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When Do Personal Mindsets Predict Interest in a Culture of Growth Versus Genius? A Mindset Strength Perspective

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Decades of research indicate that growth versus fixed mindsets can influence important outcomes. Some, however, have recently questioned this conclusion, documenting small to nonexistent effects. Inspired by attitudes research, we propose that some growth mindsets may be stronger—more impactful—than others. Specifically, this work examines whether mindsets held with higher certainty are more likely to influence responses. A field study, a high-powered preregistered experiment, and an integrative data analysis test whether mindset certainty influences interest and engagement in organizations that endorse fixed versus growth mindsets. These studies found that when students held their mindsets with high levels of certainty, their personal mindset beliefs were highly predictive of their relative interest in growth versus fixed classrooms, but when they held their mindsets with less certainty, their personal mindsets did not predict relative interest in growth versus fixed classrooms in this same manner. Broadly, these studies support that mindsets vary in strength, which should encourage researchers to identify "when" rather than "whether" growth mindsets predict outcomes.

Keywords: growth mindsets, certainty, organizational mindsets, mindset strength, person–environment fit

Supplemental materials: https://doi.org/10.1037/pspi0000498.supp

The belief that abilities are malleable (growth mindset) or not (fixed mindset) can profoundly influence people's outcomes (Blackwell et al., 2007; Dweck & Leggett, 1988; Hong et al., 1999; Nussbaum & Dweck, 2008; Yeager et al., 2019). Mindsets fall on a continuum from more fixed to growth, and more growth beliefs positively predict academic performance and belonging (Burnette et al., 2020; Wallace et al., 2023), intergroup relations (Goldenberg et al., 2018; Levontin et al., 2013), and self-regulation (Mrazek et al., 2018), to list some among many benefits (for review, see Dweck & Yeager, 2019; Murphy & Reeves, 2020; Rattan & Ozgumus, 2019). These diverse benefits stem from a common mechanism: fixed versus growth beliefs shift how much people weigh traits versus contextual factors in attribution—shaping goals, behavior, and social perceptions. Given these powerful effects, researchers have developed interventions to instill growth mindset beliefs to unlock human potential and address inequality (J. Aronson et al., 2002; Blackwell et al., 2007; Good et al., 2003; Heslin et al., 2005; Paunesku et al., 2015; Rattan et al., 2015; Yeager et al., 2019; Yeager, Walton, et al., 2016).

Although the benefits of personal growth mindsets have been replicated numerous times and across contexts (for review, see Burnette et al., 2023; Dweck & Yeager, 2019), recent studies and meta-analyses reporting small to nonexistent effects of personal

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growth mindsets (Barnett & Macnamara, 2023; Burgoyne et al., 2020; Foliano et al., 2019; Li & Bates, 2019; Macnamara & Burgoyne, 2023; Sisk et al., 2018) have led some to question the theory, suggest abandoning these interventions, and criticize the expenditure of taxpayer funds for these programs (Macnamara, 2018). This reaction, however, may be premature. In the current article, we provide a new "growth mindset strength" perspective for understanding when personal mindsets should have more or less influence. Specifically, drawing from attitudes research, we propose that personal mindsets can be held with varying levels of certainty.

The Growth Mindset Strength Perspective

In a situation similar to the current state of the personal mindsets literature, attitudes research in the 1960s was plagued with controversy: although attitudes were theorized to predict behavior and judgments, research found that they did so inconsistently (for review, see Wegener & Wallace, 2017). This apparent poor prediction led some to suggest abandoning the study of attitudes altogether (Wicker, 1969). In response, rather than studying w*hether* attitudes predict behavior, researchers worked to identify *when* they did.

Researchers proposed that some attitudes are "stronger" than others (Petty & Krosnick, 1995). Attitude strength refers to the impact and durability of attitudes. Strong attitudes persist over time, resist persuasion, and guide responses, much like strong objects or people withstand external forces and exert influence. Researchers have identified features of attitudes—beyond the attitude itself—that reliably *predict* its strength, such as knowledge, certainty, and (lack of) ambivalence (Luttrell & Sawicki, 2020; Petty & Krosnick, 1995). In the current article, we focus on certainty—a metacognitive judgment of correctness or validity (Gross et al., 1995). Two people may both think "I support Issue 1" and have identical attitude positions. However, one might be certain in their support, the other not. Attitudes held with certainty are more likely to guide behavior and other relevant judgments. For example, attitudes held with more certainty better predict attraction to similar others (for details and moderators, see Philipp-Muller, Wallace, Sawicki, et al., 2020; Sawicki & Wegener, 2018).

Extending these ideas, we propose a novel "mindset strength" framework: personal mindset beliefs should be more predictive of responses when held with greater certainty. Consistent with the attitude strength literature, we use "mindset strength" to capture the idea that some mindsets are more impactful and durable, and we test "mindset certainty" as a *predictor* of strength.

Our approach builds on and adds nuance to the recent "heterogeneity revolution" in mindsets research (Bryan et al., 2021; Burnette et al., 2023; Rege et al., 2021; Tipton et al., 2023; Yeager et al., 2019). Consistent with our approach, the heterogeneity revolution focuses on identifying conditions under which personal mindsets predict outcomes. Much of this work has focused on social contexts—for example, finding the right "soil" for the "seed" (see Walton & Yeager, 2020). For example, direct-to-student growth mindset interventions only work in classrooms in which teachers also endorse growth mindset beliefs (those that provide fertile soil; Yeager et al., 2022). By contrast, we propose that researchers should consider "what makes seeds grow?" and whether seeds and soils might both vary in those features. We propose mindset certainty as one feature reflective of a seed's likelihood to grow.

We provide an initial test of the mindset strength framework by exploring a previously documented effect: Personal mindsets predict relative interest in growth over fixed organizations (Wallace et al., 2023). The major contribution of this prior work is to identify which people are most likely to enter fixed versus growth organizations. This effect is a good test case for the initial demonstration of the mindset strength framework for several reasons. First, using an effect with consistent prior evidence represents a conservative test. Second, as outlined below, this effect likely stems from the same shared mechanism underlying other growth mindset effects. Third, it is an important metascience practice for researchers to identify moderators proactively rather than respond reactively to failed replication attempts. Finally, because a key contribution of this work is to highlight the need to consider both features of seeds (certainty) and soils (organizational mindsets), this provided us with an opportunity to consider both.

Personal Mindsets Predict Relative Preferences for Growth Versus Fixed Organizations

Just as individuals can have relatively more fixed or growth mindsets, organizations can also communicate these mindsets through their policies, practices, norms, and leadership messages (Canning et al., 2020; Emerson & Murphy, 2015; Murphy & Dweck, 2010). Critically, people's personal mindsets predict their relative interest in more growth versus fixed organizations (Wallace et al., 2023), consistent with other work on person–environment/organization fit (e.g., Cable & Judge, 1996; Ebert et al., 2020; Fulmer et al., 2010; Sekiguchi & Yang, 2021; Van Vianen, 2018). Although this is statistically represented as a two-way interaction between personal and organizational mindsets, it conceptually reflects an effect of personal mindsets: that is, personal growth mindsets predict interest in growth relative to fixed organizations.

Notably, prior work suggests a nuanced pattern of results. Whereas people with more growth mindsets are more interested in joining growth versus fixed organizations, those with more fixed mindsets are more agnostic. At times they demonstrate no preference between fixed and growth organizations; other times, they even prefer growth environments, but to a lesser extent than those with growth mindsets. Thus, personal mindset beliefs predict relative rather than absolute differences in interest in growth over fixed organizations. This pattern likely reflects the meaning system mechanism theorized to underlie growth mindset effects more generally.

Theory suggests that growth mindsets are associated with a diversity of positive outcomes like grades, persistence in the face of challenges, intergroup harmony, and self-regulation because people with more fixed mindsets attribute behavior to traits, whereas those with more growth mindsets emphasize context-sensitive psychological processes (Hong et al., 1999; Plaks et al., 2009). These attributional differences lead to distinct goals: those who endorse more fixed beliefs prioritize showcasing innate abilities (performance goals), whereas those endorsing more growth beliefs focus on improving their abilities (mastery goals). People's preferences for different environments likely reflect these goals. One can readily pursue mastery goals in growth mindset environments as the organizational beliefs are consistent with these ends; the pursuit of such goals, however, is impeded by the beliefs that define fixed mindset environments—that is, change is not possible. By contrast, there is nothing to prevent individuals from pursuing performance goals in either growth or fixed mindset environments—although these goals may not be the preferred goals of growth organizations,

one could still pursue them in this context if desired. Furthermore, people with more fixed mindsets who perceive themselves as low in ability may even prefer growth over fixed environments, given the threatening nature of fixed environments where "some people have it and some people do not" (Canning et al., 2020; Emerson & Murphy, 2015). If those with more fixed mindsets vary in their perceived abilities, they may not have a clear preference for fixed over growth organizations.

Current Hypotheses

In the present work, we apply the mindset strength approach to understand not *whether*, but *when* personal growth mindsets predict preferences for growth over fixed environments. Specifically, we hypothesize that when people hold their personal mindsets with greater certainty, their personal mindsets should be more predictive of relative preferences for growth over fixed environments. Statistically, this is a three-way interaction between organizational mindset, personal mindset, and personal mindset certainty. We test whether certainty determines the likelihood of observing the two-way interaction between personal and organizational mindsets reported in prior research (Wallace et al., 2023). Recall that although the effect of personal mindsets on relative preferences for growth versus fixed mindsets is statistically a two-way interaction, it can be conceptually thought of as a main effect of personal mindsets. For the same reason, although we test a three-way interaction, conceptually our model could be thought of as a two-way interaction in which we test whether certainty moderates the effect of personal mindsets on relative preferences for growth versus fixed organizations.[1]

Confusion in Previous Treatments of "Certainty" in the Mindset Literature

Some might suggest that researchers have already considered the role of personal mindset certainty in predicting responses. Researchers have described beliefs at the midpoint of commonly used mindset measures as "unclear" (Chiu et al., 1997; Dweck et al., 1995; Levy & Dweck, 1998), "inconsistent" (Plaks et al., 2001), or "not well-defined" (Plaks et al., 2001)—terms that may appear synonymous with "uncertain." Based on this untested assumption, researchers have excluded midpoint responses, only analyzing those with "clear" personal mindsets (Chiu et al., 1997; Dweck et al., 1995; Levy & Dweck, 1998; Plaks et al., 2001).

This perspective equates mindset certainty with mindset extremity—distance from the midpoint of the scale. In contrast, the attitudes literature treats certainty and extremity as distinct constructs, allowing certainty to vary independently of where attitudes fall on the scale. Although these factors are moderately correlated ($r = .50$), they have independent and sometimes different consequences (Krosnick et al., 1993; Luttrell & Sawicki, 2020; Luttrell et al., 2016; Petty & Krosnick, 1995; Philipp-Muller, Wallace, & Wegener, 2020).

To provide a concrete example, consider a person who holds the position: "I think that some people are born with more intelligence than others, and there is a limit to how much you can improve; but within that limit, people can improve drastically." Some have suggested that this sort of reasoning explains how people can endorse both fixed and growth mindsets (Chiu et al., 2023; Dweck et al., 1995; Schunk, 1995). While a midpoint analysis might label this as "uncertain," individuals may feel highly confident in this mixed view. Thus, endorsing the midpoint does not equate to uncertainty. Given that previous work treating mindset extremity and mindset certainty interchangeably has not provided any empirical justification (Chiu et al., 1997; Dweck et al., 1995; Levy & Dweck, 1998; Plaks et al., 2001), in the current article, we conduct empirical tests of the relation between these two constructs and critically examine whether the effects of certainty in enhancing the predictive power of personal mindsets can be simply reduced to mindset extremity.

The Present Research

The current work is organized around two primary goals. First, we provide an initial test of the "mindset strength" framework. We examine when (rather than whether) personal mindset beliefs predict interest in joining and engagement in organizations with growth versus fixed mindsets, hypothesizing that certainty should lead to relatively more personal mindset consistent organizational interest. Second, we examine relations between personal mindset certainty and extremity, exploring whether the latter can account for the former in predicting people's responses.

We report two focal studies. Study 1 represents a field test of our hypotheses with students in classrooms reporting their in vivo experiences of engagement in classes taught by instructors perceived as having more fixed versus growth mindsets. Study 2 is a high-powered, preregistered experiment in which participants reported their interest in taking a course from a professor who espoused a fixed or growth mindset. Our treatment of instructor mindset as one instantiation of organizational mindset is consistent with prior work (e.g., Murphy & Reeves, 2020), which has examined organizational mindsets in both classroom and corporate contexts—messages communicated by powerful people are a central and impactful signal of organizational mindsets.

To test whether our hypothesis is supported across data sets, we report an integrative data analysis (Curran & Hussong, 2009) that combines the data from Study 2 with six additional data sets published in previous research that could be used to test the current hypotheses (Wallace et al., 2023, Studies 1, 2, S1a, S2a, S1b, and S2b). The individual results of each of the latter are reported in the online Supplemental Materials. These additional data sets involved participants reporting their interest in joining workplace and volunteer organizations, providing us the opportunity to examine whether the hypothesized mindset certainty effects generalize beyond the classroom context. Study 1 was excluded from this integrative analysis because it is not an experiment. Given that our focal studies employ students in classrooms, in Studies 1 and 2, we use the terms "student mindset" and "instructor mindset." In the Integrative Data Analysis section, which examines a broader range of contexts, we use the terms

[1] Wallace et al. (2023) found that those with more growth mindsets strongly preferred growth over fixed organizations, whereas those with more fixed mindsets were relatively indifferent. Given this, we did not anticipate that certainty would always lead to interest in a mindset-consistent organization in an absolute sense. Instead, we make relative predictions: among more fixed individuals, greater certainty might result in an attenuation of a preference for organizations that endorse a contrasting growth versus fixed mindset. Because our theory makes predictions about relative, but not absolute differences, we relegate analyses reporting simple effects among more growth and fixed participants to the online Supplemental Materials.

"organizational mindset" (rather than "instructor mindset") and "personal mindset" (rather than "student mindset").

An additional goal of this integrative analysis was to examine whether certainty may be interchangeable with extremity. We explored this question in two ways. First, we examined the correlation between mindset certainty and extremity. Second, we examined whether the effect of mindset certainty persisted when we statistically controlled for the effects of extremity.

Transparency and Openness

We report our sample size determination, all data exclusions, all manipulations, and all measures in all studies, and we follow Journal Article Reporting Standards (Appelbaum et al., 2018). The Institutional Review Board at Ohio State University (OSU) approved all studies in this package (Protocol 2018B0395, "Individual and Organizational Lay Theories"). De-identified data and code for all experiments are available at this link (Wallace et al., 2025): https://osf.io/dqw9f/?view_only=73ac34111fe24c6e9670cec0f92c95a0. Analysis code for the field study is also available at that link. The Institutional Review Board would not approve public posting of the field data so it is available upon request and by Institutional Review Board approval. All materials are available in the online Supplemental Materials. Study 1 was not preregistered; Study 2 was preregistered.

Study 1

We began by testing our hypotheses in the field. Study 1 examined students' engagement in classrooms with instructors they perceived to espouse more fixed versus growth beliefs. We predicted that students' personal mindsets should guide interest in instructors who espouse relatively similar mindset beliefs—a pattern that should be evident primarily when students hold their own mindset beliefs with certainty.

Method

Participants

Sample size for Study 1 was primarily determined by the availability of resources. In this study, we were constrained by the number of participants who were willing to participate. Study 1 involved simultaneous data collection at two comparable universities with the intent to combine the data. We recruited undergraduate students at Ohio State University ($N = 176$) and Indiana University—Bloomington ($N = 120$). Ohio State University students were recruited from the Department of Psychology's Introductory Psychology participant pool and earned course credit for their participation. Indiana University—Bloomington students were paid $5 for their participation. No participants were excluded; this resulted in a total of 296 participants for analyses (24.3% male, 75.0% female, .7% nonbinary; $M_{age} = 19.05$, $SD_{age} = 2.27$; 1.0% Native American, 5.7% African American, 11.8% East Asian, 4.1% Hispanic/Latino, 2.4% Middle Eastern, 2.7% South Asian, 0.3% West Indian/Caribbean, 77.7% White, 1.0% other race). This sample size reflects the number of participants who returned to take a second study, following an initial one at the start of the semester (see online Supplemental Materials for details). Given the complexity of the statistical model we tested, we employed bootstrapping to conduct a sensitivity power analysis, which indicated that we would have 81.2% power to detect γ's as small as .075 (unstandardized coefficient is on the same scale as the models reported below). The methods and results we report in the text focus on data we collected at the end of the semester when participants would have had ample opportunity to form their own mindset beliefs and impressions of their professors' mindsets.[2]

Materials and Procedure

After providing consent, students rated their own mindset beliefs using two validated items (Dweck, 1999): "You have a certain amount of intelligence, and you can't really do much to change it" and "Your intelligence is something about you that you can't change very much" (1 = *strongly agree*, 7 = *strongly disagree*; higher numbers corresponded to a more growth mindset). $r = .80$. Adapting an approach by Barden and Petty (2008) to measure certainty, after each mindset item, participants were asked, "How certain are you about the response you just provided?" (1 = *not at all*, 7 = *very much*), $r = .66$. Then, for each class that they were taking that semester, they reported their perceptions of their instructors' mindset beliefs using similar items to those used to measure student mindsets (e.g., "My instructor for [Course X] seems to believe that intelligence is something about people that they can't change very much"; 1 = *strongly agree*, 7 = *strongly disagree*; Muenks et al., 2020; higher numbers corresponded to endorsement of more growth beliefs), $r = .94$. Finally, they reported their evaluation of their instructor, "To what extent do you like your instructor for [Course X]?" and how engaged they felt in the course, "To what extent do you feel engaged by course [Course X]?" each on a single item anchored with 1 = *not at all* to 7 = *very much*, along with several filler items (available in the online Supplemental Materials). A detailed description of all materials used in these studies is provided in the online Supplemental Materials.

Results

Means, standard deviations, ranges, and correlations for primary variables of interest are reported in Table 1. As Study 1 contains nested data, we employed multilevel modeling. Recall that each participant reported their perception of their instructor's mindset for every course in which they were enrolled that semester. For every analysis in this study, we modeled these data by nesting courses (Level 1) within students (Level 2) within schools (Level 3).[3] We allowed for random intercepts for both school and students and

[2] We had also collected an initial first wave of data, hoping to analyze the data longitudinally. Preliminary analyses, however, revealed low correspondence in the ratings of instructors' mindsets at the beginning versus the end of the semester ($r = .29$) and between students' ratings of their own mindset beliefs at the beginning and end of the semester ($r = .31$), suggesting that at Time 1 participants did not have a robust impression of their own or their instructors' mindsets. This is consistent with other work finding low correspondence between growth mindset measures over extended periods of time (Gonida et al., 2006). Indeed, we did not observe moderation by certainty either when we regressed Time 2 outcomes on Time 1 predictors or when we solely examined effects using Time 1 variables. More information about Time 1 data collection and analyses using variables from Time 1 is available in the online Supplemental Materials.

[3] Note that as we do not know whether our students were enrolled in the same courses and sections of courses, we cannot nest students within classrooms; thus, courses are nested within students, who are nested within schools.

Table 1
Descriptive Statistics and Correlations for Variables of Interest in Study 1

Variable	*M*	Between subjects *SD*	Within subjects *SD*	Range	1	2	3	4	5
1. Student mindset	4.83	1.42		1–7	—				
2. Student mindset certainty	4.72	1.30		1–7	.34***	—			
3. Instructor mindset	5.12	1.27	1.08	1–7	.50***	.21***	—	.37***	.24***
4. Instructor evaluation	5.43	0.94	1.49	1–7	.20***	.15**	.33***	—	.70***
5. Course engagement	4.93	1.03	1.69	1–7	.14*	.16**	.21***	.73***	—

Note. Student mindset beliefs and student mindset certainty are between-subjects variables. Instructor mindset beliefs, instructor evaluation, and course engagement are within-subjects variables. Between-subjects correlations are reported below the diagonal. Within-subjects correlations are reported above the diagonal.
* $p < .05$. ** $p < .01$. *** $p < .001$.

random effects of instructor mindset for each student (Barr et al., 2013). Models in which the random effect of instructor mindset was included for school did not converge, possibly because there are only two school levels. Consistent with recommendations from Nezlek (2011), we group-mean-centered Level 1 predictors (perceived instructor mindset) and grand-mean-centered Level 2 predictors (personal mindsets and personal mindset certainty).

In the analyses reported below, we first examined the two-way interaction between student and instructor mindsets to test for replication of Wallace et al. (2023). We followed that analysis by testing the three-way interaction between student mindset, instructor mindset, and student mindset certainty. The key test of our hypotheses is whether this three-way interaction is significant and whether the simple two-way between student and instructor mindset is significant at high but not low levels of certainty.

Do Student Mindsets Predict Instructor Evaluation and Course Engagement for Growth Versus Fixed Instructors?

Instructor Evaluation. To examine whether students' mindsets predicted their evaluation of instructors they perceived as having growth versus fixed mindsets, we regressed instructor evaluation on grand-mean-centered student mindsets, group-mean-centered perceptions of instructors' mindsets, and their interaction. There was a significant main effect of perceived instructor mindset, with participants reporting more positive evaluations of growth over fixed instructors, $\gamma = .55$, 95% CI [.44, .66], $SE = 0.05$, $t(1,096) = 10.23$, $p < .001$, $r = .30$. There was also a significant effect of student mindsets, with more growth participants reporting more positive instructor evaluations, $\gamma = .13$, 95% CI [.06, .20], $SE = 0.04$, $t(290) = 3.57$, $p < .001$, $r = .21$. Consistent with past research (Wallace et al., 2023), the effect of student mindsets was marginally qualified by their instructors' mindset, $\gamma = .06$, 95% CI [−.01, .13], $SE = 0.04$, $t(1,096) = 1.79$, $p = .074$, $r = .05$. That is, students with more growth beliefs (operationalized as averaging a six on the mindset scale[4]) reported more positive evaluations of growth over fixed instructors, $\gamma = .63$, 95% CI [.49, .76], $SE = 0.07$, $t(1,096) = 8.79$, $p < .001$, $r = .27$. Those with more fixed mindsets (operationalized as averaging a two on the mindset scale) were also more favorable to growth versus fixed instructors, but to a lesser degree, $\gamma = .37$, 95% CI [.15, .59], $SE = 0.11$, $t(1,096) = 3.36$, $p < .001$, $r = .10$. Note that the latter's interest in growth over fixed instructors was merely attenuated, not reversed, revealing a similar asymmetric matching effect as documented in past research (Wallace et al., 2023). That we replicated prior results directionally, but not statistically significantly, highlights the importance of identifying when this matching pattern is most likely to be observed.

Course Engagement. We also examined whether this matching pattern would occur with course engagement. Conducting an analysis parallel to that described above, there were again main effects of student mindsets, $\gamma = .10$, 95% CI [.02, .18], $SE = 0.04$, $t(290) = 2.43$, $p = .016$, $r = .14$, and instructor mindsets, $\gamma = .45$, 95% CI [.33, .58], $SE = 0.06$, $t(1,094) = 7.39$, $p < .001$, $r = .22$. These effects were qualified by a significant interaction, $\gamma = .09$, 95% CI [.01, .17], $SE = 0.04$, $t(1,094) = 2.33$, $p = .020$, $r = .07$. Consistent with past research (Wallace et al., 2023), the tendency for students to report being more engaged when instructors were perceived as endorsing growth over fixed mindsets was more apparent among students who themselves endorsed more growth mindsets, $\gamma = .56$, 95% CI [.40, .72], $SE = 0.08$, $t(1,094) = 6.94$, $p < .001$, $r = .21$, rather than fixed mindsets, $\gamma = .19$, 95% CI [−.06, .43], $SE = 0.12$, $t(1,094) = 1.51$, $p = .132$, $r = .05$. Note again that the latter's engagement in classrooms taught by growth versus fixed mindset instructors was merely attenuated rather than reversed, consistent with the asymmetric matching effect documented in past work (Wallace et al., 2023).

When Do Student Mindsets Predict Instructor Evaluations and Course Engagement for Growth Versus Fixed Instructors?

Next, we examined to what extent mindset certainty predicts when these mindset-matching effects occur. Therefore, we regressed students' instructor evaluations on grand-mean-centered student mindset beliefs and mindset certainty, and group-mean-centered perceptions of professors' mindsets, along with their corresponding two- and three-way interactions.

[4] We examine effects at 2 (clear endorsement of fixed beliefs) and 6 (clear endorsement of growth beliefs) on the mindsets scale because, as in previous research, people skew toward endorsing more growth mindsets in this study ($M = 4.83$ on a 7-point scale). Wallace et al. (2023) argued that using the more traditional approach of exploring simple slopes at ±1 *SD* results in analyses in which those with more fixed mindsets (−1 *SD* or 3.41 on the mindset scale) do not endorse their beliefs to the same extreme as those with more growth mindsets (+1 *SD* or 6.25 on the mindset scale). For this reason, we present results at 2 versus 6, as preregistered in Study 2. Results examining effects at ±1 *SD* are available in the online Supplemental Materials and support the same conclusions.

Table 2
Instructor Evaluation Regressed on Students' Mindset Beliefs, Certainty, and Perceived Instructor Mindsets, Along With Their Two- and Three-Way Interactions in Study 1

Predictor	γ	95% CI	*SE*	*df*	*t*	*p*	*r*
SM	.12	[.04, .20]	0.04	288	3.03	.003	.18
Student mindset certainty	.06	[−.02, .15]	0.04	288	1.47	.143	.09
IM	.51	[.40, .62]	0.06	1,094	9.19	<.001	.27
SM × Certainty	−.03	[−.08, .03]	0.03	288	−1.02	.311	−.06
Certainty × IM	.06	[−.03, .14]	0.04	1,094	1.34	.181	.04
SM × IM	.04	[−.04, .11]	0.04	1,094	0.92	.355	.03
SM × Certainty × IM	.05	[.00, .09]	0.02	1,094	2.01	.045	.06

Note. CI = confidence interval; *SE* = standard error; SM = student mindset; IM = instructor mindset.

Instructor Evaluation. As predicted, the three-way interaction between student mindset beliefs, student mindset certainty, and instructor mindset was significant (Table 2, Figure 1, panel a), $\gamma = .05$, 95% CI [.00, .09], $SE = 0.02$, $t(1{,}094) = 2.01$, $p = .045$, $r = .06$.[5]

To interpret this three-way interaction, we examined the simple two-way interactions between student and instructor mindsets at high and low (±1 *SD*) levels of certainty. When students' mindset beliefs were held with high certainty (+1 *SD* above the mean), there was a significant interaction between instructor mindset and student mindset, $\gamma = .10$, 95% CI [.01, .18], $SE = 0.04$, $t(1{,}094) = 2.27$, $p = .024$, $r = .07$, indicating that at high mindset certainty, as students endorsed more growth beliefs, they more positively evaluated growth over fixed instructors. When mindsets were held with low certainty (−1 *SD* below the mean), there was no significant interaction between instructor and student mindsets, $\gamma = -.03$, 95% CI [−.13, .08], $SE = 0.05$, $t(1{,}094) = -.48$, $p = .629$, $r = -.01$. This is consistent with the notion that student mindsets are less predictive of the relative evaluation of growth versus fixed instructors when held with low certainty. In short, student mindset beliefs predicted relative preferences for growth versus fixed instructors only when those beliefs were held with certainty. Note that these analyses represent the key tests of our framework. Our theoretical framework does not generate specific predictions about whether these effects are more likely to be apparent among more fixed or growth students so we have relegated these exploratory analyses to the online Supplemental Materials and addressed this question in the more highly powered integrative data analysis.

Course Engagement. We conducted parallel analyses as those described above with course engagement as the focal dependent variable (Table 3, Figure 1, panel b). As with instructor evaluation, there was a significant three-way interaction between students' mindset beliefs, mindset certainty, and instructor mindset, $\gamma = .06$, 95% CI [.01, .11], $SE = 0.03$, $t(1{,}092) = 2.19$, $p = .028$, $r = .07$. As before, we examined whether mindset matching occurred at high versus low levels of mindset certainty. When students' mindset beliefs were held with high certainty (+1 *SD* above the mean), there was a significant interaction between student and instructor mindsets on course engagement, $\gamma = .13$, 95% CI [.03, .22], $SE = 0.05$, $t(1{,}092) = 2.62$, $p = .009$, $r = .08$. However, when students' mindset beliefs were held with less certainty (−1 *SD* below the mean), there was no interaction between student and instructor mindsets, $\gamma = -.02$, 95% CI [−.15, .10], $SE = 0.06$, $t(1{,}092) = -.41$, $p = .683$, $r = -.01$. That is, students' personal mindsets only predicted their relative interest in growth versus fixed instructors when students held their mindsets with high certainty. Exploratory analyses breaking down this interaction by personal mindset are available in the online Supplemental Materials.

Discussion

Study 1 accomplished several goals. First, we replicated the asymmetric mindset-matching effect originally documented by Wallace et al. (2023). Although students were generally more engaged in classrooms led by instructors seen as endorsing growth versus fixed mindsets, this was more apparent among students with more growth mindsets. Wallace et al. (2023) speculated that the threatening nature of fixed environments may counter benefits that fixed students might gain from being in a context that endorses mindset beliefs that match their own—leading to an asymmetric matching pattern. More broadly, these findings provide further evidence that personal growth mindsets predict course engagement in growth versus fixed classrooms.

Second and more importantly, Study 1 provided an initial test of the mindset certainty hypothesis in a field setting—examining the effects of mindset certainty among students in their actual college classrooms. This study demonstrated that personal mindsets *only* significantly predicted differential reactions to professors endorsing more growth versus fixed beliefs when students held their personal mindset beliefs with certainty. This finding thus highlights the utility of the mindset strength framework in identifying when mindset beliefs are most likely to have effects.

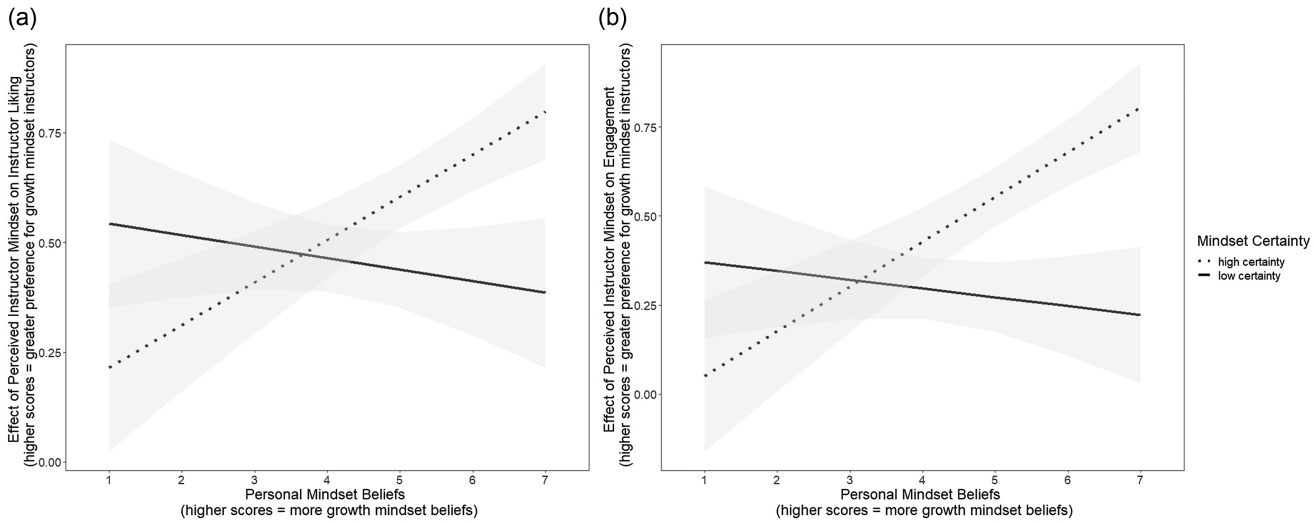
Study 2

In Study 2, we wanted to replicate Study 1 and extend it in several ways. First, whereas Study 1 relied on students' inferences about their instructors' mindsets, in Study 2, we directly manipulated the beliefs that teachers espoused. Second, although Study 1 provided insight into students' experiences once they are in classrooms, it did not address whether these same effects might influence whether students might want to take courses from particular instructors in the first place. Thus, Study 2 examined interest in taking a course from a fixed versus growth instructor as the dependent variable. Third, Study 2 was preregistered at https://osf.io/m7v8h/?view_only=8eeab6abb69c4de29f09aa879801a435.

[5] The interaction between mindset certainty, personal mindsets, and organizational mindsets was not moderated by sample on either instructor evaluation, $p = .80$, or course engagement, $p = .73$.

Figure 1

Effect of Instructor Mindset at Each Level of Students' Mindsets and ±1 SD of Mindset Certainty on Instructor Evaluation (Panel a) and Course Engagement (Panel b) in Study 1



Note. The *y*-axis represents unstandardized regression coefficients reflecting relative interest in growth over fixed instructors, with higher numbers indicating more interest in the former over the latter. The *x*-axis represents students' mindset beliefs, with higher numbers indicating increasing endorsement of growth mindset beliefs. When students were high in certainty, their personal mindsets strongly predicted their liking and engagement with instructors who endorsed mindsets consistent with their own. When students were low in certainty, their personal mindsets did not predict differential reactions to professors endorsing fixed versus growth beliefs.

Method

Participants

Through Prolific, we recruited 850 students who were U.S. nationals and current residents and who had not participated in previous research that we had conducted on mindsets. We conducted a power analysis simulating the predicted three-way interaction of interest, using values from previously conducted studies. This power analysis suggested that we would need 600 participants to detect the three-way interaction between student mindsets, instructor mindsets, and student mindset certainty, based on the average observed effect size in previous between-subjects studies that could test this question (see online Supplemental Materials; $r = .10$). However, we also wanted to ensure that we could examine the simple two-way interaction between instructor mindsets and student mindset certainty among more fixed participants (an analysis we report in the online Supplemental Materials), for which the average of the previously observed effects sizes was $r = -.07$, resulting in a required sample size of 850. Using the preregistered exclusion criteria, we excluded one participant for not indicating that they had read the passages, eight participants for failing at least one of the attention checks, and three participants who did not pass the open-ended text response question.[6] This left 838 participants (45.5% male, 54.4% female, .1% not reporting gender; $M_{age} = 24.41$, $SD_{age} = 7.13$) for analyses. The study took approximately 10 min to complete, and participants were compensated with $1.10 for their participation.

Materials and Procedure

First, participants reported their mindset beliefs about intelligence using three validated items (Dweck, 1999): "You have a certain amount of intelligence, and you can't really do much to change it," "Your intelligence is something about you that you can't change very much," and "You can learn new things, but you can't really change your basic intelligence" (1 = *strongly agree*, 7 = *strongly disagree*; higher numbers reflect the endorsement of more growth beliefs), $\alpha = .91$. After these items, they reported their mindset certainty with three items (Barden & Petty, 2008; Luttrell et al., 2016): "How confident are you in your beliefs about intelligence that you indicated in the previous questions?" "How sure are you of your responses to the previous questions about intelligence beliefs?" and "How certain do you feel about your responses to the questions about intelligence?" (1 = *not at all*, 7 = *very much*), $\alpha = .96$.

To assess students' interest in taking a class with a fixed versus growth instructor, we randomly assigned them to view an instructor espousing fixed versus growth beliefs. As part of a longer manipulation, in the growth condition, the professor said,

> If you come to the lectures, do the homework and practice sets, and seek help when you're struggling, you should be able to do well in this course. I believe that success in my class is achieved through effort, persistence, and good strategies.

[6] For the open-text questions, participants were asked, "Sam felt crushed when her longtime rival Suzie revealed that she was the winner of the competition. Who was the winner of the competition? [open text response box]" and "Joe tried to call Paul on the phone, but he wasn't available. Who wasn't available? [open text response box]." Consistent with our preregistration, participants who answered both of these incorrectly or who provided an answer that did not correspond to one of the two response options (Sam or Suzie for Question 1 or Joe or Paul for Question 2) for at least one question were excluded.

Table 3
Course Engagement Regressed on Student Mindsets, Mindset Certainty, and Instructor Mindsets, Along With Their Two- and Three-Way Interactions in Study 1

Predictor	γ	95% CI	*SE*	*df*	*t*	*p*	*r*
SM	.08	[−.01, .17]	0.04	288	1.76	.080	.10
Student mindset certainty	.10	[.01, .20]	0.05	288	2.15	.033	.13
IM	.40	[.28, .53]	0.06	1,092	6.38	<.001	.19
SM × Certainty	−.03	[−.09, .03]	0.03	288	−0.92	.358	.05
Certainty × IM	.10	[.01, .19]	0.05	1,092	2.10	.036	.06
SM × IM	.05	[−.03, .13]	0.04	1,092	1.17	.241	.04
SM × Certainty × IM	.06	[.01, .11]	0.03	1,092	2.19	.028	.07

Note. CI = confidence interval; *SE* = standard error; SM = student mindset; IM = instructor mindset.

In the fixed condition she said,

> Some students are naturally gifted when it comes to the content we'll cover in my class, and other students just struggle without making much progress. If you decide you are not well-suited to this course, come talk to me and I'll do everything I can to help you drop the class and find something more suited to your natural talents.

After reading the statement from the instructor, participants completed a manipulation check about their perceptions of the instructor's mindset (measured with four items adapted from the student mindset scale, e.g., "The professor seems to believe that students have a certain amount of intelligence, and they can't really do much to change it"; 1 = *strongly agree*, 7 = *strongly disagree*; Muenks et al., 2020; higher numbers corresponded to endorsement of more growth beliefs), α = .94.

As our primary dependent measure, participants then reported the extent to which they were interested in taking a course with the target instructor on three items: "How interested would you be in taking a class taught by the professor?" "How much would you want to take a class with this professor?" and "To what extent would you be willing to take a class taught by this professor?" on a 7-point Likert scale (1 = *not at all* to 7 = *extremely*), α = .98. After completing the measures, participants reported demographics. They were then debriefed and thanked for participating in the study.

Results

Descriptive Statistics

Means, standard deviations, ranges, and correlations for primary variables of interest are available in Table 4.

Table 4
Descriptive Statistics and Correlations for Variables of Interest in Study 2

Variable	*M*	*SD*	Range	1	2	3
1. Student mindset	4.69	1.44	1–7	—		
2. Student mindset certainty	5.12	1.32	1–7	.31***	—	
3. Interest in course	4.15	1.99	1–7	−.02	.03	—

*** $p < .001$.

Manipulation Check

As intended, participants in the growth mindset instructor condition ($M = 5.43$, $SD = 1.49$) perceived the instructor to endorse more growth mindset beliefs than did those in the fixed mindset instructor condition ($M = 2.51$, $SD = 1.48$), $t(836) = 28.40$, $p < .001$, 95% CI of mean difference [2.72, 3.12], $d = 1.96$.

Do Student Mindsets Predict Responses to Fixed Versus Growth Instructors?

To test whether students' mindsets predicted interest in fixed versus growth instructors, we regressed course interest on centered student mindsets, instructor mindset condition (1 = growth, −1 = fixed), and their interaction. In this model, there was a significant effect of instructor mindset, with participants on average being more interested in a growth versus fixed instructor, $b = 1.38$, 95% CI [1.28, 1.47], $t(834) = 28.20$, $p < .001$, $r = .70$, replicating previous research (Canning et al., 2021; Emerson & Murphy, 2015; Muenks et al., 2020). There was no effect of student mindsets, $b = -.05$, 95% CI [−.12, .01], $t(834) = -1.54$, $p = .13$, $r = .05$. Most importantly, consistent with the mindset matching hypothesis, there was a significant interaction between student and instructor mindsets, $b = .18$, 95% CI [.12, .25], $t(834) = 5.40$, $p < .001$, $r = .18$. Breaking down this interaction, students with more growth mindsets (i.e., those who averaged a six on the mindset scale) were much more interested in the growth over fixed instructor, $b = 1.62$, 95% CI [1.49, 1.75], $t(834) = 24.48$, $p < .001$, $r = .65$; this difference in interest was attenuated among students with more fixed mindsets (i.e., those who averaged a two on the mindset scale), $b = .88$, 95% CI [.68, 1.09], $t(834) = 8.53$, $p < .001$, $r = .28$.

When Do Student Mindsets Predict Responses to Fixed Versus Growth Instructors?

To test when students' mindsets predict interest in instructors with growth versus fixed mindsets, we regressed course interest on students' centered mindset beliefs, centered student mindset certainty, and instructor mindset condition (1 = growth, −1 = fixed), along with their two- and three-way interactions. Results of the key three-way interaction model are presented in Table 5 and Figure 2.

As predicted and conceptually replicating Study 1, the extent to which student mindsets predicted reactions to growth versus fixed instructors depended on students' mindset certainty, $b = .09$, 95% CI

Table 5

Course Interest Regressed on Students' Mindset Beliefs, Student Mindset Certainty, and Manipulated Instructor Mindset, Along With Their Two- and Three-Way Interactions in Study 2

Predictor	*b*	*t*	*p*	95% CI	*r*
SM	−0.03	−0.75	.454	[−0.11, 0.05]	−.03
Mindset certainty	0.07	1.75	.080	[−0.01, 0.15]	.06
IM	1.33	25.95	<.001	[1.23, 1.43]	.67
SM × Certainty	−0.07	−2.37	.018	[−0.13, −0.01]	−.08
Certainty × IM	−0.01	−0.15	.879	[−0.08, 0.07]	.01
SM × IM	0.13	3.37	<.001	[0.05, 0.21]	.12
SM × Certainty × IM	0.09	3.10	.002	[0.03, 0.15]	.11

Note. CI = confidence interval; SM = student mindset; IM = instructor mindset.

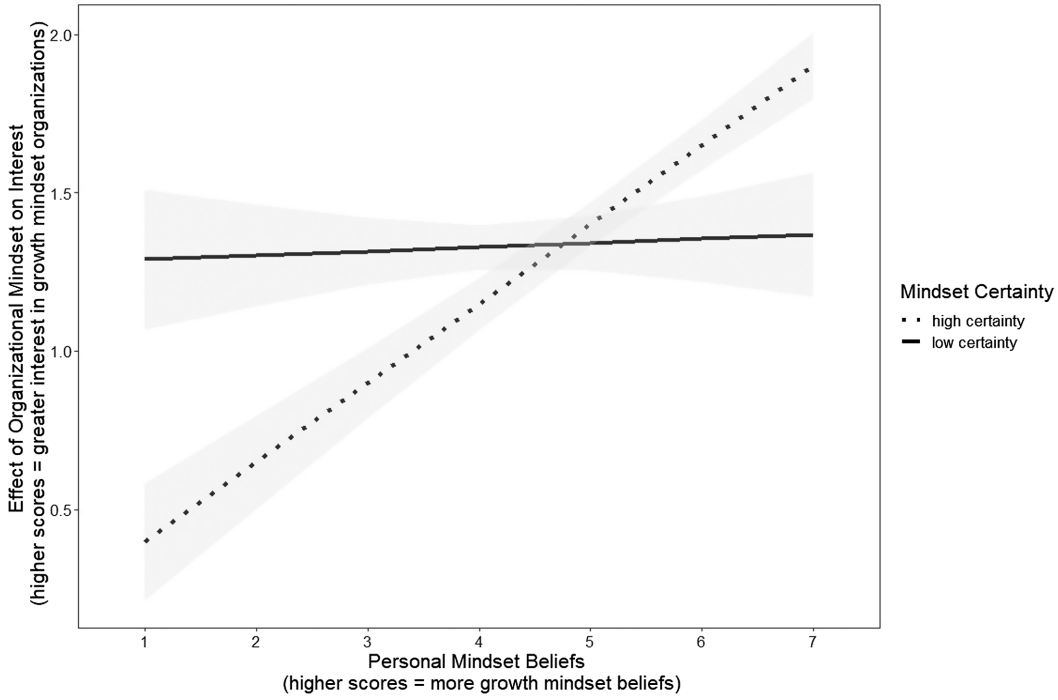
[.03, .15], $t(830) = 3.10$, $p = .002$, $r = .11$. To further interpret this interaction, we again examined the simple two-way interactions between student and instructor mindsets as a function of mindset certainty. Among students who were more certain (+1 *SD*) of their mindsets, there was a significant interaction between the instructor's mindset and students' mindset beliefs, $b = .25$, 95% CI [.17, .33], $t(830) = 6.03$, $p < .001$, $r = .20$, consistent with the assertion that student mindsets predict relative interest in growth versus fixed instructors when held with certainty. However, among students who were less certain (−1 *SD*) of their mindset beliefs, there was no corresponding interaction between student and instructor mindsets, $b = .01$, 95% CI [−.12, .14], $t(830) = .20$, $p = .84$, $r = .01$, consistent with the assertion that students' mindset beliefs are less predictive of interest when held with less certainty. In sum, students' personal mindsets only predicted their relative interest in growth versus fixed instructors when they held the former with certainty. Exploratory analyses breaking down this interaction by personal mindset are available in the online Supplemental Materials.

Discussion

Study 2 provided a replication of Study 1 using experimental lab rather than correlational field methods by manipulating instructor mindset rather than relying on students' perceptions of their own professors' mindsets. Results replicated the asymmetrical mindset matching pattern originally documented by Wallace et al. (2023): Interest in courses taught by instructors with matching mindset beliefs was more apparent among students who endorsed growth relative to fixed mindsets. More importantly, replicating Study 1, this pattern emerged exclusively among students who held their mindset beliefs with high rather than low certainty. Study 2 also extended the results of Study 1 by demonstrating that mindset certainty not only determines when students' mindsets impact their

Figure 2

Effect of Instructor Mindset at Each Level of Students' Mindset and ±1 SD of Mindset Certainty on Interest in Study 2



Note. The *y*-axis represents unstandardized regression coefficients reflecting relative interest in growth over fixed instructors, with higher numbers indicating more interest in the former over the latter. The *x*-axis represents students' mindset beliefs, with higher numbers indicating increasing endorsement of growth mindset beliefs. When students were high, but not low, in certainty of their mindsets, their mindset beliefs predicted relative interest in growth versus fixed instructors.

evaluation of instructors and engagement in the classroom but also their interest in taking the course in the first place.

Integrative Data Analysis

To provide a more comprehensive test of our hypotheses, we conducted an integrative data analysis (Curran & Hussong, 2009; Wallace et al., 2020; Wegener et al., 2022) that combined Study 2 with archival data that could be brought to bear on our research questions. Beyond testing the robustness and strength of evidence for our primary hypothesis about mindset certainty, this integrative analysis provided three additional empirical opportunities. First, because the archival data explored interest in workplace and volunteer organizations, we were able to test whether the effects would generalize beyond the classroom context. Second, the archival data employed several different instantiations of organizational mindsets. Whereas the studies described in the main text used perceptions of a single professor's mindset, the archival data used a more diverse set of materials to communicate organizational mindsets (mission statements and meeting minutes), providing the opportunity to examine generalizability to these instantiations of organizational mindsets. Third, this integrative data analysis availed the opportunity to explore relations between mindset extremity and mindset certainty with a large sample data set. We examined both how mindset certainty and extremity relate to one another and whether the mindset certainty effects that we documented above persist after statistically adjusting for the effects of extremity.

Integrative Analysis Inclusion Criteria

This analysis includes data from Study 2, as well as six studies whose results are reported individually in the online Supplemental Materials (Studies 1a–c and 2a–c), resulting in a total $N = 3{,}601$. We were unable to include the data from Study 1 as perceived instructor mindset was measured within rather than between subjects. To conduct this integrative analysis, we combined the data for all seven of these studies, each separately identified with a "study" factor. This analysis represents all data that we could possibly include in this analysis so these estimates should be unbiased and represent the most inclusive test of our hypotheses. Information about the individual studies is provided in Table 6 and in the online Supplemental Materials.

Interaction Between Organizational Mindset, Personal Mindset, and Mindset Certainty

We ran a general linear model in which organizational mindset and study were entered as factors, and grand-mean-centered personal mindsets and personal mindset certainty were entered as measured variables. This model included main effects, along with all two-, three-, and four-way interactions. General linear model has the advantage of allowing us to account for the effect of study, as well as explore moderation by it, in a more straightforward manner than regression-based approaches. This analysis revealed the predicted interaction between personal mindsets, organizational mindsets, and personal mindset certainty, $F(1, 3{,}545) = 26.29$, $p < .001$ (Figure 3). Importantly, even with so much power, there was only marginal evidence of moderation by study, $F(6, 3{,}545) = 1.84$, $p = .088$, suggesting the possibility of heterogeneity, but overall highlighting the relative consistency across studies.

To interpret this interaction, we next examined the simple two-way interaction between personal and organizational mindsets at high and low levels of certainty. Among participants who were high in certainty about their personal mindset beliefs (+1 *SD*), there was a significant interaction between personal and organizational mindsets, $F(1, 3{,}545) = 100.40$, $p < .001$. By contrast, among participants who were low in certainty about their personal mindset beliefs (−1 *SD*), there was no significant interaction, $F(1, 3{,}545) = .132$, $p = .717$—despite having thousands of participants with which to detect an effect. This pattern of results thus provides strong support for the notion that mindsets predict people's responses when they are held with high rather than low certainty.

Finally, we conducted exploratory analyses to examine whether the effect of mindset certainty was similar among those who personally endorsed more fixed and growth mindsets. There was support for the simple two-way interaction between organizational mindsets and certainty among both people with more fixed mindsets (two on the scale), $F(1, 3{,}545) = 19.66$, $p < .001$, and more growth mindsets (six on the scale), $F(1, 3{,}545) = 12.71$, $p < .001$. Thus, certainty influenced whether personal mindsets predicted interest in growth versus fixed organizations for both those who endorsed more fixed and growth mindsets.

Is Mindset Certainty Interchangeable With Mindset Extremity?

The extant mindsets literature suggests that those who endorse the midpoint of the mindset scale have "unclear mindsets" (Chiu et al., 1997; Dweck et al., 1995; Levy & Dweck, 1998; Plaks et al., 2001)—suggesting an element of high uncertainty. Given this, we wanted to examine whether the relation between mindset certainty and extremity would be similar to that observed in the attitudes literature ($r = .50$; Krosnick et al., 1993), which has already provided considerable evidence that certainty and extremity are distinct from one another.

In the attitudes literature, extremity is typically computed by calculating the distance of participants' responses from the midpoint of the scale.[7] Using this method, we found that mindset extremity and mindset certainty were only moderately correlated, and the size was consistent with that observed in the attitudes literature, $r(3{,}601) = .54$, $p < .001$ (see Figure 4).[8] We note too that this moderate association is comparable to relationships between other constructs that researchers typically expect to be related, but distinct, such as the relations between self-esteem and the personality trait of emotional stability ($r = .50$; Robins et al., 2001), between grandiose and vulnerable narcissism ($r = .53$; Di Pierro et al., 2016), and between intentions and behavior ($r = .57$; Webb & Sheeran, 2006). Thus, although mindset certainty and extremity are related to one another, they do not appear isomorphic and pragmatically interchangeable.

[7] An alternative way to operationalize extremity is to examine it as a quadratic function of participants' mindsets. We found a significant correlation between the quadratic personal mindsets term and certainty, $r(3{,}598) = .51$, $p < .001$, that was comparable in size to the midpoint-based analysis. Details are reported in the online Supplemental Materials.

[8] The association between extremity and certainty was not moderated by whether participants had more fixed or growth mindsets, $F(1, 3573) = .06$, $p = .808$.

Table 6
Studies in the Integrative Data Analysis

Study	*N*	Organizational context	Organizational mindset manipulation
Study 2	838	Classroom	Statement from professor
Study S1a	238	Consulting company	Mission statement
Study S1b	382	Consulting company	Mission statement
Study S1c	796	Consulting company	Mission statement
Study S2a	214	Volunteer tutoring organization	Meeting minutes
Study S2b	340	Volunteer tutoring organization	Meeting minutes
Study S2c	793	Volunteer tutoring organization	Meeting minutes

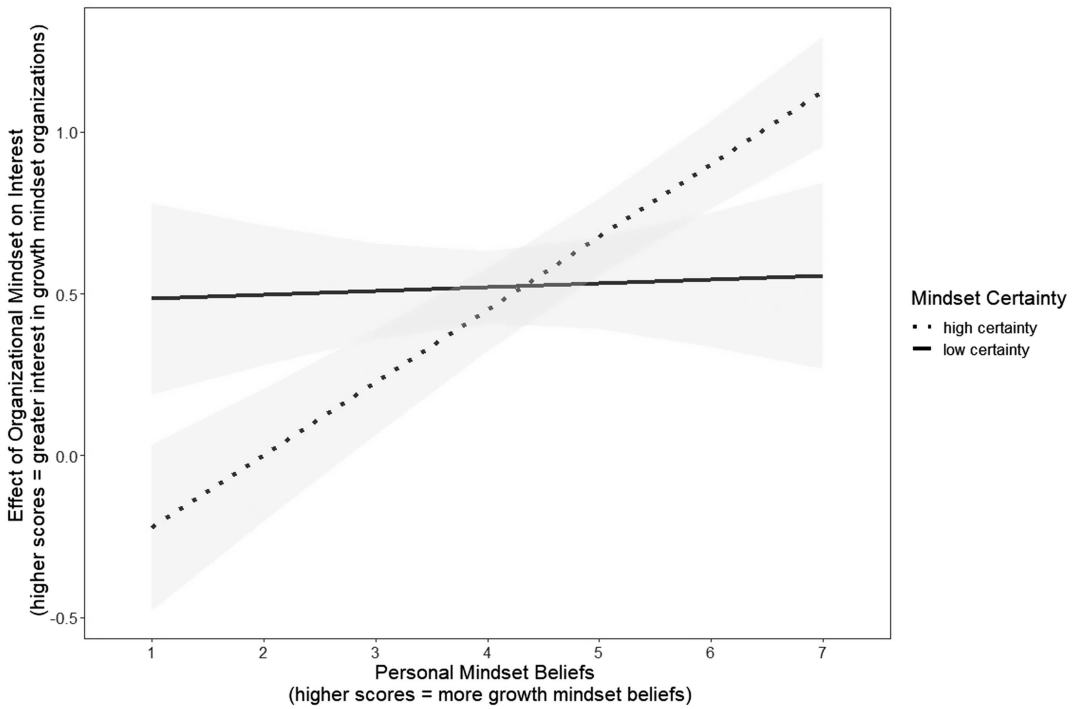
Figure 4 visually depicts the relationship between mindset extremity and mindset certainty. Although those reporting the most extreme mindsets did tend to report high levels of certainty, nearly all levels of mindset extremity evidenced notable variation in people's mindset certainty. Indeed, those with the least extreme mindset views (i.e., those whose mindset extremity was 0 and mindset beliefs were at 4) varied substantially in their levels of certainty, with some reporting being very certain that the middle of the scale was the correct view to hold. These results counter the view that those with middling mindset beliefs are necessarily uncertain about those beliefs.

As an additional test, we repeated the integrative data analysis described earlier, examining the interaction between certainty, personal mindsets, and organizational mindsets on organizational interest—this time controlling for extremity, along with its two- and three-way interactions with personal mindsets and organizational mindsets. There was no support for the three-way interaction between personal mindsets, organizational mindsets, and extremity, $F(1, 3{,}517) = .06$, $p = .817$. There was, however, as before, a significant three-way interaction between personal mindsets, organizational mindsets, and certainty, $F(1, 3{,}517) = 15.26$, $p < .001$. Thus, the effect of mindset certainty is independent of the effect of mindset belief extremity.

General Discussion

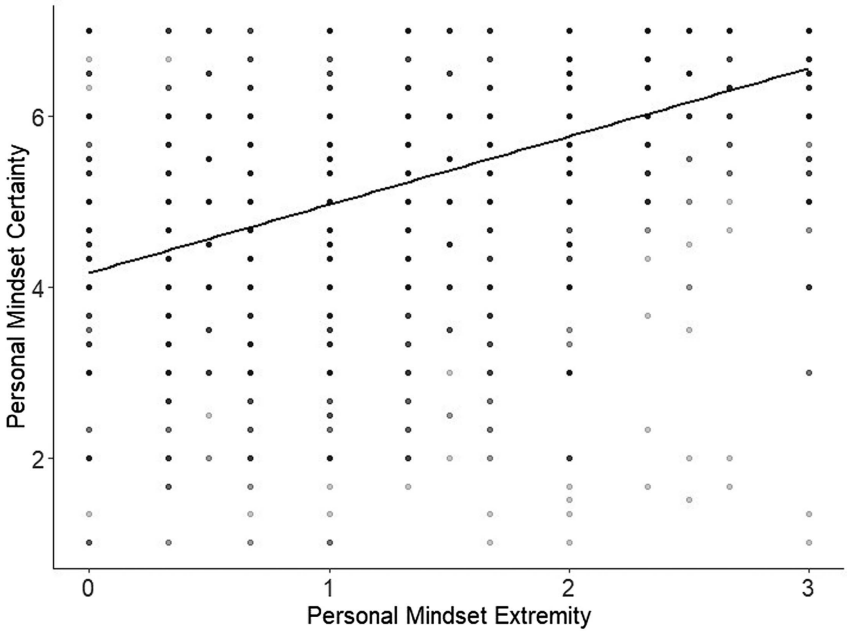
The current research offers the first test of the mindset strength framework, demonstrating that the predictive power of mindsets varies

Figure 3
Effect of Organizational Mindset at Each Level of Participants' Personal Mindset and ±1 SD of Mindset Certainty on Organizational Interest in the Integrative Data Analysis



Note. The *y*-axis represents unstandardized regression coefficients reflecting interest in growth over fixed organizations, with higher numbers indicating more interest in the former over the latter. The *x*-axis represents participants' personal mindset beliefs, with higher numbers indicating increasing endorsement of growth mindset beliefs. When people were high, but not low, in certainty of their mindsets, their personal mindset beliefs predicted relative interest in growth versus fixed organizations.

Figure 4
The Relation Between Personal Mindset Extremity and Certainty



Note. The darkness of dots indicates the relative number of participants in that position, with darker dots indicating more participants.

based on the certainty with which individuals hold their beliefs. Using a multimethod approach—a field study, a high-powered preregistered experiment, and integrative data analysis—we show that personal mindsets predict relative interest in organizations with similar mindset views, particularly when these beliefs are held with greater certainty. This work not only introduces the concept of mindset strength as a key theoretical advance but also provides a methodological contribution: measuring mindset certainty can significantly enhance the predictive power of personal mindset beliefs.

This work is also the first to distinguish mindset certainty from extremity. Past work has assumed that those who endorse the least extreme mindsets are also uncertain (Chiu et al., 1997; Dweck et al., 1995; Levy & Dweck, 1998; Plaks et al., 2001). Our findings speak against this: those who endorse the midpoint of the mindsets scale vary widely in their certainty. These results clarify the distinction between mindset certainty and extremity and underscore the importance of directly measuring mindset certainty.

Toward an Integrative Framework for Understanding When Personal Mindsets Produce Effects

These findings provide important insight about the impact of personal mindset beliefs. Whereas researchers have debated *whether* personal mindset beliefs predict responses (Burgoyne et al., 2020; Foliano et al., 2019; Macnamara & Burgoyne, 2023; Sisk et al., 2018), we argue that the more productive question is *when*. One reason that previous studies may have failed to find effects of personal mindsets is that participants may have been particularly uncertain about their mindset beliefs. The current work is the first to suggest that people have metacognitions about their personal mindset beliefs and that these metacognitions can influence the ultimate impact of those mindsets.

Importantly, the current work builds on and contributes to the "heterogeneity revolution" (Bryan et al., 2021; Burnette et al., 2023; Rege et al., 2021; Tipton et al., 2023; Yeager et al., 2019). Whereas the heterogeneity revolution has largely focused on how contextual features provide affordances for direct-to-student mindset interventions (e.g., finding the "right soil" for "seeds to grow"; Walton & Yeager, 2020), we emphasize that it is also important to identify features of personal mindsets themselves that contribute to heterogeneity. Rather than simply focusing on the "right soil," researchers need to address a broader question: "What makes seeds grow?" and whether seeds and soils might both vary in those features. Our personal mindset strength approach provides a novel framework with which to address this question.

Our work may, moreover, advance a more mechanistic account for how social contexts (e.g., "the right soil") impact the relation between personal mindsets and outcomes. For example, personal mindset interventions that tend to be more successful (e.g., Yeager, Walton, et al., 2016) include features that boost certainty, such as social consensus information and elaboration ("saying is believing"), whereas those that tend to be unsuccessful (e.g., Foliano et al., 2019; Ganimian, 2020) omit one or both of these features. Similarly, researchers have identified that personal mindset interventions tend to be effective when there are social norms that support them—either through peers' or teachers' beliefs (Hecht et al., 2021; Yeager et al., 2019). One reason why norms enhance intervention efficacy may be by boosting the certainty of newly formed mindset beliefs.

Thus, the mindset strength framework may provide a simple yet parsimonious account for why social contexts moderate the effect of personal mindsets on outcomes.

The mindset strength approach may also provide a framework for generating novel predictions about previously unidentified moderators of personal mindset effects. Factors that affect attitude certainty (Tormala, 2016) may also influence personal mindset certainty, and thus, their effects. For example, feeling powerful can boost certainty (Briñol et al., 2017): In classrooms where students feel a greater sense of autonomy, personal mindsets may be more likely to produce salubrious effects. Thus, the mindset strength approach promises considerable generative potential in expanding understanding of when mindsets predict outcomes and why.

Understanding the Heterogeneity of Matching Effects More Broadly

Beyond its implications for understanding when personal mindsets predict outcomes, the current work sheds light on the broader phenomenon of person–environment matching effects, extending beyond the mindset context. Indeed, many such effects have been documented. Research on matching effects in persuasion highlights the benefits of matching features of a persuasive appeal with features of the message recipient (for a review see Teeny et al., 2021). The literature on person–environment fit in organizations (Fulmer et al., 2010; Phillips et al., 2020; Sekiguchi & Yang, 2021; Van Vianen, 2018) similarly suggests the potential benefits of matching features of people with those of their social contexts. However, recent work has highlighted that these matching effects do not always occur (Van Vianen, 2018) as well as the value of understanding when and why they do (Teeny et al., 2021). These questions are particularly important to address as researchers and practitioners alike leverage matching as a tool for both persuasion and intervention. By documenting certainty as an antecedent to mindset matching, we suggest that certainty might determine when matches between organizational and personal growth mindsets affect other outcomes, including persuasion, interest, and well-being. Interventionists inspired by previous research on mindset matching (Wallace et al., 2023) should also consider for whom and when such matching effects produce beneficial effects—questions the present research helps to address. More broadly, this work calls for those who study matching and fit effects to recognize the potential heterogeneity of these effects in persuasion, organizational behavior, and other domains, as well as to better understand the various sources of this variance.

Future Directions

Persistence and Performance Outcomes

Much of the debate about the impact of personal mindset beliefs has taken place within the context of direct-to-student mindset interventions and their influence on persistence and academic performance. Ongoing work in our laboratory suggests that mindset certainty may also be crucial in determining when people's growth mindset beliefs lead them to persist on challenging tasks and boost their academic performance; exploring how mindset certainty influences these outcomes offers a promising direction for future study.

Enhancing Growth Mindset Certainty in Interventions

The current work suggests that interventionists should not only attempt to instill participants with growth mindset beliefs but also ensure that those growth mindset beliefs are held with certainty. As noted, there is already some suggestion that enhancing growth mindset certainty may be a critical feature of successful interventions. Features such as testimonies from peers who also endorse growth mindset beliefs (Yeager et al., 2019; Yeager, Romero, et al., 2016) and completing "saying is believing" exercises (e.g., E. Aronson, 1999; Walton, 2014; Wilson & Linville, 1985) in which students elaborate and attempt to explain to others why intelligence is malleable may be key components of successful interventions because they enhance mindset certainty (Petrocelli et al., 2007; Petty et al., 1995). Future work should examine whether these and other factors known to increase certainty function as critical ingredients in creating effective mindset interventions.

Limitations

Differences in How Mindset Certainty Impacts Growth Versus Fixed Participants

The integrative data analysis revealed that mindset certainty moderated relative interest in growth versus fixed environments among both more fixed and more growth participants. However, consistent with the asymmetric matching pattern documented in previous research (Wallace et al., 2023), fixed versus growth mindsets demonstrated distinct patterns (see online Supplemental Materials). Specifically, participants endorsing more growth beliefs expressed much more interest in growth over fixed mindset organizations when certain; this relative difference in interest was attenuated when they were uncertain. In contrast, participants endorsing more fixed beliefs did not demonstrate greater interest in fixed over growth organizations when certain, and they were somewhat paradoxically more interested in growth over fixed mindset organizations when uncertain. Both patterns align with our predictions: certainty relative to uncertainty increased positive reactions to mindset-consistent environments in relative (and not necessarily absolute) terms. Nevertheless, one might ask why we observed this asymmetry.

As noted earlier, the relative affordances that growth versus fixed environments offer for achieving mastery versus performance goals may differ. Growth environments provide affordances for both mastery and performance goals—even though the latter may be nonnormative; by contrast, fixed environments only afford performance goals. The inability to pursue mastery goals in the latter may lead those with more certain versus uncertain growth mindsets to be particularly attracted to growth environments. By contrast, although people can also pursue performance goals in both fixed and growth environments, the threatening nature of fixed environments may reduce interest in these environments. Moreover, although people who perceive themselves as high in ability and are certain in their fixed mindsets might relish the opportunity to be "one of the chosen few" in fixed environments, those who perceive themselves as low in ability and/or are less certain in their fixed mindsets may prefer to avoid the threats associated with fixed environments, resulting in no differences in interest between fixed and growth

environments, or even more interest in growth over fixed environments among people with fixed beliefs.

Measuring Fixed and Growth Mindsets With Unipolar Scales

At the time the current studies were conducted, we employed what were commonly considered the gold standard of mindset measures, as outlined by Dweck (1999). This included exclusively fixed mindset-coded items. Since then, researchers have noted the value of assessing both fixed and growth mindsets as separate unipolar measures (Chiu et al., 2023; Grüning et al., 2024). Fixed and growth mindsets appear not to be mere opposites on a bipolar continuum but rather independent constructs. Future research should aim to replicate the current findings with a measure that includes unipolar items assessing fixed and growth beliefs independently. Moreover, employing unipolar items may provide greater insight into the nature of "middling" mindset beliefs.

Experimental Tests of Mindset Certainty

The current tests of the mindset strength framework employed measures of certainty, which of course limits our ability to make claims about the causal role of certainty. We think it is unlikely that participants' interest or engagement in fixed versus growth organizations is driving their certainty in their mindsets (the reverse causal pathway). Instead, it seems more likely that certainty drives their interest and engagement in each of these environments. Nonetheless, we look forward to future work manipulating certainty to provide more clarity on this issue.

Generalizability

As our studies utilized Western, Educated, Industrialized, Rich, and Democratic samples (Henrich et al., 2010), we cannot draw definitive conclusions about the role of mindset certainty among those populations of people not represented in our sample.

Conclusion

Using interest in fixed versus growth mindset organizations as an initial illustrative example, we propose a novel mindset strength framework that we anticipate will have predictive power across a number of outcomes and situations. This framework is particularly important in light of recent work calling into question effects of personal mindset beliefs (Foliano et al., 2019; Sisk et al., 2018). The current research suggests that researchers should not always expect people's growth mindset beliefs to predict their responses. Rather, personal mindset beliefs should primarily influence responses when their mindsets are held with certainty. More broadly, rather than asking "whether" growth mindset beliefs predict outcomes, we hope this work encourages more researchers to identify "when."

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