A Multi-Informant Study on Teachers' Mindset, Classroom Practices, and Student Well-Being

Abstract

Background. A student's ability mindset is associated with their academic success, but less is known about how teachers' ability mindset and classroom practices promote student well-being.

Aims and methodology. Using data from two concurrent studies with samples of 6^{th}-12^{th}-grade students (N = 2,665; M_{age} = 14.73 years, 62% qualified for free/reduced-price lunch; 49% girls; 33% Black, 49% White, 18% Other ethnicity-race) and math teachers (N = 195; 59% women; 94% White, 2% Black, 4% Other ethnicity-race; 40% bachelor's degrees, 60% graduate degrees), this prospective study used multi-informant, multi-level approaches to test (a) the links between teachers' mindset and students' learning engagement, emotional well-being, and social connectedness and (b) the mediational role of growth-oriented instructional approaches.

Results and conclusion. Within and between classrooms, student-reported teacher mindset was positively associated with all well-being outcomes. Growth-oriented classroom practices mediated the link between student-reported teacher mindset and all well-being outcomes at the individual level, but mediational pathways at the classroom level were only significant for emotional well-being. Teachers' self-reported mindset was not a significant predictor at the classroom level.

Keywords: teachers' growth mindset; teaching practice; emotional well-being; learning engagement; social connectedness

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Education reform centered around the idea that intelligence is a malleable rather than fixed trait—or the *growth mindset principle*—has become a global phenomenon. One way that teachers' internalized mindset beliefs can be manifested within the classroom is through growth-oriented approaches within their interpersonal interactions with youth and their classroom practices (Bardach & Klassen, 2021; Lauermann & Butler, 2021; Murphy et al., 2021; Park et al., 2016; Trzesniewski et al., 2021). When teachers hold a growth mindset, they are more likely to engage in classroom practices that reflect teachers' beliefs that intelligence is malleable, such as being sensitive and responsive to student needs (Rissanen et al., 2018), valuing mastery over performance goals (Daumiller et al., 2022), and giving students constructive feedback after failure (Park et al., 2016; Rattan et al., 2012). In turn, these growth-oriented practices have been associated with better academic achievement in students (Bostwick et al., 2020, 2022; Muenks et al., 2020).

It is also likely the case that the ramifications of a teacher's growth mindset and subsequent growth-oriented practices (e.g., sensitivity to learning needs, mastery orientation, high-quality feedback) may extend beyond achievement outcomes to influence student well-being more holistically. *Student well-being*—defined as the valence of integrated academic, emotional, and social experiences within the school environment (Hossain et al., 2023)—has been identified as a prominent influence on youth's current and future educational outcomes (Upadyaya & Salmela-Aro, 2013). Students who have positive well-being are said to be engaged in learning (Thorsteinsen & Vittersø, 2018), derive enjoyment and satisfaction from learning tasks (López-Pérez & Fernández-Castilla, 2018; Tian et al., 2016), and feel connected to their classmates, teachers, and other school-based adults (Kiuru et al., 2020). While student well-being

is a highly contextualized (i.e., school-based) construct, ecological theories of development assert that well-being within one developmental context (e.g., school) impacts well-being in other developmental context(s) (e.g., family, community); thus, student well-being represents an important facet of youths' holistic adaptive functioning (Bronfenbrenner & Morris, 2007; Hossain et al., 2023; Wang et al., 2019).

Few scholars have explored the ramifications of teacher mindset and practices on student well-being—instead of achievement—outcomes. In addition, the existing body of literature examining teacher effects on student outcomes lacks multi-informant approaches, thereby precluding researchers' ability to examine whether and how students and teachers may view elements of the growth-oriented classroom differently. To improve upon extant research on teacher mindset and student well-being, we leveraged a multi-informant, longitudinal design that examines (a) the links between a teacher's growth mindset and their students' learning engagement, emotional well-being, and social connectedness at the student and classroom levels and (b) whether a teacher's use of growth-oriented classroom practices (i.e., sensitivity to student needs, a focus on content mastery and understanding, quality feedback) mediates these associations.

Literature Review

The implicit theory of intelligence (Dweck & Leggett, 1988) posits that there are two primary perspectives on the nature of human ability: the entity theory of intelligence (i.e., *fixed mindset*) and the incremental theory of intelligence (i.e., *growth mindset*). Those with a fixed mindset view intelligence as a stable, static trait, while those with a growth mindset believe intelligence is malleable and can increase over time. The concept of 'mindset' has been operationalized in the educational context to better understand teacher and student perspectives

on learning, particularly regarding its connections with student academic outcomes. Students with a stronger growth mindset tend to have better grades than their more fixed-mindset peers (Blackwell et al., 2007; Burnette et al., 2013). As such, interventions aimed to instill growth mindsets in students have been widely adopted as a means of supporting students' academic resilience in the face of learning setbacks.

While these interventions have been found to support the internalization of growth mindsets among vulnerable groups of students, there has been widespread heterogeneity regarding the effects of students' growth mindset on their academic and non-academic outcomes across different contexts (Burnette et al., 2022; Macnamara & Burgoyne, 2023; Sisk et al., 2018). To explain this heterogeneity, scholars have recognized the role that classroom context—especially students' interactions with teachers—plays in understanding how students internalize growth mindset principles within and across various settings (i.e., the *mindset-plus-supportive-context* hypothesis; Walton & Yeager, 2020). Echoing the tenets of widely accepted theories in applied developmental research (e.g., Wang et al., 2019), this hypothesis asserts that student outcomes unfold as a product of social interactions and educational experiences within the learning environment. By exploring teacher mindset beliefs and instructional practices within the secondary-school math classroom and attending to multi-informant, multi-level patterns within our data, we stand to gain an ecologically grounded understanding of whether and how teachers' mindset beliefs and practices translate into student outcomes.

Defining Student Well-Being

There is a paucity of literature examining the ramifications of teacher mindset on non-academic student outcomes. This dearth may be influenced by a lack of conceptual clarity regarding student well-being as a multi-dimensional construct. Hossain and colleagues' (2023)

recent review explores hedonic, eudaimonic, and integrative views of student well-being. While hedonic views of well-being tend to focus on the state of feeling good (e.g., affective experiences), the eudaimonic view characterizes well-being as a representation of students' optimal academic functioning in school (e.g., learning engagement) across a range of cognitive, emotional, and social domains (Thorsteinsen & Vittersø, 2018). Because neither approach captures the complexity of well-being holistically, Hossain and colleagues (2023) also present an integrative approach that combines the hedonic state of 'feeling good' with the eudaimonic focus on learning engagement within the classroom's social ecology. This integrative approach frequently encompasses domains related to social well-being and classroom-based interpersonal relationships (e.g., social connectedness; López-Pérez & Fernández-Castilla, 2018; Tobia et al., 2019).

In the current study, we examine hedonic (e.g., emotional well-being), eudaimonic (e.g., learning engagement), and integrative (e.g., social connectedness) conceptualizations of student well-being that represent students' positive cognitive, emotional, and social experiences during school-based academic pursuits and interpersonal exchanges (Hossain et al., 2023; Wang et al., 2019). Effortful engagement in the learning process has been associated with the development of critical thinking skills, positive educational outcomes, and a commitment to lifelong learning (Murphy et al., 2021; Thorsteinsen & Vittersø, 2018), thereby making it a prominent part of well-being within the school context. Emotional well-being—that is, the ability to cope with learning challenges and state of feeling good during learning tasks—is also a critical part of student well-being (López-Pérez & Fernández-Castilla, 2018; Tian et al., 2016). Students who are emotionally healthy tend to understand and express their emotions, empathize with others, and build healthy relationships in ways that benefit their social development within school and

out-of-school settings (Saarni et al., 2007). Relatedly, relationships with teachers and classmates allow students to develop interpersonal skills related to collaboration, communication, and cooperation that transfer to non-academic settings (Eisenberg et al., 2007). By using classroom practices that support youth's well-being outcomes, teachers can help students develop into well-rounded individuals who are equipped to thrive academically, socially, and emotionally (Wang et al., 2019).

Teacher Ability Mindset and Student Well-Being

Student growth mindset has a strong, positive predictive relation with academic achievement across the literature (for review, see Costa & Faria, 2018). To a lesser extent, scholars have shown that students with a growth mindset tend to have better socioemotional outcomes, such as psychological well-being (Seo et al., 2022) and prosocial peer relationships (Rudolph, 2010). It appears, then, that a student's mindset beliefs are consequential for more than academic outcomes, but do students' perceptions of their teacher's mindset beliefs have the same effect? Researchers have only started to explore non-academic student outcomes in conjunction with teacher mindset. In the few available pieces of empirical literature addressing this topic, scholars have found significant positive effects of STEM teachers' growth mindsets on students' learning engagement (Bostwick et al., 2020, 2022; Canning et al., 2019; Hornstra et al., 2018; Martin et al., 2022), psychological well-being (Daumiller et al., 2022; Muenks et al., 2020), and sense of connectedness (Heyder et al., 2020; Rattan et al., 2018).

In one of the few studies examining teachers' beliefs about student ability in conjunction with non-academic student outcomes, teachers' judgements of students' ability were associated with students' motivation and emotional well-being; however, this association was mediated by teachers' differential pedagogical and interpersonal interactions with students (Urhahne, 2015).

Another study found that teachers' student-oriented mastery goals influenced students' perceptions of classroom goal structures (Daumiller et al., 2022). In other words, teachers' internalized beliefs emerged within teaching practices and teacher-student interactions, which in turn were associated with student engagement and socioemotional well-being.

Recent studies (e.g., Murphy et al., 2021; Trzesniewski et al., 2021) have also explored the concept of a growth mindset culture whereby teachers' actions within the classroom create an ambiance centered on celebrating failure as an indicator of learning, which in turn influences student educational and interpersonal outcomes. Similarly, the mindset-plus-supportive-context theory (Walton & Yeager, 2020) as well as sociocultural perspectives on classroom climate (Wang, Degol, et al., 2020) suggest that any effect of teacher mindset filters through classroom practices, including teachers' pedagogical decisions and interpersonal exchanges with students. Unfortunately, few studies have explored the processes that connect teachers' mindset (or students' perceptions thereof) with student outcomes (for review on extant work, see Bardach & Klassen, 2021; Lauermann & Butler, 2021).

Teacher Ability Mindset and Growth-Oriented Classroom Practices

Theoretical (Lauermann & Butler, 2021; Murphy et al., 2021; Trzesniewski et al., 2021; Walton & Yeager, 2020) and empirical literature (Bostwick et al., 2020; Kroeper et al., 2022; Park et al., 2016; Rattan et al., 2012; Urhahne, 2015) have indicated that teachers' growth mindset beliefs are embedded in the ways in which they respond to student learning needs, structure classroom assignments, and respond to student failure. Recent scholarship has holistically captured these processes into what has been termed a 'growth mindset classroom culture' characterized by (a) a shared, productive understanding of challenges, setbacks, and

learning and (b) the incorporation of growth mindset beliefs and behaviors into routine practices and interactions (Murphy et al., 2021).

While teacher preparatory programs and professional development have stressed the importance of adopting growth mindset beliefs, less attention has been given to how teachers can actuate these growth mindset beliefs in the classroom. In fact, the field currently lacks a pedagogical framework that delineates specific classroom practices through which teachers communicate their growth mindset during classroom learning activities (Murphy et al., 2021; Trzesniewski et al., 2021). To fill this void, we examine three distinct classroom practices—a sensitivity to students' individualized learning needs, a focus on mastery-oriented goals, and high-quality feedback—as mechanisms through which teachers' growth-oriented beliefs are demonstrated to students.

The core tenet underlying teacher's growth mindset beliefs is that all students can find academic success given the appropriate time, effort, and support (Dweck & Yeager, 2019). To provide this support, teachers must first be attuned to students' unique academic needs during the learning process. When teachers are sensitive to students' needs and abilities, they create an environment that highlights students' individual strengths and encourages developmentally appropriate academic risk-taking (Eccles & Roeser, 2011). Indeed, scholarship has shown that teachers who hold a growth mindset tend to be more sensitive to students' individual learning needs (Rissanen et al., 2018).

Relatedly, growth mindset beliefs also underscore the importance of mastery and the learning process as opposed to performance or achievement. Teachers with a mastery orientation view challenges and setbacks as opportunities for growth rather than signs of failure; thus, they tend to use instructional practices that help students acquire new skills while concurrently

deepening their learning engagement (Schiefele & Schaffner, 2015). In doing so, they foster a safe and supportive classroom environment where students feel comfortable taking risks, making mistakes, and persevering through challenges. It should come as no surprise, then, that teachers with a strong growth mindset tend to rely on mastery-oriented goal structures that position failure as an inevitable part of the learning process (Allen et al., 2013; Daumiller et al., 2022; Park et al., 2016).

Researchers have also shown how the growth mindset can be communicated through the types of praise and feedback given to youth (Dweck, 2007). When this feedback is delivered in a manner that emphasizes effort, progress, and the process of learning, it sends the message that success is attained through hard work, learning from mistakes, and embracing challenges. Rather than solely praising or criticizing student work, then, growth-oriented teachers tend to offer guidance and support to help students understand how they can grow and excel in their learning (Rattan et al., 2012). The positive association between teachers' growth mindset and the provision of effort praise has been extensively supported in the existing literature (for review, see Haimovitz & Dweck, 2017).

Each of these teacher practices (i.e., teacher sensitivity, mastery orientation, high-quality feedback) are ways in which teachers' can empower students to believe in their own abilities, embrace challenges, and strive for continuous growth and improvement. Because these messages closely align with growth mindset beliefs, we refer to them as *growth-oriented classroom practices*. Such practices may be essential to creating growth mindset cultures that promote positive student well-being outcomes (Murphy et al., 2021; Trzesniewski et al., 2021).

Growth-Oriented Classroom Practices and Student Outcomes

Adolescence is a period of increased sensitivity to messages embedded within social interactions (Eisenberg et al., 2007; Saarni et al., 2007), including those within teachers' verbal communication and classroom practices (Wang, Degol, et al., 2020; Wang, Hofkens, et al., 2020). Advances in adolescents' metacognitive abilities facilitate an increasing sensitivity to verbal or behavioral cues that are indicative of how others—including teachers—perceive them. Students—and especially adolescents—derive meaning from their learning interactions with teachers that inform their academic identities (Wang, Degol, et al., 2020; Wang et al., 2019) and learning goals (Daumiller et al., 2022). In fact, teaching practices are frequently conceptualized as a prominent element of the classroom climate with the potential to impact student well-being (Murphy et al., 2021; Trzesniewski et al., 2021; Wang, Degol, et al., 2020).

Growth-oriented classroom practices have been positively associated with indicators of academic achievement (Bostwick et al., 2020, 2022). These practices have also been studied in relation to eudaimonic indicators of student well-being, such as student engagement. For example, researchers have shown that students' learning engagement tends to be higher when teachers ensure that students' individualized learning needs are met (Hornstra et al., 2018), teach for content mastery (Schiefele & Schaffner, 2015), and offer critical (as opposed to comforting) feedback in the face of failure (Rattan et al., 2012). As such, we expect that students in classrooms where growth-oriented practices are used frequently will report higher levels of learning engagement.

Fewer studies have attended to whether and how growth-oriented practices are associated with hedonic and integrative indicators of student well-being, such as emotional well-being and social connectedness (respectively). From a developmental perspective, growth-oriented practices may be uniquely catered toward meeting adolescents' emotional and social needs.

Pianta & Hamre (2009) found teachers who promote content mastery (vs. performance) and provide quality feedback in the wake of academic challenges create a supportive classroom environment that is sensitive to students' individualized learning needs. Indeed, growth-oriented practices have been associated with better classroom emotional climates (Donker et al., 2021; Romero et al., 2014) and a higher sense of belonging among students (Kiuru et al., 2020). Growth-oriented approaches also tend to rely upon collaborative problem-solving and group work (Hannafin et al., 2014), thereby increasing the number of opportunities to foster social connectedness in the classroom. As such, it is likely that growth-oriented practices will be positively associated with students' emotional well-being and social connectedness.

The Importance of a Multi-Informant, Multi-Level Design

The mindset literature is fraught with heterogenous findings. Some scholars have attributed these differences to the lack of multi-informant approaches explicating both teacher and student perspectives on mindset. While teacher and student reports are somewhat correlated, student reports tend to be more predictive of student outcomes and more closely associated with parent- or observer-reports (Guo et al., 2023; Wang, Hofkens, et al., 2020). Because teacher reports on their own beliefs and practices are prone to social desirability bias (Trzesniewski et al., 2021), student reports may be more reflective of the ability beliefs teachers are communicating within their classroom. It is also likely that students are more responsive to teachers' observable actions rather than their internalized beliefs (Park et al., 2016), as these beliefs are abstract and hidden from students' view. Even if a teacher endorses a growth mindset, they may have difficulty constructing classroom activities that convey these beliefs to students (Buttrick, 2019). Thus, a multi-informant approach is necessary to understand how teachers' endorsed mindset beliefs are actually being perceived by students. When it comes to shaping

students' mindset, motivation, and overall educational experiences, teachers' actions often carry more weight than what they believe internally; hence, we predict that the hypothesized associations will be significant when teacher mindset is assessed using student (as opposed to teacher) reports.

Another concern within the extant mindset literature relates to the lack of expected results in several large-scale studies (e.g., Foliano et al., 2019; Rienzo et al., 2015). Morin and colleagues (2022) argued that results obtained at one level of analysis (e.g., the individual level) cannot be expected to generalize to other levels (e.g., the school/classroom level). This phenomenon was observed in Rienzo and colleagues' (2015) randomized control trial, where teacher mindset predicted outcomes at the student- but not school-level, thus suggesting that the benefits associated with mindset beliefs are largely dependent on processes activated in one-on-one interactions with students as opposed to collective approaches at the classroom or school level.

It is important to take a multi-level approach that examines findings at both the individual and setting levels because they disentangle inter-individual differences from classroom-level effects, thus allowing more nuanced implications for educational practice (Morin et al., 2014, 2022). At the person level, significant mediational pathways between teacher mindset, classroom practices, and student well-being may hold implications that inform teachers' interpersonal approaches with individual students during learning tasks. Person-level findings can also provide information as to whether certain practices are more consequential for supporting well-being among students from different sociocultural backgrounds. This information may be especially useful to teachers serving student populations characterized by minoritization and marginalization, as these youth are at-risk for lower personal and academic well-being.

Conversely, student reports that are aggregated at the classroom level may be more reflective of an overarching classroom culture (Morin et al., 2014; Skinner et al., 2022). As such, significant findings at the classroom level may indicate that initiatives aimed at supporting student well-being via the activation of teachers' mindset beliefs should target whole classes (e.g., classroom-wide instructional practices). Classroom-level findings also allow for the identification of between-classroom differences (e.g., teacher experience, course difficulty) that can inform administrator-level decisions on curriculum and resource allocation. Considering that education scholars have started to explore the concept of a growth-oriented classroom culture (e.g., Murphy et al., 2021; Trzesniewski et al., 2021), it is critically important to distinguish the within- and between-classroom effects of teacher mindset and classroom practices on student well-being via rigorous methodological approaches (e.g., doubly-latent multilevel approaches; for review, see Morin et al., 2022).

The Current Study

Despite the concept of mindset gaining traction within educational reform, the mindset literature has primarily focused on the associations between student mindset and ensuant academic outcomes, leaving the links between teacher mindset and student well-being understudied. In addition, there have been mixed findings as to whether teacher mindset trainings can bring about positive student and classroom outcomes. To advance the body of knowledge surrounding mindset phenomenon within educational spaces, we take a multi-informant (i.e., student and teacher reports), multi-level approach to examining the links between teacher/classroom factors and student well-being outcomes (i.e., learning engagement, emotional well-being, social connectedness) at both the student and classroom levels. Our research questions are:

1. What is the association between teachers' mindset beliefs and student well-being?
2. Do teachers' growth-oriented instructional approaches mediate the association between teacher mindset and student well-being outcomes?

Based on developmental literature (Saarni et al., 2007; Wang et al., 2019) and research on teachers' internalized beliefs and ensuant teaching practices (Lauermann & Butler, 2021; Walton & Yeager, 2020), we assert that a teacher's mindset is linked to student well-being through their classroom practices. Specifically, we posit that teachers with a stronger growth mindset will have students with better learning engagement, emotional well-being, and social connectedness. We predict that teachers' use of growth-oriented practices will mediate these associations. Finally, we expect that the hypothesized associations will be statistically significant only when teacher mindset is assessed using student (vs. teacher) reports.

Method

Participants

Participants were middle- and high-school students and teachers across two concurrent studies aimed at understanding students' math classroom experiences. A total of 2,665 sixth, eighth, tenth, and twelfth-grade students participated in the study (M_{age} = 14.73 years, SD = 1.94; 16% sixth grade, 45% eighth grade, 23% tenth grade, 16% twelfth grade; 49% girls; 33% Black, 49% White, 18% Other ethnicity-race). Among student participants, 62% were qualified for free or reduced-price lunch. Students attended 17 public secondary schools located in a northeastern U.S. metropolitan area and were nested within 195 math teachers/classrooms (59% women; 94% White, 2% Black, 4% Other ethnicity-race; 40% bachelor's degrees, 60% graduate degrees; $M_{class\ size}$ = 14, with a range of 10 to 28 students). On average, teachers had 14.87 years of teaching experience (SD = 7.67 years; Range = <1 to 30 years). All students were taught by different

teachers for each subject (i.e., a standard format for U.S. secondary schools). Students reported about their experience with one math teacher for one particular math class.

Procedure

Student survey data were collected in the fall 2018 (Time 1) and spring 2019 (Time 2) semesters of the 2018-19 school year, and teacher survey data were collected in fall 2018 (Time 1). School record data were collected at the end of the 2017-2018 and 2018-2019 school years. In fall 2018, the research team distributed a study description and informed consent/assent forms for students, their parents, and teachers. More than 98% of students consented, and this participation rate was similar across schools and grade levels. Of math teachers invited to participate, roughly 87% consented.

Students completed our online surveys during their regularly scheduled class time. All survey questions were audio-recorded to proactively address literacy issues, and members of the research team were available to answer students' questions during the survey administration period. Math teachers completed an online survey outside of instruction time. Students received a small gift with $10 face value (e.g., T-shirt, mug) for participating in the survey, and teachers received $60 for their participation. The authors' University Institutional Review Board (IRB) reviewed and approved all study materials and procedures.

Missingness

Across all waves, 95% of the student sample had complete data (5% missing data in the spring; no missing data at the end of the school year). The most common source of attrition was students either moving out of the school district or being absent during data collection. Students with complete data were not significantly different from students with missing data regarding demographic characteristics and key study constructs.

Within waves, teacher-reported teacher mindset had 3.8% missingness while student-reported teacher mindset had 25% missingness; student-reported classroom practices had 13% missing data; and there were no missing data on covariates. Little's MCAR test (Little, 1988) indicated that the missingness patterns of student-report data were not completely at random (Little's MCAR; χ^2 =228, df =22, p <.01). However, missingness on items for student-reported teacher mindset (χ^2 =50.70, df =1, p <.001) and classroom practices (Teacher Sensitivity: χ^2 = 17.22, df =1, p <.001; Quality Feedback: χ^2 = 16.12, df =1, p <.001; Content Understanding: χ^2 = 19.90, df =1, p <.001) was associated with the order of survey items, as these items appeared in the latter half of the electronic survey. Two versions of the student survey were administrated as a means of combating survey bias introduced by the ordering of survey items. The survey versions were given to students at random, and there were no demographic differences in the sample completing the two survey versions. Students in basic (vs. advanced) courses and 8th graders were less likely to complete the survey than other grades. We controlled for these variables in the analyses.

Measures

Teacher Ability Mindset as Predictor

In fall 2018, teachers and students reported on teachers' growth mindset using the Implicit Theory of Math Ability Scale (3 student-report items, e.g., *My teacher believes that everybody can be very good at math*; 4 teacher-report items, e.g., *To be honest, students can always change how intelligent they are in math*; Rattan et al., 2012). Responses fell on a 5-point Likert scale (student report: 1 = *not at all*, 5 = *extremely true;* teacher report: 1 = *strongly disagree*, 5 = *strongly agree*) and were averaged together (i.e., one for students and one for

teachers) such that higher scores reflected a stronger growth mindset (Student report: $\omega_{student}$ = .72; $\omega_{classroom}$ = .86; teacher report: $\alpha_{classroom}$ = .82).

Growth-Oriented Classroom Practices as Mediators

In fall 2018, students reported on three growth-oriented practices using the Classroom Assessment Scoring System Student Report Scale (Downer et al., 2015). The student report scale has been validated in studies examining academic and psychological outcomes among adolescent students (Downer et al., 2015; Wang, Hofkens, et al., 2020). *Teacher Sensitivity* was measured using three items (e.g., *My math teacher helps me when I need help*; $\omega_{student}$ = .78; $\omega_{classroom}$ = .95). *Teacher Provision of Quality Feedback* measured teachers' response to students after a setback using three items (e.g., *My math teacher suggests new study strategies I can try*; $\omega_{student}$ = .84; $\omega_{classroom}$ = .98). *Teacher Focus on Content Understanding and Mastery* was measured using six items (e.g., *My math teacher asks me to think about what I have learned at the end of activities*; $\omega_{student}$ = .76; $\omega_{classroom}$ = .92). All items were scored on a 5-point Likert scale with responses that ranged from 1 (*strongly disagree*) to 5 (*strongly agree*).

Student Well-Being Outcomes

In fall 2018 and spring 2019, students reported on their learning engagement, social connectedness, and emotional well-being. *Learning Engagement* was measured using the Classroom Engagement Scale (Wang et al., 2016; 3 items; e.g., *When I do poorly in class, I put more effort*; $\omega_{student}$ = .88; $\omega_{classroom}$ = .95). All items were scored on a 5-point Likert scale (1 = *not at all like me*, 5 = *very much like me*). *Emotional Well-Being* (3 items; e.g., *I feel good when I am in class*; $\omega_{student}$ = .71; $\omega_{classroom}$ = .98) was assessed using Likert scale items (1 = *not at all*, 5 = *very much*) adapted from the well-validated Social and Emotional Competency Assessment (SECA; Davidson et al., 2018), which includes items inquiring about adolescents emotion well-

being and regulation during classroom tasks. *Social Connectedness* (3 items; e.g., *I feel close and connected to classmates*; $\omega_{student}$ = .90; $\omega_{classroom}$ = .98) was assessed using Likert scale items (1 = *not at all*, 5 = *very much*) from the connection subscale of the well-validated Positive Youth Development Short Form (PYD-SF; Geldhof et al., 2014).

Covariates

Heterogeneity is a noted problem in the existing mindset literature, with results varying across school contexts and student populations (for review, see Yeager & Dweck, 2020). To account for this heterogeneity, we controlled for a series of covariates that could have biased the link between teacher mindset and student outcomes at the student and classroom levels.

We controlled for students' free/reduced-priced lunch eligibility (as a proxy of socioeconomic status), prior year's math achievement[1], grade, survey version, gender, ethnicity-race, and well-being outcomes in the fall semester. We included adolescents' self-reported free and reduced-price status, racial-ethnic group membership, and gender covariates due to the influences of marginalization and minoritization on positive youth development and educators' classroom interactions with students (for review on how sociocultural influence youth well-being and school experiences, see (Velez & Spencer, 2018; Wang, Degol, et al., 2020; Wang, Hofkens, et al., 2020). We also included students' grade level as a covariate to control for well-documented developmental declines in students' learning engagement throughout middle and high school (Benner & Graham, 2009; Davis et al., 2014).

At the classroom level, we accounted for the two concurrent study datasets to ensure there were no differences due to students completing different surveys with parallel items. We controlled for teacher experience (in years), teacher degree (1 = *graduate degree*, 0 = *bachelor's*

[1] For math achievement, students' letter grade (A-F, with 'A' being the highest grade and 'F' indicating failure), was converted to a 4-point scale such that higher scores indicated better grades.

degree), and grade level. The rigor of certain advanced-level courses may pose socially comparison threats to student well-being, and advanced courses may include a greater percentage of students who already are academically engaged and have an emotional interest in math (Wang, Degol, et al., 2020); hence, we controlled for course difficulty. Lastly, since there were 17 schools, we used TYPE = COMPLEX TWOLEVEL to account for school random effects.

Analytic Plan

First, we conducted a doubly-latent multilevel confirmatory factor analysis (DL-MLCFA) using the mean scores for our three growth-oriented practices: Teacher Sensitivity, Teacher Provision of Quality Feedback, Teacher Focus on Content Understanding, and Mastery. Each of these mean scores represented one of three items that made up our latent construct of growth-oriented practices. Prior theoretical and empirical data suggests a higher-order structure to the data in which these three constructs make up a larger omnibus classroom latent variable, as opposed to a bi-factor or single-order structure to the data (Murphy et al., 2021; Trzesniewski et al., 2021). We achieved goodness-of-fit via this factor structure, $\chi^2(2) = 18.44$, $p < .001$, RMSEA = .06, CFI = .99, TLI = .97; SRMRwithin = .01, SRMRbetween = .03. Please see Table S1 for model fit details for different factor structures. Thus, we measured growth-oriented practices as a doubly latent construct that enables us to parse out within- and between-level effects and account for measurement errors (Jia & Konold, 2021).

For our DL-MLCFA, we also imposed isomorphism to stabilize the model estimation process and to obtain more accurate parameter estimates (Lüdtke et al., 2008, 2011; Morin et al., 2022). There was only a slight decrease in model fit when comparing our isomorphic and non-isomorphic DL-MLSEM (see supplementary Table S1); however, Morin et al. (2022) recommend imposing isomorphism even when it is not fully supported by the data. As a final

check, we ran our structural models with and without constrained loadings across levels, and our results stayed the same across all models.

Second, we fit multilevel structural equation models (MLSEM) in Mplus version 7.4 to account for the nested structure of the data (2,665 students in 195 classrooms; Preacher et al., 2010). In addition to our doubly latent variable for growth-oriented teaching practices, we created manifest-latent variables to assess all other key variables (i.e., student- and teacher-report of teacher mindsets; student-reported learning engagement, emotional well-being, and social connectedness). To measure manifest-latent variables, we used a single manifest mean score indicator for each of these variables at the student level (Level 1); then, we used latent aggregation of the Level 1 variables to form Level 2 variables. The intra-class correlations (ICCs) indicated that the majority of the variance across student outcomes were at the within-classroom levels (.92–.97) relative to the between-classroom levels (.03–.08).

For our first research question, we examined whether student and teacher reports of teacher mindsets predicted students' learning engagement, emotional well-being, and social connectedness. For our second research question, we evaluated whether students' perceptions of growth-oriented practices mediated the link between teacher mindsets (as reported by students and teachers) and student well-being outcomes via two MSEM mediation models. The model examining student-reported teacher mindset as the key predictor used a 1-1-1 MSEM model (see Figure 1) to assess predictors, mediators, and outcome variables at both the within- and between-classroom levels (Pituch & Stapleton, 2008; Preacher et al., 2010). The model examining teachers' self-reported growth mindset as the key predictor used a 2-1-1 MSEM model (see Figure 2) to assess the teacher mindset predictor at Level 2, while classroom practices and student outcomes were assessed both Level 1 and 2. For all models, we controlled for Level 1

and 2 covariates. Due to potential multicollinearity issues among the three well-being outcomes, we ran separate models for each well-being outcome to understand how teachers' mindsets and practices uniquely contribute to each outcome. For all models, we controlled for Level 1 and 2 covariates.

Across all mediation models, we used MODEL CONSTRAINTS in Mplus to calculate the indirect effects of classroom practices on the links between student and teacher-reported teacher mindset and well-being outcomes (Preacher et al., 2010). The standardized regression slope is presented as a measure of effect size. For a coefficient β, effect sizes between 0.10–0.29 are said to be only small, effect sizes between 0.30–0.49 are medium, and effect sizes of 0.50 or greater are large (Cohen, 2016). We used maximum likelihood estimation with robust standard errors (MLR) as an estimator because it is robust to non-normality.

Results

Descriptive Statistics

Table 1 presents descriptive statistics and the within- and between-classroom zero-order correlations among key constructs.

Multilevel Structural Equation Models (MSEM)

We found goodness-of-fit for both the isomorphic and non-isomorphic models for the growth-oriented classroom practices DL-MLCFA. We also assessed a full measurement model with the growth-oriented classroom practices doubly latent variable, manifest latent predictor and outcome variables, and mean score covariates. All measurement models showed goodness-of-fit (see supplementary Table S2).

The direct effects of the mediated and non-mediated MSEMs are shown in Table 2, and the indirect effects of our mediated MSEMs are shown in Table 3. Across all models, we found

acceptable model fit (supplementary Table S2). All models' standardized coefficients and confidence intervals are depicted in supplementary materials (see Tables S3 through S8).

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Teacher Mindset and Student Outcomes. According to Table 3, the within-classroom effects show that student reports of teacher mindsets were positively related to students' learning engagement ($b = 0.16$, *S.E.* $= .04$, $p < .001$, $\beta = .16$), emotional well-being ($b = 0.17$, *S.E.* $= .02$, $p < .001$, $\beta = .13$), and social connectedness ($b = .15$, *S.E.* $= .02$, $p < .01$, $\beta = .13$). For between-classroom effects, student-reported teacher mindset was positively related to students' learning engagement ($b = 1.02$, *S.E.* $= .21$, $p < .001$, $\beta = .86$), emotional well-being ($b = 0.82$, *S.E.* $= .35$, $p < .05$, $\beta = .60$), and social connectedness ($b = .63$, *S.E.* $= .15$, $p < .001$, $\beta = .86$).

Mediation Effect of Classroom Practices. In Table 4, we present models positioning growth-oriented practices as a mediator between student report of teacher mindsets and student well-being outcomes. When examining the within-classroom direct effects between teacher mindset (predictor) and classroom practices (mediator), student-reported teacher mindset was positively linked to growth-oriented practices across all three student outcomes (learning engagement model: $b = 0.26$, *S.E.* $= .02$, $p < .001$, $\beta = .34$; emotional well-being model: $b = 0.27$, *S.E.* $= .02$, $p < .001$, $\beta = .36$, and social connectedness model: $b = 0.26$, *S.E.* $= .02$, $p < .001$, $\beta = .34$). At Level 2, classroom-level student-reported teacher mindset was positively linked to classroom-level growth-oriented practices (learning engagement model: $b = 1.05$, *S.E.* $= .21$, $p < .001$, $\beta = .95$; emotional well-being model: $b = 1.00$, *S.E.* $= .17$, $p < .001$, $\beta = .92$, and social connectedness model: $b = 1.01$, *S.E.* $= .19$, $p < .001$, $\beta = .94$).

When examining the link between classroom practices (mediator) and student outcomes (outcome), within-classroom effects showed that growth-oriented practices were positively

linked to learning engagement (b = 0.38, *S.E.* = .04, p < .001, β = .28), emotional well-being (b = 0.53, *S.E.* = .05, p < .001, β = .32), and social connectedness (b = 0.38, *S.E.* = .03, p < .001, β = .26). For between-classroom effects, classroom practices positively predicted emotional well-being (b = 1.15, *S.E.* = .25, p < .001, β = .88), but not learning engagement or social connectedness.

When examining within-classroom indirect effects, student-reported teacher mindset was positively linked to students' learning engagement (b = 0.10, *S.E.* = .01, p < .001, β = .12), emotional well-being (b = 0.15, *S.E.* = .02, p < .001, β = .14), and social connectedness (b = 0.10, *S.E.* = .01, p < .001, β = .10) through growth-oriented practices. For between-classroom effects, we found growth-oriented practices positively predicted emotional well-being through growth-oriented practices (b = 1.15, *S.E.* = .23, p < .001, β = 1.37[2]), but these links were not significant for learning engagement or social connectedness. These results suggested that growth-oriented practices mediated the positive links between student perceptions of teacher growth mindsets and students' emotional well-being both within and between classrooms. The effects of student perceptions of teacher growth mindset on learning engagement and social connectedness were mediated by classroom practices within classrooms but not between classrooms.

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[2] Standardized coefficients exceeding one in absolute value can occur when there is more than one explanatory variable. This has been linked to multicollinearity (Deegan, 1978); however, standardized coefficients greater can be attributed to suppression effects in a path model or variables besides the outcome in the model having some correlation to one another (Maassen & Bakker, 2001).

Teacher Mindset and Student Outcomes. According to Table 5, the between-classroom effects of teachers' self-reported growth mindset were not linked to students' learning engagement, emotional well-being, or social connectedness.

Mediation Effect of Classroom Practices. Teachers' self-reported growth mindset was measured solely at the classroom level (see Table 6). Teachers with stronger growth mindsets did not tend to use more growth-oriented practices in models for learning engagement, emotional well-being, or social connectedness. When examining the link between classroom practices (mediator) and student outcomes (outcome), between-classroom effects show that student reports of growth-oriented practices were positively linked to students' learning engagement ($b = 0.72$, $S.E. = .13$, $p < .001$, $\beta = .65$), emotional well-being ($b = 1.03$, $S.E. = .18$, $p < .001$, $\beta = .78$), and social connectedness ($b = 0.50$, $S.E. = .04$, $p < .001$, $\beta = .68$).

When examining between-classroom indirect effects, teacher-reported growth mindset was not linked to classroom differences in any student outcomes, suggesting that growth-oriented practices did not mediate the links between teacher-reported growth mindsets and student outcomes.

Discussion

Our investigation of the relations between teacher mindset, classroom practices, and student well-being provides some of the first empirical evidence that teachers' growth mindset is communicated to students through their instructional approaches. Across a large sample of adolescent math learners and teachers, we found that students' perceptions of their teachers' beliefs about math ability and their ensuing classroom practices played a significant role in promoting student engagement, emotional well-being, and social connectedness. When students reported that their teachers held a strong growth mindset, they tended to have better learning

engagement, social connectedness, and emotional well-being. In addition, students' perceptions of teacher mindset were linked to all three student well-being outcomes through growth-oriented practices as mediators at the within-classroom level, but at the between-classroom level, this mediational pathway was only significant for students' emotional well-being. Teachers' self-reported mindset beliefs were not significantly associated with student well-being outcomes.

Teacher Mindset Beliefs vs. Practices on Individual Student Well-Being

Our findings (a) align with the existing literature explicating the positive association between students' perceptions of teacher mindset and learning engagement (Bostwick et al., 2020, 2022; Canning et al., 2019; Muenks et al., 2020) and (b) extend the existing literature by finding significant associations between students' perceptions of teacher mindset and their emotional well-being and social connectedness. By supporting eudaimonic (i.e., learning engagement), hedonic (e.g., emotional well-being), and integrative (e.g., social connectedness) indicators of student well-being (Hossain et al., 2023), teachers' growth mindset beliefs can promote academic and socioemotional resilience in the face of learning challenges. We also found a positive link between growth-oriented practices and all three student well-being outcomes. Importantly, the direct link between growth-oriented practices and well-being outcomes was stronger than the direct link between student-reported teacher mindset and well-being outcomes. In other words, a student's exposure to growth-oriented practices seemed more strongly associated with well-being outcomes than their perceptions of teacher mindset.

Why might student well-being be more responsive to growth-oriented practices than teachers' internalized growth mindset beliefs? Even if teachers directly espouse a growth mindset within their classrooms, students—and especially adolescents—are highly sensitive to the messages embedded within pedagogical and interpersonal interactions with teachers. While

our latent variable representing growth-oriented practices prevented us from examining nuanced pathways between these classroom practices and well-being outcomes, we can postulate how each practice communicated a growth-mindset belief that contributed to student well-being. For instance, teachers who tailor their pedagogical approach to meet students' unique learning needs may reduce the likelihood of frustration and disengagement associated with completing classroom work that exceeds one's cognitive skills while simultaneously strengthening the teacher-student relationship (Eccles, 2009). Teachers' emphasis on mastery (vs. performance) goals has been associated with lower anxiety (Daniels et al., 2009), lower social comparison among students (Darnon et al., 2010), and re-engagement with learning activities following educational setbacks (Skinner et al., 2020).

Teacher feedback may be an especially salient growth-oriented practice for supporting student well-being among middle- and high-school students. Adolescents are particularly attuned to how they are perceived by others (Eisenberg et al., 2007), and this sensitivity to social comparison makes a teacher's feedback in the wake of learning setbacks of paramount importance. In Rattan et al.'s (2012) study, students who received comfort-oriented praise (vs. strategy-oriented praise or no praise) not only perceived that their teacher had a weaker growth mindset, but they also reported lower self-expectations and engagement. The same processes seen in Rattan et al.'s (2012) study were observed in the current study: A student who experienced fewer growth-oriented practices may have perceived a weaker growth mindset within their teacher, thereby increasing the chance of less desirable well-being outcomes. Arguably, then, education researchers looking to support student well-being may want to focus on developing teacher interventions that focus more on implementing growth-oriented strategies

for learning and instruction rather than solely encouraging teachers to adopt growth mindset beliefs.

The Mediating Role of Growth-Oriented Classroom Practices

If students are more responsive to growth-oriented practices than perceived teacher mindset, then why does teacher mindset matter? Our results position growth-oriented practices as the conduit through which teacher mindset influences student outcomes: When students believed that their teachers endorsed a growth mindset, they were more likely to report growth-oriented practices, which was in turn associated with better student well-being. Although empirical evidence to support this hypothesis was limited, our results did replicate the generalized scholarly consensus showing that teachers' internalized beliefs link to student outcomes through their pedagogical and interpersonal interactions with students (Bostwick et al., 2020, 2022; Daumiller et al., 2022; Heyder et al., 2020; Muenks et al., 2020).

Results also confirmed the findings from one of the few empirical studies addressing teachers' classroom behaviors as the mechanism through which teacher mindset is associated with student well-being (Urhahne, 2015). These findings suggest that both students' perceptions of teacher mindset as well as their exposure to growth-oriented learning activities are consequential for supporting student well-being; however, individual student outcomes may be more tightly tethered to teachers' instructional and interpersonal approaches rather than their mindset beliefs. As expressed by Park and colleagues (2016), it may be the case that "what matters…is not what teachers believe, but rather how teachers embed their beliefs into teaching practices" (p. 310).

Our findings show how information about growth mindsets is integrated into teacher preparation programs and in-service trainings. These professional development opportunities

have mainly taken the form of informational sessions about mindset theory without addressing how mindset beliefs are communicated to students through pedagogical actions as well as teacher-student dynamics (The New Teacher Project, 2015). By siloing theory and practice, we risk scenarios in which teachers verbally or cognitively endorse the belief that all students can grow and succeed while using practices that communicate the notion that student ability is innate and static (Willingham et al., 2021). Indeed, Buttrick (2019) found that approximately half of teachers who cognitively endorsed a growth mindset used classroom practices that devalued the need for individually tailored learning strategies and expressed indifference to help-seeking behaviors. It may be the case that (a) educators are being introduced to the concept of mindset in decontextualized ways that fail to provide practical knowledge on how to embed these beliefs into classroom practices or (b) teachers lack the knowledge or support to sustain growth-oriented practices in their classrooms.

Accordingly, teacher trainings need to explicitly address how growth mindset beliefs are communicated to students via growth-oriented classroom strategies. Rather than push teachers to internalize a growth mindset, professional development should focus on how to implement growth-oriented beliefs within specific instructional and interpersonal strategies. Our findings indicate that being sensitive to student needs, adopting a mastery-oriented approach, and providing high-quality feedback may be especially effective ways that teachers can actuate a growth mindset. By supplying such resources, we stand to help teachers imbue growth mindset beliefs into classroom practices associated with student well-being without delving into the ethically dubious requirement that teachers internalize growth mindset beliefs. Relatedly, interventionists may also want to integrate tools to measure how trainings influence teachers' internalized mindset beliefs as well as their pedagogical choices and actions.

Design Considerations for Mindset Research

The Importance of a Multi-Level Approach

By taking doubly latent multilevel modeling approaches, we were able to disentangle the effects of within vs. between-classroom effects (Morin et al., 2014, 2022; Skinner et al., 2022). Student reports of teacher mindset shared significant direct and indirect effects with outcomes at the within-classroom level, but there were mixed findings at the between-classroom level. Although student reports of teacher mindset shared direct links to between-classroom outcomes, mediation models at this level of analysis were only significant for emotional well-being. These findings imply that interventions that aim to improve student well-being via pathways associated with teachers' ascription to and activation of growth mindset beliefs may be most effective when they target the dynamics between teachers and individual students within the sociocultural context of the classroom, especially those that focus on supporting individualized student needs through high-quality teacher-student relationships.

It also may be the case that our latent classification of growth-oriented practices obfuscated our ability to understand nuances in the mediational link between student-reported teacher mindset and our three student well-being outcomes at the within- and between-classroom levels. Indeed, existing literature has shown that teacher sensitivity is predictive of students' emotional well-being, whereas cognitive and social outcomes (e.g., engagement, interpersonal dynamics) tend to be more tightly coupled with mastery-oriented classroom practices and the quality of teacher feedback (Gregory & Korth, 2016; McKellar et al., 2020). In the current study, teacher sensitivity drove our latent variable for growth-oriented practices at the between-classroom level, and when considered in light of existing literature, it makes sense that we observed significant between-classroom indirect effects only in the emotional well-being model

rather than seeing effects distributed more evenly across student well-being outcomes. Future research should examine the links between distinct teaching approaches and student outcomes to tease out which constellation of practices is best for promoting students' holistic well-being.

The heterogeneity observed in within- vs. between-classroom outcomes is reflective of the controversies seen in studies whereby teacher mindset interventions did not translate into the expected outcomes at the school as opposed to individual level (for review, see Yeager & Dweck, 2020). Notably, these prior studies have largely focused on academic outcomes, while the current study explores student well-being outcomes. Developmental theories have taken phenomenological (Velez & Spencer, 2018) and sociocultural (Wang, Degol, et al., 2020) approaches to understanding students' classroom-based experiences, including their interactions with school-based adults and perceptions of equitable teaching practices. For instance, it is likely that student-level factors—such as the strength of individual students' interpersonal relationships with their teacher (Wang, Hofkens, et al., 2020)—may have influenced the links between teachers' instructional approaches and student well-being outcomes. We recommend that future mindset work continues to investigate student outcomes at both the individual and classroom levels to better capture nuanced patterns and heterogeneity in student well-being outcomes.

The Importance of a Multi-Informant Approach

While student-reported teacher mindset shared significant indirect associations with student outcomes at the within- and between-classroom level, growth-oriented practices did not mediate the association between teachers' self-reports of their mindset beliefs and classroom-level student outcomes. First, we acknowledge that student and teacher reports of teachers' growth mindset each provide a unique perspective; thus, they may perceive and report on these practices differently. Indeed, student- and teacher-reports of instructional quality (Desimone et

al., 2010) and teacher-student relationships (Mitchell et al., 2010) tend to vary significantly. We see this discrepancy in student vs. teacher reports in the current study, as student reports of teachers' mindset beliefs shared a weak correlation with teacher's self-reported mindset beliefs (r = .04, *ns*).

What could be contributing to the difference in student and teacher reports of teachers' mindset beliefs? It may be the case that teachers are unaware of whether and how their mindset beliefs are communicated through their instructional practices. A teacher's own growth mindset beliefs do not necessarily mean that their classroom-based interpersonal and educational interactions reflect said mindset (Buttrick, 2019). In the current study, it appears that teachers may be underestimating their ability to communicate growth mindset beliefs to their students, as student-reported teacher mindset tended to be higher than teacher's self-reported mindset beliefs. As such, teachers' reports of their mindset beliefs may not necessarily have been reflective of the beliefs that they were communicating to students through their classroom practices.

It may have also been the case that our outcome measures were not sensitive in capturing teachers' growth mindset beliefs and attitudes. For instance, certain outcome variables—such as teachers' subjective evaluations of students' academic performance (e.g., classroom grades)—may be more strongly linked to teachers' growth mindset, which may result in greater teacher/classroom-level effects. Future research should take these issues into consideration. Moreover, teacher mindset trainings may want to consider modules addressing reflective practice whereby teachers can learn to assess their own mindset beliefs more accurately and become more aware of the ways in which students interpret their classroom-based behaviors.

Implications for Student Well-Being Research and Practice

At the within-classroom level, teacher mindset and growth-oriented practices were significantly associated with each of the three main indicators of student well-being (i.e., eudaimonic, hedonic, and integrative) presented by Hossain and colleagues (2023). Simply stated, our results imply that student well-being is higher when students (a) believe their teacher believes all students can succeed and (b) experience those beliefs through their teacher's use of growth-oriented practices. Based on the findings in this study, classroom practices that emphasize mastery, attend to students' individualized learning needs, and provide high-quality feedback explain how teachers' perceived mindset beliefs contribute to a classroom environment characterized by high learning engagement, emotional well-being, and social connectedness among students.

To capitalize on this information, schools should recognize the value of pedagogical tools that allow teachers to cater to the unique needs of individual students while supporting student well-being. For instance, differentiated instruction—that is, practices that tailor educational approaches based on students' educational needs and assets—has been found to be particularly effective in supporting secondary students' school-based social, emotional, and academic well-being (Pozas et al., 2021). According to the current study, differentiated instruction approaches that are sensitive to students' needs, provide individualized feedback, and contribute to mastery experiences may be associated with student well-being in part because they convey growth mindset beliefs.

Notably, student-reported teacher mindset and growth-oriented classroom practices shared the strongest association with hedonic student well-being (i.e., emotional well-being) at the within-classroom level, and it was the only well-being outcome with a significant mediational path at the between-classroom level. When it comes to student well-being, then, it

appears that students' perceptions of their teacher's mindset and classroom practices may be particularly consequential for adolescents' emotional well-being. Emotional well-being is a salient topic considering worldwide trends of declining mental health among adolescents (Racine et al., 2021); hence, schools may want to consider addressing these approaches both through individualized and classroom-wide approaches that communicate growth mindset beliefs.

Limitations and Future Directions

While this study's design advances the literature, there are several limitations that must be considered when interpreting results. First, our findings are correlational, not causal; however, we do present robust evidence that teacher mindset is linked to student outcomes through growth-oriented practices. Future research should consider experimental designs to determine whether the observed relations between teacher mindset, growth-oriented practices, and student outcomes are causal. In addition, there was low variability at the classroom level; hence, results should be interpreted with caution until replication studies are conducted that verify the classroom-level effects observed in this study.

This study found links between teachers' mindset and classroom practices; yet, it is important to replicate our findings within a more diverse teacher sample. For example, youth tend to have better engagement and performance when their teacher is of the same ethnicity-race (Rasheed et al., 2020; Redding, 2019), thus positioning cultural background as an important consideration when understanding student responses to teachers' ability mindsets and instructional practices. This consideration may be especially important given racial stereotypes in STEM learning where students from marginalized racial groups may be socialized into a fixed mindset (Wang et al., 2022). Researchers should also explore whether and how individual student characteristics (e.g., students' ability mindset or perceived teacher-student relationship)

influence or are influenced by teacher ability mindset and classroom practices. For instance, growth-oriented practices may be more effective in classrooms characterized by positive relationships between students and their peers and teachers. In addition, scholars should consider controlling for student mindset beliefs to isolate the variance in student well-being associated with teacher mindset beliefs and practices.

While we examined both teacher- and student-reports of teacher mindset, we only examined students' reports of growth-oriented practices. While students' (vs. teachers') subjective interpretation of classroom practices are arguably more important due to their stronger link to student outcomes (Bardach et al., 2021; Bardach & Klassen, 2021; Stroet et al., 2013), future studies should query teachers directly about their pedagogical approaches. Observations may provide an alternative way to assess classroom practices (Bardach & Klassen, 2021; Trzesniewski et al., 2021); however, this approach may still not adequately capture teachers' average practices and behaviors when delivering lessons. A potential line of future research would be to compare how teacher-report, observational assessments, and student-reports of classroom practices converge and differentially relate to teachers' ability mindset. For instance, future studies could examine these multi-informant perspectives in the same model or conduct cognitive interviews to investigate whether the messages teachers think they are conveying to their students are interpreted by students as intended. Finally, qualitative inquiry may help explain how students interpret and respond to messages about intellect and ability within their classroom.

Conclusion

Research that examines the predictors of student well-being is crucial, as student well-being significantly influences adolescents' academic performance and developmental trajectories

related to identity (Eccles, 2009; Velez & Spencer, 2018), self-regulation (Eisenberg et al., 2007; Saarni et al., 2007), and social competence (Kiuru et al., 2020; Rudolph, 2010). Addressing this issue is not only a developmental and educational concern but also a societal one, as it impacts the future well-being of communities and nations. In response, this study identified instructional practices as a mechanism through which teachers' ability mindsets are associated with student well-being: When students reported that their teacher had a strong growth mindset, they experienced more growth-oriented practices in their classroom, which in turn were associated with better learning engagement, emotional well-being, and social connectedness. Understanding the factors that contribute to well-being, as well as the challenges that may hinder it, allows educators, policymakers, and parents to provide effective support systems and interventions.

Our findings also have clear implications for future mindset research and interventions. Teacher preparatory programs and in-service teacher trainings may need to evolve beyond informational sessions about the benefits of growth mindset so that they focus more on operationalizing growth mindset beliefs within daily instructional practices and student interactions. By explicitly directing teachers to implement practices that communicate a growth mindset, we stand to better scaffold adolescent students' well-being in math classrooms. Moving forward, education researchers may find that attending to individual- and classroom-level differences within data helps to disentangle the mechanisms through which teacher mindset translates into student outcomes. In doing so, we stand to bring clarity to the current body of mindset work by establishing which mindset interventions work for whom and which classroom characteristics are most likely to support student well-being.

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Figure 1.

Student Report of Teacher Mindsets Predicting Student Well-Being

1-1-1 Multilevel Mediation Model

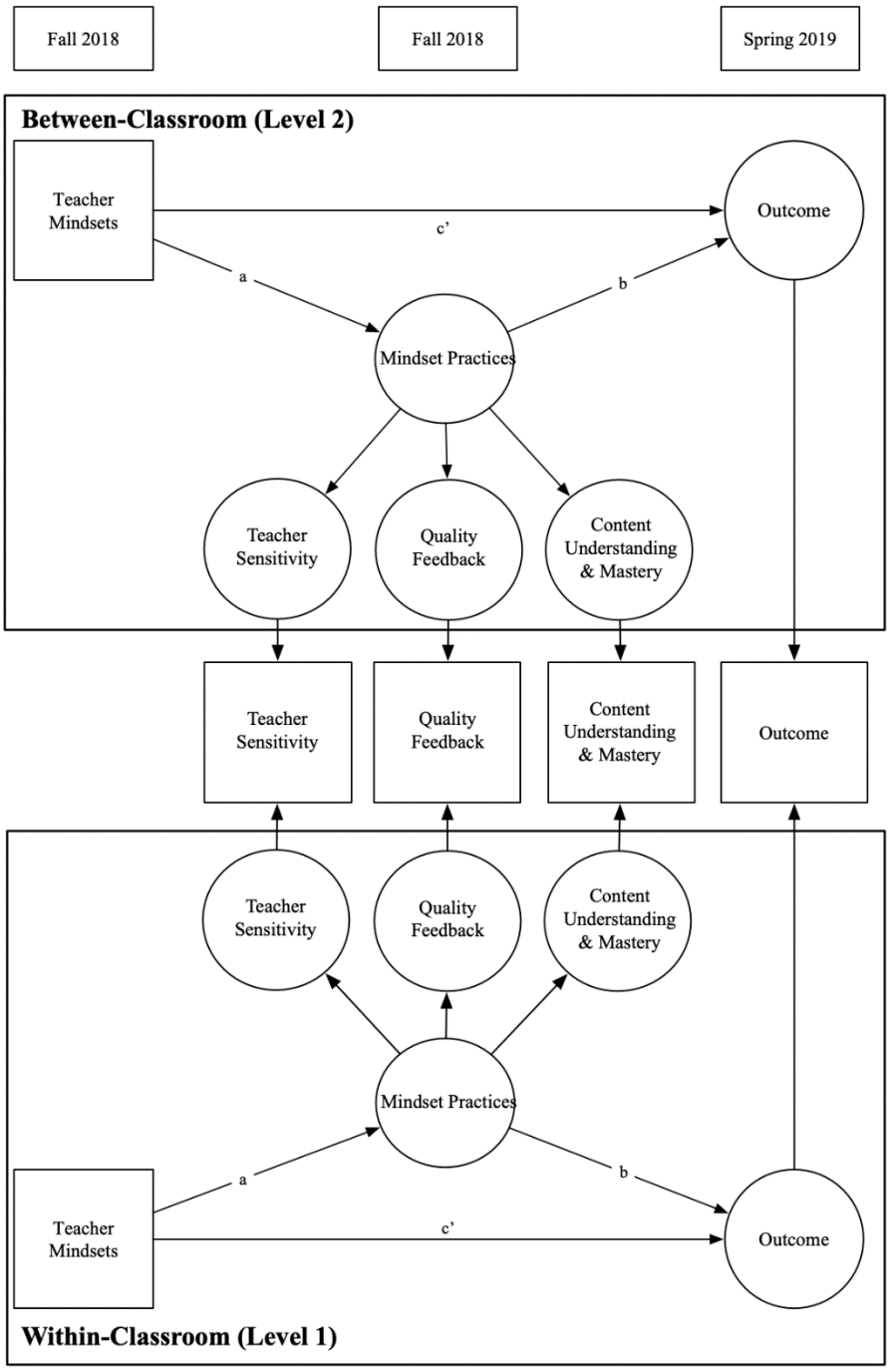

Figure 2.

Teacher Report of Teacher Mindsets Predicting Student Well-Being

2-1-1 Multilevel Mediation Model

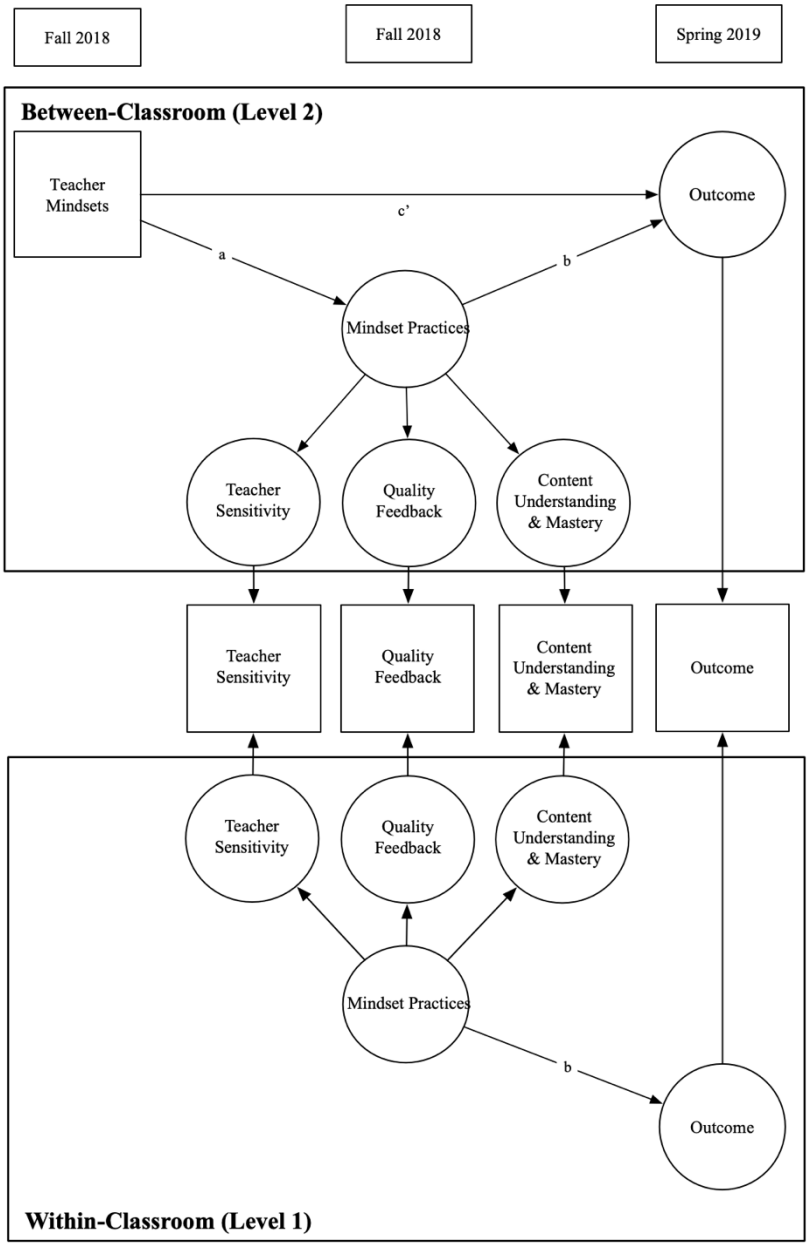

Table 1

Descriptive Statistics and Correlations for Within Classroom (Level 1) Variables

	M	SD	1a	1b	2	3	4	5	6	7	8	9	10	11	12
1a. Teacher Mindsets Std rpt	3.69	0.9													
1b. Teacher Mindsets Tch rpt	2.18	0.7	.04												
2. Teacher Sensitivity	3.81	1.03	.36***	.03											
3. Quality Feedback	3.73	1.01	.36***	-.03	.70***										
4. Content Mastery	3.65	0.93	.29***	-.01	.59***	.69***									
5. Learning Engagement	3.69	0.94	.29***	.04	.39***	.36***	.36***								
6. Emotional Well-Being	3.00	1.15	.18***	-.02	.43***	.35***	.37***	.57***							
7. Social Connectedness	3.25	0.98	.22***	-.01	.34***	.35***	.34***	.53***	.47***						
8. Boys = 1	0.51		-.11***	-.03	-.04*	-.03	-.03	-.07**	.06**	-.03					
9. White Students = 1	0.60		.12***	.04	.19***	.16***	.09***	.12***	.01	.10***	-.04				
10. Non-Black or White Students = 1	0.35		.02	.04	.02	.04	-.02	-.01	-.05	-.03	-.06*	NA			
11. Free Lunch = 1	0.63		-.10***	.02	-.14***	-.13***	-.09***	-.14***	-.04*	-.14***	.00	-.45***	-.13***		
12. Survey Version 2 = 1	0.49		-.04	.03	-.04	-.07	-.05	.00	-.06	-.06	-.08*	.06	.07	-.02	
13. Prior Year math achievement	2.99	0.76	.26***	.08**	.25***	.21***	.17***	.36***	.13***	.20***	-.21***	.41***	.20***	-.33***	.12**

Note. M = Mean. *SD* = Standard Deviation. All variables followed by = 1 were dummy coded. Girls = 0, Black Students = 0, Paid Lunch = 0, and Dataset A Survey Order Version 1 = 0. Pearson correlations were used for continuous variables. Point-Biserial Correlation Coefficients were used for dichotomous variables. Correlations with two dichotomous variables should be interpreted with caution. For student racial group membership, only the two groups being compared were kept for each created variable; these dichotomous variables differ from the dummy codes used in the MSEM analyses (e.g., the dummy code of White Students compared with all other students would be less meaningful than the dichotomous variables used in this table, signifying White Students were only compared with Black Students).

* $p < .05$, ** $p < .01$, *** $p < .001$.

Table 2

Descriptive Statistics and Correlations for Between Classroom (Level 2) Variables

	M	SD	1a	1b	2	3	4	5	6	7	8	9	10	11	12	13
1a. Teacher Mindsets Std rpt	3.60	0.49														
1b. Teacher Mindsets Tch rpt	2.12	0.71	.04													
2. Teacher Sensitivity	3.76	0.57	.50***	.07												
3. Quality Feedback	3.68	0.52	.46***	-.03	.82***											
4. Content Mastery	3.63	0.43	.35***	.05	.73***	.81***										
5. Avg. Learning Engagement	3.65	0.45	.29***	.13	.40***	.39***	.39***									
6. Avg. Emotional Well-Being	2.98	0.57	.20**	.05	.53***	.46***	.51***	.51***								
7. Avg. Social Connectedness	3.24	0.41	.31***	-.03	.49***	.45***	.44***	.56***	.56***							
8. Teacher Gender: Man = 1	0.59	__	.05	-.04	.04	.06	.09	.15	.06	.03						
9. Study = 1	0.78	__	-.05	-.05	.12	.04	.09	.03	-.04	.18*	-.08					
10. Remedial Course = 1	0.38	__	-.64***	-.32	-.30*	-.18	-.20	-.45**	-.05	-.26	-.42*	.28				
11. Regular Course = 1	0.76	__	-.42***	-.35**	-.16	0.00	-.10	-.18	-.13	-.27**	.08	-.05	NA			
12. Mixed Level Course = 1	0.69	__	-.38***	-.11	-.20	-.11	-.07	-.15	-.04	-.18	-.05	-.11	NA	NA		
13. Teacher Graduate Degree = 1	1.65	__	.14	.13	.17	.07	.02	.25**	.08	.22*	-.43***	.12	-.32	-.13	-.11	
14. Teacher Yrs. of Experience	14.87	7.67	-.11	.52***	-.05	-.04	.06	.08	-.04	-.03	-.07	.11	-.39*	-.13	.04	0.18*

Note. M = Mean. *SD* = Standard Deviation. All variables followed by = 1 were dummy coded. Study 1 = 0, Advanced Course Difficulty = 0, and Teachers with a Bachelors Degree = 0. Pearson correlations were used for continuous variables. Point-Biserial Correlation Coefficients (as special case of Pearson's correlation) were used with dichotomous variables. Correlations with two dichotomous variables should be interpreted with caution. For course difficulty level and race, only the two groups being compared were kept for each created variable, these dichotomous variables differ from the dummy codes used in the MSEM analyses (e.g., the dummy code of Regular Courses compared with all other courses would be less meaningful than the dichotomous variables used in this table, signifying Regular Courses were compared only with Advanced Courses. There were 17 Remedial Courses, 89 Regular Courses, 28 Advanced Courses, and 61 courses designated for Students with Mixed Ability Levels.

* $p < .05$, ** $p < .01$, *** $p < .001$.

Table 3.
Student Reported Teacher Mindsets Predicting Well-being Outcomes (No Mediators)

	Model 1: Learning Engagement b (S.E.)	Model 2: Emotional Well-Being b (S.E.)	Model 3: Social Connectedness b (S.E.)
Direct Effects			
Within Classrooms			
Boys = 1	-0.01 (.03)	0.12 (.06)*	0.04 (.04)
White Students = 1	0.02 (.06)	-0.07 (.06)	0.07 (.07)
Non-Black or White Students = 1	-0.11 (.05)*	-0.11 (.05)*	-0.09 (.05)*
Free Lunch = 1	-0.09 (.03)**	-0.04 (.06)	-0.13 (.05)**
Survey Version 2 = 1	0.04 (.03)	0.00 (.01)	-0.03 (.04)
Prior Yr. Outcome	0.40 (.03)***	0.42 (.04)***	0.42 (.03)***
Prior Yr. Math Grade	0.22 (.04)***	0.11 (.09)	0.12 (.07)
Grade (6th to 12th)	-0.03 (.04)	0.00 (.03)	0.00 (.02)
Teacher Mindsets Student Rpt.	0.16 (.04)***	0.17 (.02)***	0.15 (.02)***
Between Classrooms			
Study = 1	-0.01 (.14)	-0.09 (.17)	0.09 (.07)
Remedial Course = 1	0.17 (.12)	0.45 (.33)	0.12 (.1)
Regular Course = 1	0.19 (.13)	0.26 (.23)	0.08 (.07)
Mixed Level Course = 1	0.26 (.14)	0.35 (.21)	0.18 (.07)**
Teacher MA/MS Degree = 1	0.00 (.07)	0.00 (.04)	0.01 (.06)
Teacher Experience	0.01 (.01)	0.00 (.01)	0.00 (.01)
Teacher Mindsets Student Rpt.	1.02 (.21)***	0.82 (.35)*	0.63 (.15)***

Note. b = unstandardized coefficient. *S.E.* = standard error. Prior Yr. Outcome represents the autoregressive path for each of the three well-being outcomes. All variables followed by = 1 were dummy coded. For the Within Classroom variables, Girls = 0, Black Students = 0, Paid Lunch = 0, and Survey Version 1 = 0. For the Between Classroom variables, Study 1 = 0, Advanced Course Difficulty = 0, and Teachers with a Bachelor's Degree = 0.
$p < .05$, ** $p < .01$, *** $p < .001$.

Table 4.

Student-Reported Teacher Mindsets Predicting Well-being Outcomes Through Mindset Practices as Mediators

	Model 1: Learning Engagement		Model 2: Emotional Well-Being		Model 3: Social Connectedness	
	Mindset Practices b (S.E.)	Learning Engagement b (S.E.)	Mindset Practices b (S.E.)	Emotional Well-Being b (S.E.)	Mindset Practices b (S.E.)	Social Connectedness b (S.E.)
Direct Effects						
Within Classrooms						
Boys = 1	0.01 (.03)	-0.02 (.03)	0.00 (.03)	0.13 (.06)*	0.03 (.02)	0.02 (.03)
White Students = 1	0.02 (.04)	0.00 (.05)	0.03 (.03)	-0.10 (.05)*	0.04 (.03)	0.03 (.06)
Non-Black or White Students = 1	-0.01 (.05)	-0.11 (.04)**	-0.01 (.05)	-0.10 (.05)	-0.01 (.05)	-0.09 (.05)*
Free Lunch = 1	-0.07 (.05)	-0.07 (.02)**	-0.07 (.04)	0.00 (.04)	-0.06 (.04)	-0.12 (.03)**
Survey Version 2 = 1	-0.07 (.04)	0.05 (.05)	-0.05 (.04)	0.01 (.01)	-0.07 (.04)	-0.03 (.03)
Prior Yr. Outcome	0.16 (.03)***	0.33 (.03)***	0.14 (.03)***	0.34 (.03)***	0.18 (.03)***	0.35 (.03)***
Prior Yr. Math Grade	0.03 (.04)	0.22 (.03)***	0.08 (.04)*	0.08 (.07)	0.09 (.04)*	0.09 (.06)
Grade (6th to 12th)	0.03 (.02)	-0.05 (.03)	0.03 (.02)	0.00 (.03)	0.02 (.02)	-0.02 (.02)
Teacher Mindsets Student Rpt.	0.26 (.02)***	0.05 (.04)	0.27 (.02)***	0.00 (.02)	0.26 (.02)***	0.03 (.02)
Mindset Practices		0.38 (.04)***		0.53 (.05)***		0.38 (.03)***
Between Classrooms						
Study = 1	-0.05 (.14)	0.01 (.10)	-0.05 (.14)	-0.06 (.09)	-0.05 (.14)	0.11 (.05)*
Remedial Course = 1	0.40 (.12)**	0.06 (.19)	0.39 (.12)**	-0.02 (.29)	0.39 (.11)**	0.04 (.12)
Regular Course = 1	0.39 (.09)***	0.09 (.21)	0.37 (.09)***	-0.13 (.22)	0.39 (.09)***	0.02 (.09)
Mixed Level Course = 1	0.31 (.12)**	0.17 (.20)	0.29 (.11)**	0.01 (.19)	0.30 (.11)**	0.11 (.06)
Teacher MA/MS Degree = 1	-0.06 (.06)	0.01 (.09)	-0.06 (.06)	0.05 (.04)	-0.06 (.06)	0.01 (.06)
Teacher Experience	0.00 (.01)	0.01 (.01)	0.01 (.01)	-0.01 (.01)	0.01 (.01)	0.00 (.01)
Teacher Mindsets Student Rpt.	1.05 (.21)***	0.79 (.52)	1.00 (.17)***	-0.25 (.37)	1.01 (.19)***	0.51 (.25)*
Mindset Practices		0.30 (.35)		1.15 (.25)***		0.22 (.13)
Indirect Effects						
Within		0.10 (.01)***		0.15 (.02)***		0.10 (.01)***
Between		0.31 (.33)		1.15 (.23)***		0.22 (.13)
Total Effects						
Within		0.15 (.04)***		0.15 (.02)***		0.13 (.02)***
Between		1.10 (.24)***		0.90 (.38)*		0.72 (.16)***

Note. b represents unstandardized coefficient. S.E. represents standard error. Prior Yr. Outcome represents the autoregressive path for each of the three well-being outcomes. All variables followed by = 1 were dummy coded. For the Within Classroom variables, Girls = 0, Black Students = 0, Paid Lunch = 0, and Survey Version 1 = 0. For the Between Classroom variables, Study 1 = 0, Advanced Course Difficulty = 0, and Teachers with a Bachelors Degree = 0.

$p < .05$, ** $p < .01$, *** $p < .001$.

Table 5.
Teachers' Self-Reported Mindsets Predicting Well-being Outcomes (No Mediators)

	Model 1: Learning Engagement b (S.E.)	Model 2: Emotional Well-being b (S.E.)	Model 3: Social Connectedness b (S.E.)
Direct Effects			
Within Classrooms			
Boys = 1	-0.04 (.04)	0.10 (.05)	0.01 (.03)
White Students = 1	0.03 (.06)	-0.04 (.06)	0.09 (.08)
Non-Black or White Students = 1	-0.12 (.05)*	-0.11 (.05)*	-0.09 (.05)
Free Lunch = 1	-0.11 (.03)***	-0.07 (.06)	-0.15 (.05)**
Survey Version 2 = 1	0.01 (.04)	-0.02 (.01)***	-0.05 (.04)
Prior Yr. Outcome	0.41 (.04)***	0.42 (.04)***	0.43 (.03)***
Prior Yr. Math Grade	0.25 (.05)***	0.15 (.09)	0.15 (.07)*
Grade (6th to 12th)	-0.03 (.04)	0.00 (.03)	0.00 (.03)
Between Classrooms			
Study = 1	0.10 (.22)	-0.03 (.18)	0.13 (.12)
Remedial Course = 1	-0.35 (.14)*	0.01 (.19)	-0.21 (.1)*
Regular Course = 1	-0.18 (.11)	-0.06 (.11)	-0.19 (.09)*
Mixed Level Course = 1	-0.04 (.10)	0.09 (.13)	-0.03 (.07)
Teacher MA/MS Degree = 1	0.09 (.07)	0.05 (.08)	0.07 (.03)*
Teacher Experience	-0.01 (.01)	-0.01 (.01)	0.00 (.01)
Teacher Mindsets Teacher Rpt.	-0.05 (.07)	-0.02 (.06)	0.05 (.06)

Note. b = unstandardized coefficient. *S.E.* = standard error. Prior Yr. Outcome represents the autoregressive path for each of the three well-being outcomes. All variables followed by = 1 were dummy coded. For the Within Classroom variables, Girls = 0, Black Students = 0, Paid Lunch = 0, and Survey Version 1 = 0. For the Between Classroom variables, Study 1 = 0, Advanced Course Difficulty = 0, and Teachers with a Bachelors Degree = 0.
$p < .05$, ** $p < .01$, *** $p < .001$.

Table 6.
Teachers' Self-Reported Mindsets Predicting Subjective Well-being Outcomes Through Mindset Practices as Mediators

	Model 1: Learning Engagement		Model 2: Emotional Well-Being		Model 3: Social Connectedness	
	Mindset Practices b (S.E.)	Learning Engagement b (S.E.)	Mindset Practices b (S.E.)	Emotional Well-Being b (S.E.)	Mindset Practices b (S.E.)	Social Connectedness b (S.E.)
Direct Effects						
Within Classrooms						
Boys = 1	-0.04 (.03)	-0.02 (.04)	-0.05 (.03)	0.13 (.06)*	-0.02 (.03)	0.02 (.03)
White Students = 1	0.04 (.04)	0.00 (.05)	0.05 (.04)	-0.10 (.05)	0.07 (.03)*	0.03 (.06)
Non-Black or White Students = 1	-0.02 (.05)	-0.11 (.04)**	-0.02 (.05)	-0.10 (.05)*	-0.02 (.05)	-0.09 (.05)
Free Lunch = 1	-0.10 (.04)**	-0.07 (.02)**	-0.11 (.04)***	0.00 (.04)	-0.09 (.04)*	-0.12 (.04)**
Survey Version 2 = 1	-0.11 (.04)**	0.04 (.05)	-0.09 (.04)*	0.01 (.01)	-0.10 (.04)*	-0.03 (.03)
Prior Yr. Outcome	0.18 (.02)***	0.33 (.03)***	0.14 (.03)***	0.34 (.03)***	0.20 (.03)***	0.35 (.03)***
Prior Yr. Math Grade	0.08 (.05)	0.23 (.03)***	0.14 (.05)**	0.08 (.07)	0.14 (.05)**	0.10 (.05)
Grade (6th to 12th)	0.01 (.02)	-0.04 (.03)	0.01 (.02)	0.00 (.03)	0.01 (.02)	-0.02 (.02)
Mindset Practices		0.40 (.03)***		0.53 (.05)***		0.40 (.02)***
Between Classrooms						
Study = 1	0.08 (.18)	0.06 (.13)	0.07 (.18)	-0.09 (.07)	0.07 (.17)	0.13 (.07)
Remedial Course = 1	-0.15 (.11)	-0.30 (.11)**	-0.15 (.11)	0.09 (.15)	-0.16 (.10)	-0.19 (.07)**
Regular Course = 1	0.00 (.06)	-0.19 (.10)	-0.01 (.06)	-0.05 (.11)	0.00 (.06)	-0.20 (.08)*
Mixed Level Course = 1	-0.01 (.05)	-0.06 (.09)	-0.02 (.06)	0.08 (.10)	-0.01 (.05)	-0.06 (.06)
Teacher Advanced Degree = 1	0.02 (.10)	0.06 (.07)	0.01 (.09)	0.04 (.04)	0.02 (.10)	0.05 (.04)
Teacher Yrs. Of Experience	-0.01 (.01)	0.00 (.01)	-0.01 (.01)	0.00 (.01)	-0.01 (.01)	0.00 (.00)
Teacher Mindsets Teacher Rpt.	-0.04 (.08)	-0.03 (.05)	-0.05 (.08)	0.03 (.04)	-0.04 (.07)	0.05 (.04)
Mindset Practices		0.72 (.13)***		1.03 (.18)***		0.50 (.04)***
Indirect & Total Effects						
Indirect Effects Between		-0.03 (.05)		-0.06 (.07)		-0.02 (.04)
Total Effects Between		-0.06 (.07)		-0.03 (.07)		0.03 (.07)

Note. *b* = unstandardized coefficient. *S.E.* = standard error. Prior Yr. Outcome represents the autoregressive path for each of the three well-being outcomes. All variables followed by = 1 were dummy coded. For the Within Classroom variables, Girls = 0, Black Students = 0, Paid Lunch = 0, and Survey Version 1 = 0. For the Between Classroom variables, Study 1 = 0, Advanced Course Difficulty = 0, and Teachers with a Bachelors Degree = 0.
$p < .05$, ** $p < .01$, *** $p < .001$.