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Teacher Beliefs and Student Learning

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Abstract
Bringing together research from several lines of inquiry in psychology and education, we propose a conceptual model for understanding how entrenched inequalities embedded within ecological macrosystems play out in the classroom to affect student learning. We consider how implicit teacher beliefs and belief expressions affect teacher-student interactions and relationships, student learning-related processes, and student learning outcomes. First, we review the literature on how teacher beliefs relate to student learning outcomes. Second, we discuss how teacher beliefs may shape critical classroom-level and individual-level teacher-student interactions and how these interactions can affect student factors that are critical to learning. The *Teacher Beliefs and Interactions Model,* a conceptual model that brings together related bodies of work that have traditionally been separate, proposes teacher beliefs as an important area of inquiry for future empirical research in education and human development.

Teacher Beliefs and Student Learning

Teachers are the most influential factor in student learning within an academic year, and their effects on children's life trajectories can be detected into adulthood (Chetty et al., 2014; Rivkin et al., 2005). As such, many interventions in both high- and low-income countries seeking to improve children's learning outcomes leverage teachers (e.g., through teacher professional development). Despite investments, learning inequalities persist. In the United States, achievement gaps based on race and socioeconomic status (SES) have widened (National Center on Education and the Economy, 2020; National Center for Education Statistics, 2019a). Extensive research has been conducted to better understand the gap between investments, teacher practice, and equitable learning outcomes; however, few studies draw connections or define the mechanisms between teacher beliefs and individual student outcomes.

In this paper, we bring together several lines of inquiry from psychology and education to propose a conceptual model for understanding how larger sociocultural systems play out in classroom-level processes via teacher beliefs, ultimately contributing to persistent achievement gaps. Our aim is to get inside the "black box" of teacher

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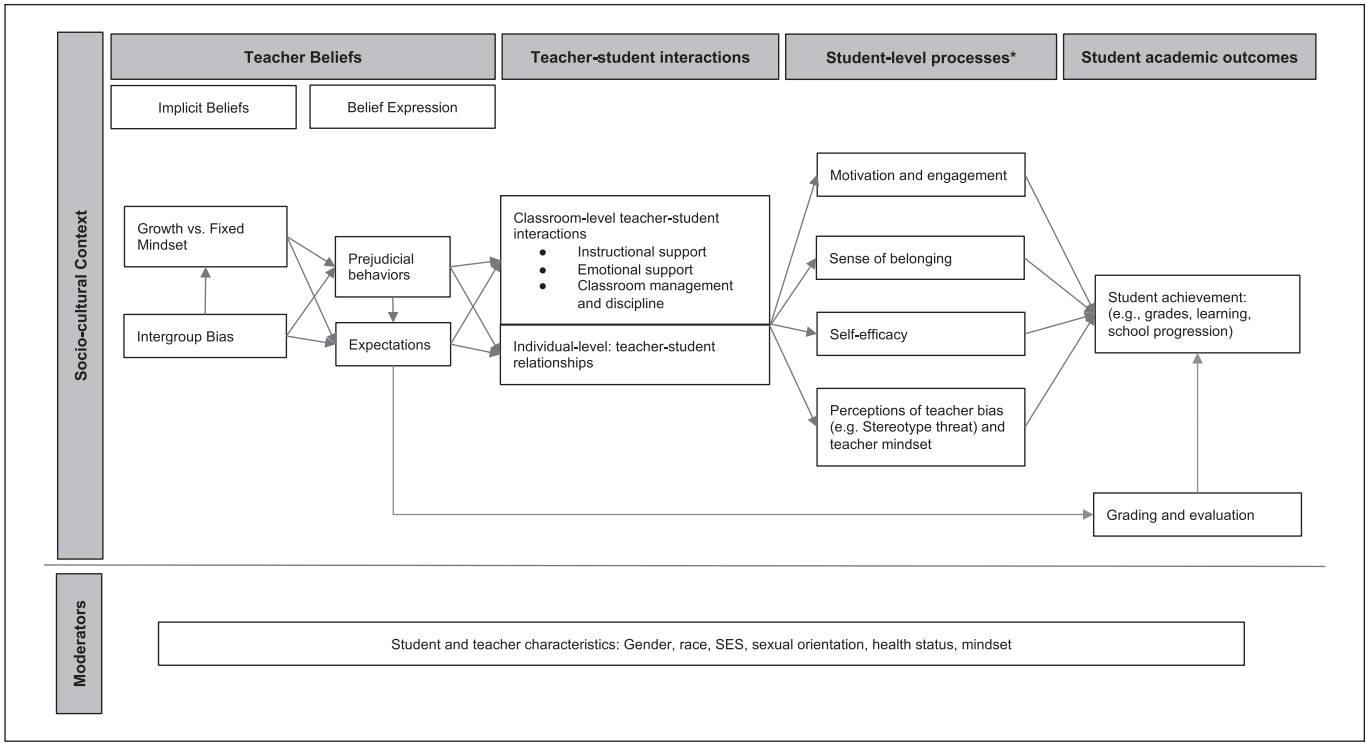

Fig. 1. Teacher Beliefs and Interactions Model: A conceptual model of how teachers' implicit and explicit beliefs affect student achievement through teacher-student interactions and relationships and student learning-related processes.

effectiveness by pointing to the processes through which teacher beliefs may lead to variation in teachers' daily emotional and instructional interactions with their students and affect teacher-student relationships. Our model details the pathways through which teacher beliefs may lead to cascading effects on classroom interactions and key student processes central to positive learning outcomes. We call attention to the concept of teacher beliefs as an important issue related to student learning that can inform efforts to support teachers' professional development and improve children's educational experiences.

We first describe our conceptualization of teacher beliefs as including both implicit beliefs and belief expression, which develop within sociocultural systems. Second, we review literature linking teacher beliefs to student learning outcomes. Third, we draw on the Teaching through Interactions model (Hamre et al., 2013) to investigate how teacher beliefs may shape both classroom-level and individual-level teacher-student interactions, how these interactions are affected by teacher beliefs, and how they may ultimately impact student processes critical for learning. Lastly, we bring together these lines of work to present a new conceptual model that we call the *Teacher Beliefs and Interactions Model* (see Fig. 1). The conceptual model sheds light on how teacher beliefs can shape several aspects of students' educational experiences and lays out several new areas for research. The model is intended to be applicable globally; while the vast majority of research we review has been conducted in the US context, we make connections to the educational contexts of children in low- and middle-income countries (LMICs) wherever possible. Lastly, we propose future research directions based on our analysis of the evidence.

Teacher Beliefs within a Macrosystem

An ecological perspective of human development focuses on how ecological and sociocultural systems shape individual development (Bronfenbrenner, 1979). In this framework, beliefs are formed by an individual's experience within surrounding ecologies in tandem with the cognitive processes used to simplify and organize information, also called cognitive heuristics (West et al., 2008).

Beliefs can be both implicit (e.g., unconscious) and explicit (e.g., conscious). Given that beliefs do not always translate into behaviors, we separate implicit beliefs from belief expression. We focus on two implicit beliefs and two forms of belief expression that may explain the connection between teachers' beliefs, classroom interactions, and differential student learning outcomes based on the evidence to date.

The first implicit belief we highlight is intergroup bias, the product of the cognitive operation of social categorization wherein individuals group themselves and others based on social groups such as gender, race, age, religion, and a multitude of other often overlapping characteristics (Allport, 1954; Dunham et al., 2008). Cultural contexts are embedded within long histories of marginalization and disenfranchisement of specific social groups, resulting in unconscious stereotyping. Starting in early childhood, humans show an implicit preference for like-groups and out-groups with an early recognition of the relative and culturally determined status of one's own social group vis-à-vis others (Dunham et al., 2008; Hewstone et al., 2002).

The limited evidence on how teachers perceive and interact with groups historically denied power, and how these perceptions and interactions may impact student learning, has largely been generated in the USA and other W.E.I.R.D countries (Western, Educated, Industrialized, Rich Democracies; Henrich et al., 2010), though the issues are relevant globally and we include studies conducted in LMICs when possible. The USA and Europe have a history of denying "out-groups," often minorities, access to political and economic power, education, and basic rights – creating both real and perceived group differences (Gillborn, 2006; Rothstein, 2017; Silverstein, 2005; Wilkerson, 2020). Out-groups are not unique to Western contexts and in some contexts out-groups may be the majority. In postcolonial LMICs, social groups were subjected to "divide and rule" strategies wherein colonizers politicized, weaponized, exacerbated, or artificially created differences to encourage fragmentation as well as to establish hierarchical structures of governance (Blanton et al., 2001; Engerman & Sokoloff, 2005; Nagel, 1994). These historical and current imbalances, both in the USA and globally, are an ever-present part of the macrosystems in which children and teachers develop.

The second implicit belief is growth mindset, which we conceptualize as a lay theory about malleability (Dweck, 1999; Plaks et al., 2009), is the belief that intelligence is not fixed and can be improved (or taught) with effort. Adopting a growth mindset can improve students' academic outcomes (Yeager et al., 2019), and it has been posited that teachers can create "growth mindset cultures" in their classroom through a set of practices and interactions with students (Murphy et al., 2021). While most of the research on growth mindsets has focused on intelligence, mindsets can also be extended to social domains wherein one can perceive characteristics as fixed or cultivatable (e.g., being a bad person, a winner, or a bully; Dweck & Yeager, 2019). Group stereotypes can affect mindsets where an individual can have a growth mindset toward certain individuals or types of characteristics and a fixed mindset for others (Rattan & Georgeac, 2017). Sociocultural contexts have been shown to influence the development of growth versus fixed mindset. For example, (Rattan et al., 2012) found that Indians and Americans had different mindsets for different characteristics; Indians were more likely than Americans to believe that anyone could become highly intelligent but were not more likely to believe that anyone could become an athlete.

These implicit beliefs form the foundation for expressed beliefs or beliefs that translate to behavior. Specifically, the expressed beliefs of prejudicial behavior and teacher expectations can mediate the link between implicit beliefs and differentiated student outcomes, including prejudicial behavior and expectations of students. We refer to implicit beliefs and belief expressions that lead to differential behavior based on group differences as "teacher bias." Importantly, we do not posit that teachers are somehow more likely to have their biased beliefs shaped by historical legacies of power imbalances than anyone else. Our examination of teacher beliefs is predicated on a model that everyone, regardless of their profession, is influenced by the larger systems in which they develop. We draw attention to teacher beliefs to better understand their role in shaping the classroom and student-level processes that result in differentiated learning outcomes.

Teacher Bias and Student Learning Outcomes

Studies drawing on diverse disciplinary perspectives and methods have documented links between teacher bias with student learning outcomes. In this section, we summarize illustrative findings highlighting this direct link, grouping studies by implicit beliefs and belief expression.

Intergroup Bias

Our review of the literature linking teacher intergroup bias to student learning explores several social

groups that have been extensively studied: race, gender, SES, and sexual orientation. We recognize that this is not a comprehensive list of historically and currently marginalized groups, as well as the intersectional and complex nature of identity. Research exploring teacher bias based on student ethnicity, for example, is extensive and includes a combination of race, religion, language, nationality, and family immigration status. We focus on a small set of historically marginalized groups not to provide an exhaustive review but to explore the mechanisms through which teacher bias has been documented to affect students.

Race

Inequitable student achievement based on race is well-documented on a variety of metrics (National Center for Education Statistics, 2022; National Center for Education Statistics, 2019b). The role that teacher bias plays in achievement gaps is also studied, including four quantitative meta-analyses that provided evidence of statistically significant differences in teacher expectations and speech based on race (Tenenbaum & Ruck, 2007). Given that the manifestation of racial bias can be subtle and difficult to observe, researchers often use "matching" as a proxy measure of bias. Matching sees if students of the same race as their teachers perform better in school. Students with teachers of the same race have been shown to have better academic (Dee, 2004; Redding, 2019) and nonacademic outcomes (Gershenson et al., 2022; Gottfried et al., 2021; Scherer et al., 2021). These findings are supported by experimental evidence from Tennessee where students randomly assigned to teachers of the same race had significantly better academic achievement, graduation rates, and college enrollment rates (Dee, 2004; Gershenson et al., 2022), with teacher expectations of students being one hypothesized mechanism. An earlier longitudinal study found that same-race and same-gender teachers did not predict children's abilities when assessed but did predict how teachers evaluated students (Ehrenberg et al., 1995). Prejudicial grading, therefore, may be another mechanism through which bias manifests in the classroom.

Two similar studies were conducted in the LMIC context of India. Hanna and Linden (2012) conducted an experiment where teachers graded exams completed by hypothetical students with randomly assigned characteristics (gender and caste). They found that teachers graded lower caste students more harshly. Rawal and Kingdon (2010) used the same matching methodology and determined that children did better in school when their teacher was the same gender, caste, and religion as them, hypothesizing that classroom interactions and/or role models drove those associations.

Gender

Another out-group that has historically been denied access to resources and power is women and girls. While the gender achievement gap in school-aged reading and math scores has largely closed (National Center for Education Statistics, 2022), gender gaps remain in STEM fields and ample research focuses on women in STEM. Evidence of teacher bias shows that teachers perceive girls as less mathematically capable than boys (Riegle-Crumb & Humphries, 2012; Tiedemann, 2002; Walkerdine, 1998) and teachers have lower expectations for girls in math (McKown & Weinstein, 2008). Girls who had more gender-biased teachers in primary school did worse in secondary school and were less likely to enroll in STEM courses than girls whose early teachers were less biased (Lavy & Sand, 2018). Sansone (2017) found that gender matching between teachers and students did impact girls' learning outcomes via their self-efficacy, but the effects became insignificant when teachers' behaviors and beliefs were taken into consideration.

In LMIC contexts, Lee et al. (2019) used the matching methodology across nine francophone African countries and found that matches between female teachers and female students led to better math and reading performance for girls despite the pervasiveness of gender stereotypes among both male and female teachers. In Turkey, Alan et al. (2018) found that girls do not perform as well when teachers have more traditional gender views. However, most of the research in LMICs examining gender bias within education has focused on girls' access to education (Tuwor & Sossou, 2008), not their learning outcomes.

Socioeconomic Status

Economic disadvantage is associated with ongoing and historical inequitable distribution of resources and opportunity based on group status, making the effects of teacher bias based on out-group statuses and SES difficult to disentangle. Additionally, these biases can be intersectional and, therefore, have compounded effects on student learning. That said, some research teases out the effects of SES by controlling for race, immigration status, religion, gender, and other characteristics. In one experimental study using vignettes, where student characteristics were randomly assigned, Auwarter and Aruguete (2008) found that teachers reported low-SES students to

have less promising futures overall, but especially low-SES boys. In a longitudinal study, Alvidrez and Weinstein (1999) found that teachers perceived children of lower SES as less intelligent than high-SES students, despite when IQ tests showed that they were not. In addition, when preschool teachers erroneously assumed higher intelligence about certain students, this predicted higher GPAs and SAT scores for children 14 years later, even after controlling for SES (Alvidrez & Weinstein, 1999). This finding shows that even the earliest prejudicial misconceptions can have long-term impacts on children's educational trajectories. In a qualitative study by Warren (2002), teachers reported not only having lower expectations for economically disadvantaged students but also feeling there was little they could do to support them. The association between student SES and teacher expectations was also replicated across nine LMICs through teacher surveys (Sabarwal et al., 2022).

Sexual Orientation

Victimization of lesbian, gay, bisexual, transgender, and queer (LGBTQ) students in school settings has been shown to negatively influence their academic outcomes (Aragon et al., 2014; Robinson & Espelage, 2011). Kosciw et al. (2013) used structural equation modeling to show that school climate with high levels of victimization of LGBTQ youth was associated with lower academic outcomes and lower self-esteem for LGBTQ students. The study and others also showed the power of safe school policies, supportive teachers and school personnel, and gay-straight alliance clubs in moderating the effects of discrimination (e.g., Poteat et al., 2022). In certain states, a teacher's ability to be a protective force in LGBTQ children's lives can be impeded by "no promo homo" laws, which restrict what a teacher is legally allowed to say about homosexuality in schools (Thoreson, 2016).

LGBTQ discrimination and violence are pervasive across LMICs, with 69 LMICs criminalizing same-sex relations (Human Rights Watch, 2022). In some countries, LGBTQ students are expelled for their sexual orientation and experience high levels of violence in schools (Okanlawon, 2021; Quarshie et al., 2020). Examining the role of teacher beliefs in this area across diverse social and policy contexts is needed (Bhana, 2012).

Teacher Mindset

A growth mindset has been well studied in relation to student academic success, and it has been shown to be important to student learning in several studies across different contexts (e.g., Claro et al., 2016; see Yeager & Dweck 2020 for a review). Interventions to improve growth mindset among students have been shown to be especially advantageous for lower performing students (Burnette et al., 2022). While teacher mindset is understudied in relation to student achievement, evidence points to the pivotal role of teachers' mindset beliefs via the importance of classroom culture and school context in sustaining and facilitating students' growth mindset (Dweck & Yeager, 2021; Yeager et al., 2019). Murphy and colleagues (Murphy et al., 2021) describe this "growth mindset culture" as a set of teacher practices and interactions wherein the teacher models instead of teaches growth mindset by infusing it into their way of speaking, classroom routines, and structured classroom interactions. A handful of studies have examined the impact of teacher mindset on student outcomes. Yeager and colleagues (Yeager et al., 2021) found that teachers' growth mindset enhanced the impacts of a mindset-building intervention on low-performing students' math achievement (Yeager et al., 2021). This suggests that teacher mindsets can potentially draw out and strengthen a student's growth mindset.

One potential mechanism through which teacher mindset could lead to differential student outcomes is prejudicial behavior. Significant evidence links fixed mindset to prejudice (Hong et al., 2004; Levy & Dweck, 1999; Rattan & Georgeac, 2017) and conceptualizes mindset as a mediator between unconscious stereotyping, or intergroup bias, and prejudicial behavior (Rattan & Georgeac, 2017). Levy et al. (1998) found that those with fixed and growth mindsets had the same knowledge of stereotypes, but those with fixed mindsets were more likely to believe the stereotype to be true. Relatedly, one experimental study found that those with growth mindsets were more likely to take note of information that contradicted stereotypes and those with fixed mindsets were more likely to remember stereotype-confirming information (Plaks et al., 2001). The moderating power of mindset between implicit intergroup bias and prejudicial behavior among teachers is supported by a study by Canning and colleagues (Canning et al., 2019), which found that teachers who believed that ability is fixed had racial achievement gaps twice as large as teachers with growth mindsets. Teachers with fixed mindsets demotivated students based on an analysis of their course evaluations (Canning et al., 2019), showing that teachers' fixed mindsets can demotivate students and lead to more negative classroom experiences.

In their review of the field, Dweck and Yeager (2019) stated that "the field will need to learn (a) precisely how

to address teachers' mindsets about themselves and their students, (b) which teacher practices feed into and maintain students' fixed and growth mindsets, (c) how to guide and alter the teachers' practices, and (d) how to do so in a way that affects students' perceptions and behaviors and that enhances students' outcomes" (p. 1281). This is a very rich area for future research.

Belief Expression

Teachers' prejudicial behaviors and expectations of students are directly influenced by their mindsets and biases. Although differential expectations are a form of prejudicial behavior, our review of the literature demonstrates that expectations are a key mechanism between teacher beliefs and student learning outcomes; therefore, teachers' expectations of their students deserve exploration as an expressed belief of their own. Importantly, and as described above, several studies linking implicit beliefs to student learning outcomes highlight the role of prejudicial behavior as a key mediating process.

Numerous studies have explored the "Pygmalion effect" in educational settings, showing that students do better when teachers hold high expectations of them (Jussim & Harber, 2005; Rosenthal & Jacobson, 1968). In one review of 35 years of research, Jussim and Harber (2005) showed that teacher expectations exert a greater Pygmalion effect on children who come from more disadvantaged backgrounds, suggesting that perhaps those who receive the lowest expectations need them the most. Teacher expectations begin to exert influence early, as differences in expectations predict achievement gaps as early as the first year of schooling (Gentrup et al., 2020). Indeed, controlling for children's previous achievement, McKown and Weinstein (2008) found that in high-bias classrooms, teacher expectancy effects accounted for an average of 0.29 and up to 0.38 standard deviations of the year-end ethnic achievement gap.

While research on teacher expectations is rare in LMICs, Sabarwal et al. (2022) found that across nine countries, teachers believed it was important to spend more time with students who were performing well than with those who were performing poorly, suggesting that similar processes may be at play in LMIC contexts.

Our review of prejudicial behaviors based on intergroup bias highlighted expectations as the dominant expression of bias. The literature on mindset mirrors that in that teachers with fixed mindsets tend to have lower expectations, which makes sense given that a fixed mindset by definition limits expectations for growth. However, research investigating if teacher mindsets about students' abilities differ by out-group identity is still needed.

Linking Teacher Bias to Teacher-Student Interactions and Relationships and Student Learning Processes

The evidence linking teacher bias and student learning outcomes has not had an explicit focus on mechanisms, though it generally makes a strong case that teacher-student interactions may serve as key mediators linking teachers' beliefs and student outcomes. The evidence suggests that teacher beliefs can undermine learning by also affecting key classroom and student processes central to learning. We aim to connect these processes within the framework of a new conceptual model. Below, we outline three key processes hypothesized to be central to understanding the links between teacher beliefs and student learning: teacher-student interactions at the classroom level, teacher-student relationships at the individual level, and student learning-related processes.

Teacher-Student Interactions

A long-standing theoretical base posits that social settings affect individuals through their daily interactions in those settings (e.g., Tseng & Seidman, 2007), including in classroom settings (Cohen et al., 2003; Pianta & Hamre, 2009). Learning and development thus rests on students' daily experiences with teachers and peers in the classroom (Seidman & Tseng, 2010), and with interactions that are culturally bound (Stigler et al., 2000). We consider two bodies of literature: one focused on observed teacher-student interactions at the classroom level, and a second focused on self-reported teacher-student relationships. Multiple psychological theories explain the effect of positive teacher-student interactions in the classroom that underlie academic success and learning. Attachment theory focuses on the importance of consistent and sensitive interactions with teachers (Ainsworth, 1989); constructivist learning theories focus on the development of cognitive skills through engaging in age-appropriate activities (Gopnik et al., 2001); and Vygotsky's sociocultural theory focuses on how skilled partners can guide and scaffold children's learning of more complex concepts (Kozulin, 1998). Teachers who pro-

vide warm and supportive relationships and learning environments for children and scaffold learning experiences can also foster a positive sense of school membership and academic self-concept for children that can promote greater effort and persistence in school (Furrer & Skinner, 2003).

Classroom Level: Teacher-Student Interaction Quality

The Teaching through Interactions framework focuses specifically on the role of teacher-student interactions and relationships in driving learning (Hamre et al., 2013). These interactions and relationships are thought to have stronger effects in the early years, though the importance of teacher-student interactions has been documented throughout secondary school (Allen et al., 2011). Children in classrooms where teachers display high levels of organization, emotional support, and instructional support tend to show greater average gains in both early academic and social-emotional skills (Burchinal et al., 2011) and more behavioral engagement (Gregory et al., 2014). Two recent rigorous studies in LMICs are worth noting. One is a study by Araujo and colleagues (Araujo et al., 2016), in Ecuador which randomly assigned children to teachers across 204 schools and assessed classroom quality using the CLASS (Pianta et al., 2008). A one standard deviation difference in classroom quality (measured as Responsive Teaching, a combination of organization, emotional support, and instruction support) resulted in an increase of 0.11, 0.11, and 0.07 standard deviations in language, math, and executive function test scores, respectively. Another methodologically rigorous (though not causal) study in Ghana showed that a one standard deviation change in some dimensions of classroom quality was associated with changes in child outcomes of the magnitude of 0.06 standard deviations (McCoy & Wolf, 2018).

The Teaching through Interactions framework organizes teacher-student interactions into three domains: Emotional Support, Classroom Organization, and Instructional Support. These three domains have strong empirical support in high-income and a few upper middle-income country contexts (e.g., Hamre et al., 2013). These three domains have been found to be correlated and relate to a higher order factor of responsive teaching (Hamre et al., 2013), but they are distinct and stand on their own. Importantly, although these classroom-level measures have been shown to be consequential for student learning, very few studies have examined teacher-level predictors of these interaction domains.

Emotional Support. Emotional support focuses on support for children's social and emotional functioning (Pianta et al., 2008). In classrooms with high emotional support, teachers are aware, sensitive, and responsive to children's needs and interests; and they promote children's autonomy and responsibility. Emotionally supportive classrooms are also warm, with frequent positive communication between teachers and children (Pianta et al., 2008). Teacher implicit bias, whether unconscious stereotyping or mindset, expressed via prejudicial behavior undermines the emotional supportiveness of classrooms. Direct observations of White teachers in Louisiana showed that Black students were treated differently, including being praised less, called by their names less, reprimanded more, and ignored more (Casteel, 1998). A meta-analysis concluded that teachers use more negative language when speaking to or with Black students (Tenenbaum & Ruck, 2007). Explicit bias from teachers has been documented by The Gay, Lesbian, and Straight Education Network's National School Climate Survey (Kosciw et al., 2020), which showed that 52.4% of LGBTQ students heard homophobic remarks from school staff. Nonaction is a common form of bias in schools with only 13.7% of LGBTQ students reporting that school staff intervened most of the time or always when hearing homophobic remarks (Kosciw et al., 2020).

Classroom Organization. Classroom organization refers to classroom processes focused on classroom behavior management and supporting productive time use for learning. In well-organized classrooms, teachers establish clear expectations and routines, are proactive rather than reactive in dealing with children's disruptive behaviors, and provide interesting activities that keep children engaged (Emmer & Stough, 2001). Effective teachers also help children self-regulate their behavior and maintain their interest in instructional activities (Pianta et al., 2008). Teachers have been documented to show differential classroom management and discipline practices based on students' race. For example, Black and Latino students are subjected to disproportionate disciplinary action compared to their White peers (Chin et al., 2020; Morris, 2016; Skiba et al., 2011), and biased disciplinary action starts as early as preschool (Gilliam et al., 2017). Bahr et al. (1991) found that teachers were more likely to perceive and nominate Black students as "difficult" and in need of behavioral adjustment despite observations of comparable behavior. Boys – and Black boys in particular (Monroe, 2005) – are more likely than girls to be referred to special education services, even with similar abilities (Wehmeyer & Schwartz, 2001). This pro-boy versus pro-

girl teacher bias can vary by age. Glock and Klapproth (2017)assessed teachers' implicit attitudes toward minority students and found that teachers were more negative toward minority boys in elementary school, but implicitly favored boys over girls in secondary school, but had more negative attitudes toward minority students in general, despite the student's gender.

Instructional Support. Instructional Support focuses on how teachers implement instructional discussions to effectively support children's cognitive and language development (Pianta et al., 2008). In classrooms with high-quality instructional support, teachers provide scaffolding (Yates & Yates, 1990), and use discussions and activities that promote concept development. Teachers who provide high-quality instruction also use questions and feedback that extend learning and provide opportunities that promote children's creativity, problem-solving, and development of complex language skills (Pianta et al., 2008).

Differential instructional support based on out-group status has been documented. For example, Black students are called on less and ignored more, and Caucasian males receive more of the teacher's time and attention (Casteel, 1998). Observational studies have also shown disparities in teacher-student interactions between girls and boys (Lee et al., 1994; Sadker & Sadker, 2010). Specifically, these studies reveal how teachers can entrench gender socialization in their teaching practices and reinforce stereotypes. Pedagogically, teachers were observed to give girls less rigorous instruction and less academic independence as compared to boys (Lee et al., 1994). Sadker and Sadker (2010) compiled 30 years of research to argue that differentiated teaching practices stemming from teachers' unconscious pro-boy bias causes girls to lose self-esteem and retreat in the classroom, making them less likely to actively participate in class as they get older.

Expectations may play a key role in how these biases are expressed in teacher-student interactions. Howe and Abedin (2013) conducted a systematic review of classroom dialogue and found that teacher interactions varied and correlated with the teacher's expectations of the student. Two recent studies found teacher feedback to be another important correlate of teacher expectations. Denessen et al. (2020) observed interactions between teachers and students in the Netherlands and found that teacher expectation effects accounted for the type of feedback teachers gave in mathematics; specifically, teachers gave more directive feedback to students for which they had low expectations and more facilitative feedback to the students for which they had high expectations; subsequently, this feedback predicted math achievement. A longitudinal study in Germany found that varying teacher expectations translated into differentiated types of feedback, but that this did not substantially mediate the expectancy effects, pointing to other potential mechanisms (Gentrup et al., 2020).

Individual-Level: Teacher-Student Relationships

A major limitation of the research on teacher-child interactions is that it focuses on global observations of the classroom. While it is likely that teacher beliefs about individual students influence their general teaching practices, it is also likely necessary to measure differences in how teachers might interact differently with individual students to understand if and how teacher bias affects the targeted students.

The important link between teacher-student relationships and students' development and learning is well established. High levels of support and low levels of conflict between teachers and students have been shown to predict children's learning outcomes during the same academic year and several years later (Hamre & Pianta, 2001; O'Connor & McCartney, 2007). Further, positive teacher-student relationships have also been found to predict classroom engagement and cooperation (e.g., Meehan et al., 2003) and peer relationships (Hughes & Kwok, 2006). Although the quality domains from the Teaching through Interactions framework have not been considered at the student level (i.e., instructional and emotional support provided, and the disciplinary strategies used toward each individual student), this would also be a fruitful area of inquiry.

Teacher bias may provide important insights into how teachers relate with students across these three areas of support. Evidence of differential teaching practices based on teacher mindset mirrors the evidence summarized around intergroup bias and prejudice. For example, Rattan et al. (2012) found that teachers with fixed mindsets more readily judged students to have low ability and would use strategies that decreased engagement with specific students that they deemed as having low ability, such as assigning less homework or giving less direct and more comforting feedback. The quality of teacher engagement and feedback with specific students mirrors that based on in-group/out-group bias. Given the evidence that having a fixed mindset leads to more prejudicial behavior, our model hypothesizes that teachers with fixed mindsets may be more likely to see historically disenfranchised students as less intelligent, ultimately shaping their relationships with those students.

In LMIC contexts, research on student-teacher relationships is scarce, though the literature on school victimization and violence is related. Some studies have found that a large majority of children experience physical and emotional violence from teachers (e.g., Hecker et al., 2021). Peer victimization is also prevalent in school and found to be associated with children's social status (e.g., Sentse et al., 2013). A recent study examined children's experiences of violence by teachers in a representative sample of Tanzanian fifth and sixth graders (Hecker et al., 2021). The researchers found that teacher violence was not directly associated with children's social status, but that teacher violence was associated with increased internalizing problems for students of low social status. Understanding children's experiences with their teachers and in their classrooms in a broader range of countries is a critical next step for advancing the literature on teacher-student relationships.

Importantly, the research on teacher-student relationships relies on teacher reports (particularly for younger children), presenting a challenge in applying this framework in the context of teacher biases and mindsets. By middle childhood and adolescence, student reports are also used. It can be argued that student perceptions are perhaps most important, as they ultimately shape children's school experiences.

Student Learning-Related Processes

The next part of our proposed conceptual model links teacher-student interactions and teacher-student relationships with student learning outcomes, including motivation and engagement, sense of belonging, self-efficacy, and student perception of teacher bias.

Motivation and Engagement

Academic achievement has consistently been linked to self-directed and intrinsically motivated learning (Pekrun et al., 2002; Schunk & Zimmerman, 2013). Motivation has been conceptualized as a continuum based on relative autonomy, with robust empirical support for self-determination as a central element of human motivation (Howard et al., 2017). Higher autonomy and self-determination are driven by a desire to perform a task for its own sake, often referred to as *intrinsic motivation,* as opposed to outside forces and external rewards that underly behaviors, often referred to as *extrinsic motivation*. Motivating factors on both ends of the continuum can lead to behavior change, though motivation driven by autonomy and self-determination leads to more sustained changes (Ryan & Deci, 2000). Theoretical insights posit that personal motivation and motivation stemming from the social environment work together in determining one's actions (Benabou & Tirole, 2003), and indeed empirical research has shown that school and classroom characteristics can play a role in the development of students' academic motivations and achievement (Eccles & Roeser, 2011; Meece et al., 2006). Similarly, a related and key affective variable is school engagement, which includes engagement-related behaviors, cognitions, and emotions (Fredricks et al., 2004). Academic motivation and engagement have a reciprocal relationship. Motivation predicts engagement in academic tasks, and engagement further enhances interest and motivation (Pekrun et al., 2002), and both motivation and engagement further self-regulated learning (Schunk & Zimmerman, 2013; Singh et al., 2002).

Several studies have linked aspects of teacher-student relationships to both motivation and engagement. For example, students who thought their teachers were caring were more engaged during class (Wentzel, 1997), while students who reported weak social bonds with their teachers were more likely to be disengaged (Murdock, 1999). More supportive and caring teachers have more motivated students, as measured by effort and self-efficacy (Goodenow, 1993; Murdock & Miller, 2003). Teachers' supportiveness predicted students' value of and intrinsic motivation for math (Midgley et al., 1998); similarly, Strati et al. (2017) found that teacher support was positively associated with student engagement across different levels of challenging academic tasks, and teachers' emotional obstruction was negatively associated with engagement. On the other side, empirical evidence shows that students' perceptions of discrimination in school are directly linked to less intrinsically oriented motivation and that this mediates the link between perceived discrimination and later academic success (Alfaro et al., 2009). Direct experiences of discrimination from police, for example, were associated with lower academic engagement and lower academic grades for White, Black, and Latinx youth (Zeiders et al., 2021). Finally, evidence also suggests that beyond the immediate moment, aspects of teacher-student relationships are associated with students' future academic plans. Murdock et al. (2000) found that students' views of their teacher's expectations of them in seventh grade predicted their future college plans better than students' own perceptions of their academic abilities. Further, Fine (1991) found that persistent negativity in the relationships between teachers and students was implicated in students' decisions to drop out of school.

The dynamic and reciprocal nature of teacher bias and student engagement is worth exploring. In Finn's (1989)

taxonomy of engagement, acquiescence to classroom rules (e.g., not being disruptive or noncompliant) and help-seeking behavior from the student to the teacher were key behaviors indicating engagement. As our review above notes, these are areas significantly and negatively impacted by teacher bias. In other words, if bias leads students to be disproportionately disciplined and receive less teacher attention, then it is logical that these engagement behaviors will decrease and create a dynamic and cyclical relationship between teacher bias and school engagement.

Sense of Belonging

Finn's identification-participation model proposed that students need to identify with their schools, specifically by feeling welcomed, respected, and valued, to be able to fully engage (Finn, 1989). A sense of belonging has been found to be a critical part of student retention (Morrow & Ackermann, 2012; O'Keeffe, 2013) and associated with academic outcomes (Anderman, 2003), especially for boys and racial minorities (Oyserman et al., 2006; Sánchez et al., 2005). Systematic alienation of students by schools and classrooms harms students' sense of belonging, with disciplinary practices being one key method of alienation (Wehlage & Others, 1989). Bias in disciplinary practices, and alienation in the form of less teacher support and attention, for example, could lead to student isolation and ultimately negatively impact student outcomes.

Much of the research on a sense of belonging and student outcomes focuses on higher education, with racial minorities reporting feeling less belonging (Hurtado & Carter, 1997; Johnson et al., 2007). Peer and teacher interactions (Hoffman et al., 2002; Johnson et al., 2007; Meeuwisse et al., 2010) and student perception of the racial climate (Hurtado & Carter, 1997; Johnson, 2012; Nuñez, 2009; Zea et al., 1997) are key predictors of racial and ethnic minority students' sense of belonging. In the Netherlands, Meeuwisse et al. (2010) explored how teacher and peer interactions and relationships related to students' sense of belonging. They found that minority students more so than majority students derive their sense of belonging from interactions with their teacher and peers, including teachers' being in-tune to when students had questions and making time to answer questions. A study on middle schoolers in the United States found that a sense of belonging declined from sixth to seventh grade, but that teachers' promotion of mutual respect in the classroom buffered the decline (Anderman, 2003).

Self-Efficacy

Self-efficacy posits that one's beliefs about one's abilities will determine behavior in the form of coping, expending effort, and dealing with obstacles (Bandura, 1997). Student self-efficacy contributes to academic achievement (Schunk & Mullen, 2012; Wigfield & Eccles, 2000), and teachers play a role in improving student self-efficacy (Margolis & Mccabe, 2006; Siegle & McCoach, 2007; Wigfield & Eccles, 2000). As described in the "Expectations" section of this paper, teacher-student interactions play a key role in mediating the relationship between teacher expectations and student-level processes, particularly self-efficacy.

In one observational study, Martin and Rimm-Kaufman (2015) found that high-quality classroom-level teacher-student interactions (emotional, organizational, and instructional support) helped students become motivated and engaged despite initial levels of low self-efficacy. Interestingly, student self-efficacy may protect students who have a poor relationship with their teachers (Lan & Moscardino, 2019) wherein high self-efficacy can help students achieve despite negative teacher-student relationships. Self-efficacy is also cumulative, where past success builds future achievement and success (Zimmerman, 2000; Marsh & Craven, 2006) showed that self-efficacy and achievement are interrelated to each other over time, especially in the math domain. This could be why early experiences with prejudicial teachers could have long-lasting impacts on girl students' academic performance in STEM and related courses (Lavy & Sand, 2018).

Perceptions of Teacher Bias and Mindset

The relationship between teacher beliefs and student perceptions is dynamic and bi-directional. The evidence points to a reciprocal relationship between teacher well-being and student well-being, with the quality of the teacher-student relationships serving an important mediating role (Spilt et al., 2012). Petegem et al. (2007) found that student well-being was lowest in classrooms where students perceived teachers as being uncertain about or dissatisfied with their work, even if teachers themselves reported being very satisfied and confident. This indicates that student perceptions are key in examining classroom experiences. Thus, in this final section, we focus on students' perceptions of their teacher's beliefs.

Perceptions of Teacher Bias. A longitudinal study by Wayman (2002) found that Mexican-American boys were more likely to find their teachers prejudiced than non-Latino boys, and those who did were more likely to drop out of school; poor teacher-student relationships

played a role in making students feel alienated. Stereotype threat is a related phenomenon where even perceived bias can have negative impacts on student learning, and the stress caused by this threat can make it more difficult to learn (Appel & Kronberger, 2012). Several studies have experimentally tested stereotype threat and found that exposing students to negative stereotypes, even subliminally, had negative impacts on their ability to take a test (Logel et al., 2009; Steele & Aronson, 1995; Taylor & Walton, 2011). Girls' perceptions of teacher bias in their math classrooms predicted their motivation in math and their intentions to enter a mathematical field (Lazarides & Watt, 2015), illustrating that perceived bias can shape other student-level learning processes such as motivation.

Perceptions of Teacher Mindset. Emerging experimental research in STEM classrooms shows that student reports of teacher's fixed mindsets, both real (such as a teacher being assigned to convey a fixed mindset) and purely perceived, led students to report fewer feelings of belonging in their class, higher evaluative concerns, imposter feelings, and negative affect, all of which in turn led to lower motivation, in-class engagement, and grades (LaCosse et al., 2021; Muenks et al., 2020). Interestingly and in line with the stereotype literature, one study found that the effects of teachers' mindset beliefs were more pronounced for female students (LaCosse et al., 2021).

Further, student reports of teaching practices were associated with student perceptions of their teacher's mindset. Students perceived teachers as having more of a growth mindset if they engaged in hands-on activities, group discussion, experiential learning projects (Muenks et al., 2021), improvement-oriented feedback (Kroeper et al., 2022; Lou & Noels, 2020), explicit messages, such as "all students can learn and grow" (Kroeper et al., 2022; Muenks et al., 2020), and time spent with struggling students (Kroeper et al., 2022). In addition to teacher practice, school-level policies, including being able to retake exams for higher grades influenced students' perceptions of their teacher's mindsets (Muenks et al., 2020). These recent studies reinforce the bi-directional nature of teacher-student mindsets, with lower growth mindsets reported in students who had fixed mindset teachers (Lou & Noels, 2020).

Perceptions of bias are linked to other learning-related processes. For example, Rattan and colleagues (Rattan et al., 2018) investigated the relation between a growth mindset and a sense of belonging in a meta-analysis. They found that minority students who perceived their instructor as having a growth mindset had a stronger sense of belonging and that an instructor's communication of growth mindset beliefs eliminated differences in women's and minority students' attraction to STEM courses. Perceptions of an instructor's fixed mindset eroded women's sense of belonging. Among middle schoolers, Anderman (2003) found that a sense of belonging was strongly associated with perceptions that the tasks teachers gave promoted their personal improvement (e.g., "Our teacher thinks mistakes are okay as long as we are learning"). These studies also provide evidence that a student's growth mindset can serve as a buffer between social identity threat (such as stereotyping) and a student's sense of belonging.

Conclusions

This paper proposed the *Teacher Beliefs and Interactions Model* to theorize the mechanisms through which teacher bias may impact student learning and contribute to persistent gaps in learning outcomes. We bring together several lines of research that have examined how teacher beliefs affect student learning outcomes, as well as student classroom experiences and learning-related processes, to form a fuller picture of how teacher beliefs shape children's educational experiences and learning. Our goal is for this model to serve as a starting point to better understand the role of teacher beliefs in classroom-level processes and, ultimately, student outcomes. As a next step, these proposed processes will need to be tested to examine if the pathways are indeed present and potentially causal. A deeper and empirically based understanding of these pathways can inform the design of future interventions to facilitate teachers' internal beliefs in ways that will lead to high-quality classroom interactions and teacher-student relationships for all students.

Additional Directions

Importantly, the set of teacher implicit beliefs and belief expressions discussed are distinct but strongly interrelated. For example, stronger intergroup biases can lead to lower expectations for individual students based on students' characteristics. A growth mindset could potentially moderate the association between teachers' implicit biases and their expectations. Biases, mindsets, prejudicial behaviors, and expectations all influence how a teacher interacts with their students, both in terms of their instructional practices and the quality of the relationships formed with students. Positive individual relationships and high-quality classroom-level interactions cause stu-

dents to become and stay motivated and engaged. The student-level processes mediating classroom interactions and student learning outcomes are also interrelated and potentially cumulative over time. These interrelations could be explored in future research.

The proposed model is intended to be broadly applicable. Our discussion of various social groups is meant to be illustrative of the associations we outline, rather than comprehensive. For example, we do not cover issues of bias related to "ethnicity," often used to refer to a set of characteristics of race, religion, and language. For example, in the USA, Muslims' experience of discrimination in school settings increased following the 9/11 attacks and subsequent surveillance of Muslims, or those perceived as Muslims given their Central or South Asian ethnicity (Bajaj et al., 2016; Ghaffar-Kucher, 2012). In a series of focus group discussions with religious minority students in the USA, Dupper et al. (2015), found that students reported teachers as often being the perpetrators of religious-based bullying and micro-aggressions or did not intervene when students experienced religious-based violence. The authors noted that religious minority students found teachers' actions, both negative and positive, to hold more weight than their peers given their power status within the school. Future research could explore the pathways laid out in the conceptual model with different relevant subgroups.

Further, our review and analysis of the literature sheds light on additional potential moderators along the path between teacher beliefs and student learning outcomes that could be integrated into future research. These not only include the individual student characteristics discussed in depth as part of our initial review (race, gender, SES, sexual orientation, etc.) but also other contextual factors that may be important to consider in future research such as family processes and school-level factors.

For family processes, evidence suggests that both a child's perception of bias and resilience in the face of discriminatory school environments can be buffered by parents' positive ethnic-racial socialization, a process through which parents educate their children on navigating their racial or ethnic identity within a broader society, including preparing them for bias (Anderson & Stevenson, 2019; Hughes et al., 2006). These family-level processes may serve as protective mechanisms between differential treatment in the classroom and a child's self-esteem and self-efficacy, especially in adolescence (Brown & Chu, 2012; Harris-Britt et al., 2007; Hughes et al., 2006). This would be a fruitful area to test and expand the conceptual model proposed here.

At the school-level, school composition and overall school climate could be explored as moderators between individual teacher bias and student learning outcomes. There is mixed evidence around how school composition influences teacher bias and student achievement. Brown and Chu (2012) assessed and observed teachers and found that Mexican-American students' perceptions of racial discrimination were highest in schools with the highest proportion of Mexican-American students, as compared to schools where the population of Mexican-Americans was smaller. Agirdag et al. (2012) found that this was also true in Belgium, where the most anti-Muslim bias among teachers was found in schools that enroll a larger share of Muslim students. However, Glock and Klapproth (2017) found that preservice teachers had more negative implicit attitudes toward minority ethnic groups versus a comparable group of in-service teachers who spent time in diverse schools, suggesting that exposure and contact may lessen negative attitudes. Other aspects of school composition, such as how the teachers' individual characteristics (e.g., race, gender, sexual orientation, disability status) reflect the characteristics of the student body could also play an important role (Egalite et al., 2015; Gottfried et al., 2021). Overall school climate, such as values related to diversity, may be critical too. For example, Brown and Chu (2012) found that children in schools where teachers valued diversity had the most positive view of their ethnic identity and perceived less discrimination in their communities outside of school.

Implications for Intervention

Given our review of the literature, we hypothesize two potential leverage points for interventions to consider: (a) addressing teacher beliefs directly, and (b) improving teacher-student interactions and relationships. Importantly, the evidence to date on how to effectively address both of these is thin, and thus it is not possible to recommend evidence-based interventions to address each. We stress that empirical research is needed to test the proposed pathways in this conceptual model prior to intervention implementation.

First, regarding teacher bias, a large body of research provides evidence-based suggestions that have the potential to reduce teacher bias (Carter et al., 2020; Emerson, 2017; Lin et al., 2008; Staats, 2016), but none have been experimentally tested. Some evidence points toward teaching empathy as a way to reduce implicit bias (Whitford & Emerson, 2019), while other evidence suggests that bias specific to groups can be reduced through training programs, such as an antibias program to improve

teacher attitudes around linguistic diversity (Wiese et al., 2017). However, teacher push-back on antibias training has also been documented (Shim, 2018; Vaught & Castagno, 2008). Although reducing teacher bias is key, the evidence around how to do this successfully is limited and mixed, and there is no evidence to date in LMICs. Well-documented efforts to create a positive environment for students, such as celebrating diversity, learning about students' cultures, and intervening in discriminatory practices (Niyozov & Pluim, 2009) should also be disseminated and studied further.

There is slightly more evidence related to improving growth mindsets among teachers. Several studies show that a growth mindset can be taught to students and can be most beneficial for disadvantaged students (Brougham & Kashubeck-West, 2017; Fink et al., 2018; Yeager et al., 2019). Yet no interventions to promote a growth mindset in teachers have been experimentally evaluated. But growth mindset has been shown to be malleable, and teachers' (lack of) growth mindset has been directly linked to student outcomes (Canning et al., 2019). Thus, developing and evaluating interventions directly aiming to improve teachers' growth mindsets about their students holds promise. For example, Bryan and colleagues (2021) recommended a teacher-training intervention that focuses on promoting a classroom growth mindset culture through changing the language and communication teachers use with students to more explicitly express belief in children's potential and enacting policies that promote this belief such as rewarding improvement. None of these beliefs happen in a vacuum, however, and the most impactful intervention may require a focus on a larger system of beliefs. Specifically, teacher expectations impact learning outcomes but are also a product of teacher biases and mindsets. Therefore, an intervention directly targeting expectations would most likely need to include implicit bias and/or growth mindset.

Second, an abundance of evidence, especially among adolescents, shows that interventions can improve teacher-student relationships (Kincade et al., 2020) and that these improvements lead to improved student outcomes (see Cornelius-White, 2007, for a meta-analysis on the topic). Gehlbach et al. (2016) conducted a randomized field experiment where they had teachers and students discuss five similarities that they shared, with the goal of forming closer relationships. Within 5 weeks of this intervention, students and teachers both reported closer relationships, and this resulted in improved course grades for students with the effects being strongest for historically marginalized groups (Gehlbach et al., 2016).

Future Directions

Exploring all the possible venues through which practitioners and policymakers can better help marginalized children is urgent and crucial work. Given the diverse historical legacies of marginalization across countries and the weaponization of differences, future research will need to place investigations into teacher beliefs within context. An understanding of entrenched inequalities and the specific mechanism through which these dynamics present in classrooms could be a way of learning how to better support teachers and students.

Intervention and policy solutions will be greatly strengthened if more attention is paid to teacher beliefs and the mechanisms underlying the associations between teacher beliefs and student outcomes. Research is needed to better understand the complex reality of classroom environments, and this includes improved measures of teacher beliefs, teacher-student interactions and relationships, and student-level processes; these measures must be valid within the cultures and countries in which they are used. Finally, an examination of those teachers who create inclusive environments and welcome diversity in ways that create positive learning experiences for all is also warranted. A focus on the links between teacher beliefs and children's daily classroom experiences across diverse contexts is necessary so that children and teachers can receive the support they need to thrive.

Statement of Ethics

No ethical approval was required for the preparation of this manuscript, as no human or animal subjects were used.

Conflict of Interest Statement

The author(s) has/have no conflicts of interest to declare.

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