Firm Are the Foundations of Mind-Set Theory? The Claims Appear Stronger Than the Evidence

Alexander P. Burgoyne[1], David Z. Hambrick[1], and Brooke N. Macnamara[2]
[1]Department of Psychology, Michigan State University, and [2]Department of Psychological Sciences, Case Western Reserve University

## Abstract

*Mind-set* refers to people's beliefs about whether attributes are malleable (*growth mind-set*) or unchangeable (*fixed mind-set*). Proponents of mind-set theory have made bold claims about mind-set's importance. For example, one's mind-set is described as having profound effects on one's motivation and achievements, 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 mind-set theory in 438 participants; we reasoned that strongly worded claims should be supported by equally strong evidence. However, no support was found for most premises. All associations ($r$s) were significantly weaker than .20. Other achievement-motivation constructs, such as self-efficacy and need for achievement, have been found to correlate much more strongly with presumed associates of mind-set. The strongest association with mind-set ($r = -.12$) was opposite from the predicted direction. The results suggest that the foundations of mind-set theory are not firm and that bold claims about mind-set appear to be overstated.

## Keywords

mind-set theory, implicit theories, growth mind-set, fixed mind-set, achievement, open data, open materials, preregistered

There is currently a great deal of scientific interest in *mind-set* (i.e., implicit theories). Mind-set refers to people's beliefs about the nature of personal attributes, such as intelligence. People who hold *growth mind-sets* (i.e., incremental theorists) believe that attributes are malleable, whereas those who hold *fixed mind-sets* (i.e., entity theorists) believe that 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 mind-sets 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 mind-set rests on several theoretical premises. Many of these premises were concisely summarized by Rattan, Savani, Chugh, and Dweck (2015) in their call to make funding mind-set research a "national education priority" (p. 723); they stated that

> 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 the present study was to test six of these key premises of mind-set theory.

**Corresponding Author:**
Brooke N. Macnamara, Case Western Reserve University, Department of Psychological Sciences, 11220 Bellflower Rd., Cleveland, OH 44106
E-mail: brooke.macnamara@case.edu

## Premise 1: People With Growth Mind-Sets Hold Learning Goals

Rattan et al. (2015) stated that "students with growth mindsets seek to learn and develop their abilities" (p. 722). Indeed, according to Dweck and Yeager (2019), mind-set 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 mind-sets "care first and foremost about learning," and "the cardinal rule is: Learn, learn, learn!" (p. 4). Thus, people's mind-set should predict their learning-goal orientation, such that people with more of a growth mind-set will endorse learning goals more than people with less of a growth mind-set.

## Premise 2: People With Fixed Mind-Sets 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* [emphasis added] 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)

Additionally, Dweck (2009) explained, people with fixed mind-sets "have to look good at all times" (p. 5), and "the cardinal rule is: Look talented at all costs" (p. 4). Thus, people's mind-set should predict their performance-goal orientation, such that people with more of a fixed mind-set endorse performance goals more than people with less of a fixed mind-set.

## Premise 3: People With Fixed Mind-Sets Hold Performance-Avoidance Goals

Burnette, O'Boyle, VanEpps, Pollack, and Finkel (2013) stated that "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) also described how people with fixed mind-sets 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, mind-set should predict performance-avoidance-goal orientation, such that people with more of a fixed mind-set endorse performance-avoidance goals more than people with less of a fixed mind-set.

## Premise 4: People With Fixed Mind-Sets Believe That Talent Alone—Without Effort—Creates Success

Dweck (2009) claimed that people "with a fixed mindset believe that if you have natural talent, you shouldn't need much effort" (p. 5). In addition, as stated on Dweck's (n.d.) website, people with fixed mind-sets "believe that talent alone creates success—without effort" (para. 3). Thus, people's mind-set should predict agreement with the statement, "Talent alone—without effort—creates success," such that people with more of a fixed mind-set agree with this statement more than do people with less of a fixed mind-set.

## Premise 5: People With Growth Mind-Sets Persist to Overcome Challenge

As 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, mind-set theory 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 mind-set-intervention company Mindset Works (2017; cofounded by Dweck) explains on its website that "children with a growth mindset persist in the face of challenges" (para. 4). Thus, people's mind-set should predict their endorsement of statements about persisting to overcome a challenge, such that people with more of a growth mind-set endorse these statements more than people with less of a growth mind-set.

## Premise 6: People With Growth Mind-Sets Are More Resilient Following Failure

According to Yeager and Dweck (2012), mind-sets "appear to create different psychological worlds for students: one that promotes resilience and one that does not" (p. 304). Boaler (2013) further explained that "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 mind-sets are "devastated by setbacks" (Dweck, 2008, para. 2). Thus, people's mind-set should predict their performance following failure, such that people with more of a growth mind-set will perform better following failure than people with less of a growth mind-set. These results should also hold after we control for ability.

## Prior Evidence for Premises

The available evidence suggests that these claims are overstated. For example, despite the claim that people with growth mind-sets care first and foremost about learning (Premise 1), a recent meta-analysis found the mean correlation ($\bar{r}$) between mind-set and learning-goal orientation was only .19 (Burnette et al., 2013). For comparison, other personality constructs have been found to correlate much more strongly with learning-goal orientation: self-efficacy ($\bar{r}$ = .56), need for achievement ($\bar{r}$ = .38), and 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: The $\bar{r}$ between mind-set and performance-goal orientation was only −.15, and the $\bar{r}$ between mind-set and performance-avoidance-goal orientation was only −.18. For comparison, Payne et al.'s meta-analysis found that the correlation between self-efficacy and performance-avoidance-goal orientation was −.47. Referring to mind-set, Payne et al. 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 [goal orientation]" (p. 140).

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

Few studies have examined the relationship between one's naturally held mind-set and resilience to failure (Premise 6). Rather, studies that examined resilience to failure by "helpless" and "mastery-oriented" children

(with no measures of mind-set; e.g., Diener & Dweck, 1978) or after manipulating praise (Mueller & Dweck, 1998) have been interpreted as evidence of mind-set's relationship with resilience (see e.g., Dweck & Leggett, 1988; Good, Rattan, & Dweck, 2012). However, Li and Bates (2019) directly tested this relationship. In one sample, they found no association between mind-set and performance following failure. In another sample, they found that the more of a growth mind-set students held, the *worse* they performed following failure.

## Present Study

Proponents of mind-set theory have made bold claims about the importance of mind-set. Dweck herself has stated multiple times that mind-set has "profound" effects on motivation and achievement (Dweck, 2006, p. ix; Dweck, 2008, para. 2, para. 3). This is not to say that every claim about mind-set implies strong effects or that none are more nuanced. However, strong claims about mind-set 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 associations predicted by mind-set theory against the mean effect size found in social-psychological research ($r$ = .20; see Effect-Size Benchmarks below). We also compared effects of mind-set with 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, mind-set's effects were significantly weaker than an association ($r$) of .20. The strongest association ($r$ = −.12) was in the opposite direction from that predicted by mind-set theory. That is, having a fixed mind-set was associated with better test performance following failure feedback (Premise 6).

## Method

All hypotheses, planned sample sizes, the sampling plan, and the data-collection stopping rule were pre-registered at https://osf.io/gkwrv/ (Premises 1–5) and https://osf.io/32bxf/ (Premise 6). Materials, descriptions of changes to the preregistration, and details of additional analyses are available at https://osf.io/buazk/. The Case Western Reserve University and Michigan State University Institutional Review Boards approved this study.

### Effect-size benchmarks

For each premise, we tested the prediction made by mind-set theory. The analyses and pattern of results

that would support each premise were preregistered at https://osf.io/gkwrv/ and https://osf.io/32bxf/.

The criterion for robust evidence supporting claims about mind-set was determined as follows: significant, standardized regression coefficients ($\beta$s $\geq |0.20|$) in the direction predicted by mind-set theory. We tested whether $\beta$s were significantly smaller than $|0.20|$ via inferiority tests (Lakens, Scheel, & Isager, 2018).

We chose to test against a criterion of $\beta$ equal to 0.20 (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 (Schäfer & Schwarz, 2019). In particular, strongly worded claims should be supported by equally strong evidence. Thus, effects described as profound should at least meet the mean effect size in social-psychological research ($r \approx .20$; Richard, Bond, & Stokes-Zoota, 2003). In addition to using this benchmark, we contextualized mind-set's effect sizes alongside other constructs in the same research area. The purpose of these contrasts is to illustrate how effects of mind-set compare with effects within the field of social psychology in general and the achievement-motivation literature in particular.

## Participants

According to a power analysis in G*Power (Faul, Erdfelder, Lang, & Buchner, 2007), a minimum of 73 participants was needed to observe an effect size ($\Delta R^2$) of at least .13 in a hierarchical regression analysis (our most complex analysis) at .90 power (G*Power's medium-sized effect benchmark of .13 is based on Cohen's, 1988, convention; we initially planned to test against medium-sized effects, see https://osf.io/y2wgv/). Our preregistered stopping rule for data collection was to run 146 participants (i.e., 73 × 2) or 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 ($\beta$s) greater than or equal to $|0.20|$ was .99 for all analyses.

## Measures

**Mind-set of intelligence.** Dweck's (2000) Implicit Theories of Intelligence Questionnaire was used to measure mind-set. Participants responded to eight 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 mind-set, reflecting the belief that intelligence is malleable. Lower scores correspond to more of a fixed mind-set, 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 statements about learning goals (e.g., "I want to learn as much as possible"), performance-approach goals (e.g., "I strive to demonstrate my ability relative to others"), and performance-avoidance goals (e.g., "I worry about the possibility of performing poorly"). Higher scores correspond to greater endorsement of each goal orientation.

***Belief in talent versus effort.*** To measure belief in talent versus effort, we asked participants to respond to three items using a 5-point Likert scale, rating the degree to which they agreed or disagreed with the following statements—(a) belief in talent alone: "Talent alone—without effort—creates success"; (b) belief in talent and effort: "Both talent and effort are needed for success"; and (c) 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 four items using a 5-point Likert scale, rating how likely they were to persist at working toward this goal in the face of challenge. The four items consisted of the following statements: (a) "I am working hard to accomplish this goal and overcome this challenge"; (b) "When this goal or challenge has proven difficult, I have worked harder to accomplish it"; (c) "When this goal or challenge has proven difficult, I have taken a break from working toward this goal" (reverse scored); and (d) "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 four 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. Alongside the target geometric figure were five other

geometric designs. Participants were asked to select the one that would allow them to place the dots in an analogous location as in the target design. Participants were given 2.5 min to complete 10 items (Cattell & Cattell, 1949). The outcome measure was the number of correct responses.

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

### Raven's Advanced Progressive Matrices Challenge Test.
Participants were presented with a set of patterns in which the lower-right portion was 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 of correct responses.

In the challenge portion of this task (i.e., Part 1), participants were given 2.5 min to complete four challenging Raven's items (Items 36, 35, 34, and 33, in that order). After 2.5 min, they were given honest feedback on their performance on the first four items in 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 min 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 of correct responses.

### Procedure

First, participants completed the questionnaires in the following order: mind-set of intelligence, goal orientation, response to challenge, and belief in talent versus effort. Next, participants completed the Cattell Culture Fair Test 4, letter sets, and the Raven's Advanced Progressive Matrices Challenge Test.

## Results

Data are publicly available at https://osf.io/buazk/. No participants met our exclusion criteria. Results from exploratory analyses are presented at https://osf.io/y2wgv/. Descriptive statistics are presented in Table 1. Correlations are presented in Table 2. Higher scores on the mind-set measure indicate more of a growth mind-set; thus, statistically significant positive effects indicate an association between growth mind-set and another measure. By contrast, statistically significant negative effects indicate an association between fixed mind-set and another measure. Each analysis was conducted to

**Table 1.** Descriptive Statistics ($N = 438$)

| Variable | $M$ | $SD$ | Reliability |
|---|---|---|---|
| Mind-set | 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 | |
| Response to challenge | 3.96 | 0.64 | $\alpha = .69$ |
| Cattell Test 4 | 5.11 | 1.59 | $r = .53$ |
| Letter sets | 9.85 | 2.90 | $r = .84$ |
| Raven's Challenge (Part 1) | 0.34 | 0.55 | |
| Raven's Test (Part 2) | 7.39 | 2.65 | $r = .66$ |

Note: Cronbach's $\alpha$ is used as the measure of reliability for the untimed, Likert-type scale questionnaires. Split-half reliability (odd/even) with Spearman-Brown correction ($r$) is used for the progressively difficult and timed tasks. Reliability was not computed for the single-item measure and was not computed for the experimental manipulation.

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.

### Testing Premise 1: people with growth mind-sets hold learning goals

If people with growth mind-sets hold learning goals, we should find a positive association between mind-set and learning-goal orientation. Regression analysis revealed that mind-set significantly predicted learning-goal orientation, $\beta = 0.10$, 95% CI = [0.004, 0.19], $t(436) = 2.05$, $p = .041$; however, an inferiority test indicated that the association was significantly weaker than the criterion for robust evidence ($\beta = 0.20$), $p = .015$.

### Testing Premise 2: people with fixed mind-sets hold performance goals

If people with fixed mind-sets hold performance goals, we should find a negative association between mind-set and performance-goal orientation. Regression analysis indicated that fixed mind-set significantly predicted performance-goal orientation, $\beta = -0.11$, 95% CI = [−0.20, −0.02], $t(436) = -2.29$, $p = .022$; however, an inferiority test indicated that the association was significantly weaker than the criterion for robust evidence ($\beta = -0.20$), $p = .026$.

### Testing Premise 3: people with fixed mind-sets hold performance-avoidance goals

If people with fixed mind-sets hold performance-avoidance goals, we should find a negative association between mind-set and performance-avoidance-goal orientation. Regression analysis indicated that mind-set

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

| Variable | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| 1. Mind-set | — | | | | | | | |
| 2. Learning goals | **.10** | — | | | | | | |
| 3. Performance goals | **–.11** | **.16** | — | | | | | |
| 4. Performance-avoidance goals | –.04 | .05 | **.78** | — | | | | |
| 5. Belief in talent alone | –.06 | –.09 | .06 | .04 | — | | | |
| 6. Response to challenge | .06 | **.33** | .06 | **–.10** | –.09 | — | | |
| 7. Cattell Test 4 | **–.10** | –.02 | –.07 | **–.11** | –.07 | –.03 | — | |
| 8. Letter sets | **–.11** | .03 | .03 | –.01 | –.06 | –.05 | **.21** | — |
| 9. Raven's Test (Part 2) | **–.12** | .01 | **–.10** | **–.11** | **–.21** | –.03 | **.36** | **.40** |

Note: Correlations in boldface are statistically significant ($p < .05$).

did not significantly predict holding performance-avoidance goals, $\beta = -0.04$, 95% CI = [–0.13, 0.05], $t(436) = -0.82$, $p = .414$. An inferiority test indicated that the association between mind-set and performance-avoidance-goal orientation was significantly weaker than the criterion for robust evidence ($\beta = -0.20$), $p < .001$.

## Testing Premise 4: people with fixed mind-sets believe that talent alone—without effort—creates success

If people with fixed mind-sets believe that talent alone—without effort—creates success, we should find a negative association between mind-set and agreement with the statement "talent alone—without effort—creates success." Regression analysis revealed that fixed

mind-set did not significantly predict the belief that talent alone is responsible for success, $\beta = -0.06$, 95% CI = [–0.16, 0.03], $t(436) = -1.28$, $p = .201$. An inferiority test indicated that the association between fixed mind-set and the belief that talent alone creates success was significantly weaker than the criterion for robust evidence ($\beta = -0.20$), $p = .002$.

## Testing Premise 5: people with growth mind-sets persist to overcome challenges

If people with growth mind-sets persist to overcome challenges, we should find a positive association between mind-set and agreement with statements about persisting to overcome challenges. Regression analysis indicated that growth mind-set did not significantly predict agreement with persisting to overcome a challenge,
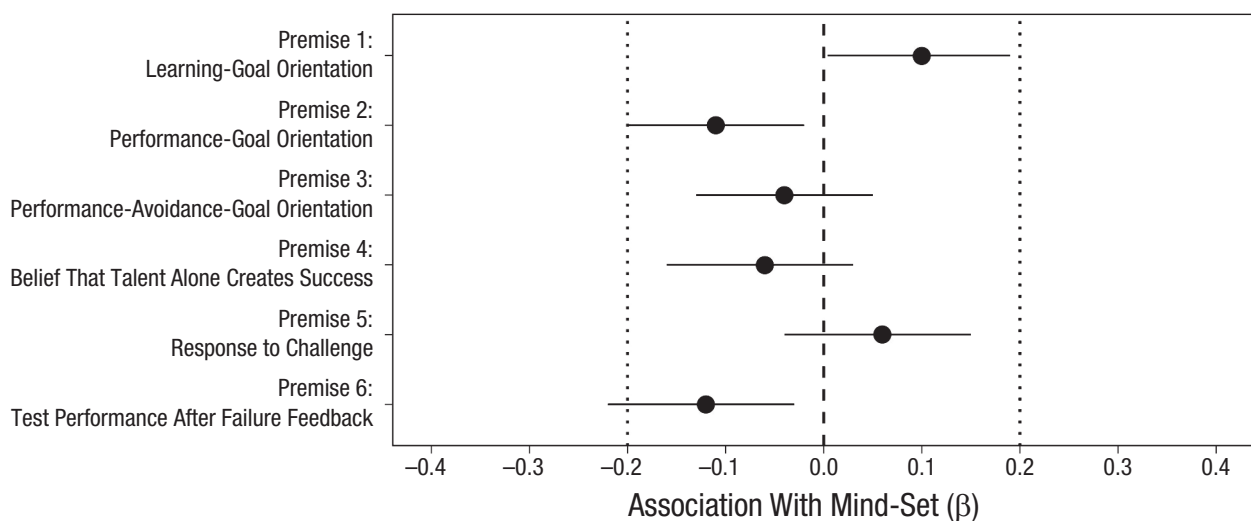


**Fig. 1.** Forest plot depicting associations of mind-set with measures hypothesized to relate to mind-set. Error bars indicate 95% confidence intervals. The area between the dotted lines signifies the range in which evidence is considered weak ($\beta$s ≤ |0.20|).
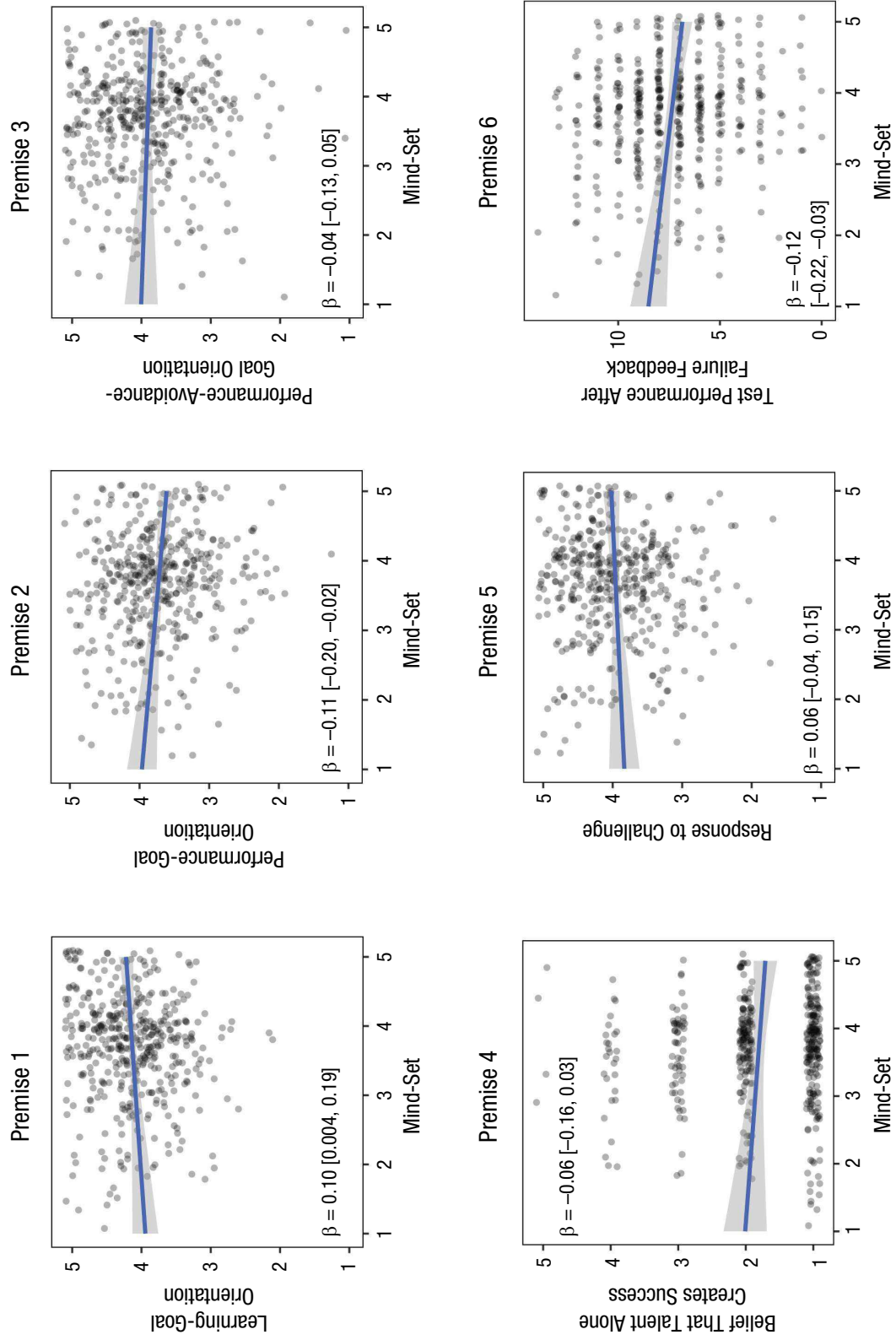
**Fig. 2.** Scatterplots (with best-fitting regression lines) depicting relationships between mind-set (higher scores indicate more of a growth mind-set) and scores on measures hypothesized to relate to mind-set. Data points have been made semitransparent and jittered slightly for readability. Confidence bands indicate 95% confidence intervals (CIs). Values in brackets are also 95% CIs.

β = 0.06, 95% CI = [−0.04, 0.15], $t(436)$ = 1.17, $p$ = .242. An inferiority test indicated that the association between growth mind-set and persistence in the face of challenge was significantly weaker than the criterion for robust evidence (β = 0.20), $p$ = .001.

### Testing Premise 6: people with growth mind-sets are more resilient following failure

If people with growth mind-sets are more resilient following failure, we should find a positive association between mind-set and performance on a task after participants receive failure feedback. The mean score on Part 1 of the Raven's Matrices Test (i.e., the failure manipulation) was 0.34 ($SD$ = 0.55) problems correct out of four. No participant correctly answered the four items. Thus, all participants received failure messages in bold red text.

Does mind-set predict which participants "bounce back" after experiencing failure and which are "devastated by setbacks" on Part 2 of the test? Indeed, mind-set significantly predicted performance on Part 2 but in the opposite direction from that predicted by mind-set theory, β = −0.12, 95% CI = [−0.22, −0.03], $t(436)$ = −2.56, $p$ = .011. That is, students with more of a fixed mind-set outperformed students with more of a growth mind-set (see Figs. 1 and 2). An inferiority test indicated that the association between growth mind-set and performance following failure feedback was significantly weaker than the criterion for robust evidence (β = 0.20), $p$ < .001.

Next, we conducted a hierarchical regression analysis to investigate whether mind-set predicted performance on Part 2 of the Raven's Matrices Test after controlling for cognitive ability. In Step 1 of the model, we entered the cognitive-ability composite variable. In Step 2, we added mind-set.

The overall model accounted for 24.1% of the variance in performance in Part 2 of the Raven's Matrices Test, $F(2, 435)$ = 69.10, $p$ < .001. The effect of cognitive ability was significant, β = 0.48, 95% CI = [0.40, 0.56], semipartial $r(435)$ = .48, $p$ < .001, whereas the effect of mind-set was not significant, β = −0.06, 95% CI = [−0.14, 0.03], semipartial $r(435)$ = −.05, $p$ = .190. The change in $R^2$ from Step 1 to Step 2 was not statistically significant, $\Delta R^2$ = .003, $p$ = .190.

### Discussion

Mind-set is a popular construct in psychological research and educational practice (Moreau, Macnamara, & Hambrick, 2018). Often, the language used to describe the importance of mind-set is bold. Such claims have led to vast amounts of funding devoted to mind-set research and a proliferation of growth-mind-set

interventions (Sisk, Burgoyne, Sun, Butler, & Macnamara, 2018).

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

Although we did not find robust support for mind-set theory's premises in terms of statistical significance, it might be argued 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 mind-set. For instance, one reason mind-set is presumed to be important is because of its relationship with learning-goal orientation. We found that mind-set accounted for 1% of the variance in learning-goal orientation. By comparison, a meta-analysis found that self-esteem, need for achievement, and general self-efficacy explained 10%, 14%, and 31% of the variance in learning-goal orientation, respectively (Payne et al., 2007). Therefore, mind-set may not be "the core of meaning systems" as Dweck and Yeager (2019, p. 483) recently claimed.

Proponents of mind-set theory have made efforts to promote mind-set interventions and shape education policy (e.g., Rattan et al., 2015). However, the results of our investigation and others suggest that the theoretical basis for these programs may not be sound. Time and money spent on mind-set-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 mind-set in their work.

### Conclusion

We tested several key premises of mind-set theory. The premises were not well supported. Only two of six associations were statistically significant in the predicted direction. All effects of mind-set 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 from that predicted by mind-set theory. Our results suggest that the foundations of mind-set theory are not firm and, in turn, call into question many assumptions made about the importance of mind-set. Given the public spotlight on mind-set, it may be prudent for mind-set researchers to temper strongly worded claims.

## Transparency

## ORCID iDs

David Z. Hambrick [ID] https://orcid.org/0000-0002-5315-5597
Brooke N. Macnamara [ID] https://orcid.org/0000-0003-1056-4996

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