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A meta-analysis of teachers' provision of structure in the classroom and students' academic competence beliefs, engagement, and achievement

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ABSTRACT

Structure reflects a variety of practices teachers use with the intent to guide students' behavior and increase academic success. A research synthesis was conducted on the role of classroom structure in the academic engagement, disengagement, competence beliefs, and achievement of preschool through high school students. A meta-analysis of 191 samples from 165 correlational studies revealed statistically significant correlations with achievement (.11), engagement (.28), and competence beliefs (.22), and a statistically non-significant relationship with disengagement (–.08). A meta-analysis of 71 samples from 46 structure intervention studies revealed a positive statistically significant average effect (*g*) on achievement (0.33), engagement (0.46), and disengagement (–0.34), but a statistically non-significant effect for competence beliefs (0.26). Consistent with a dual process model of engagement, associations were stronger for engagement than disengagement. Results related to variation suggested some universality, particularly across grade levels, and underscored the importance of emphasizing anticipatory strategies, minimizing the controlling aspects of structure, and considering the broader context, including the country context, income background of students, or whether structure is paired with other psychological supports. Methodological features also explained variation, highlighting the importance of using methods that center teachers' and students' experiences and align with the nature of the focal outcome.

Educational researchers have long proposed that the environment that teachers create in the classroom plays an important role in explaining students' educational outcomes (e.g., Brophy, 1986). In particular, teachers who *provide structure, management, or organization in the classroom environment* support students' academic learning outcomes by facilitating feelings of competence, keeping students engaged and on task, and managing their behavior (e.g., Emmer & Stough, 2001; Jang et al., 2010). Although a large body of correlational and intervention research on the academic effects of teachers' provision of structure in the classroom has accumulated over the last 50 years, there have been limited efforts to comprehensively meta-analyze the evidence. Moreover, research on classroom structure suggests that its associations with student outcomes vary depending on how structure is operationalized and implemented, the setting or characteristics of the students, or the nature of the outcome (e.g., Gottfredson et al., 1993; Jang et al., 2010; Seidel et al., 2005; Sierens et al., 2009; Skinner & Belmont, 1993).

To fill that gap, the purpose of the current research was to comprehensively and systematically meta-analyze correlational and intervention research on the role of teacher's provision of classroom structure in student outcomes, including engagement (i.e., involvement in tasks or activities; Fredricks et al., 2004), disengagement (i.e., passiveness, negative feelings, and withdrawal from tasks or activities; Skinner & Belmont, 1993), competence beliefs (i.e., cognitive representations of how successful one is or will be at a given activity; Eccles & Wigfield, 2023), and achievement. With this synthesis, we will provide information critical to recommendations for future research endeavors, policy, and teachers' practice.

We address the following questions in two separate meta-analyses, one focused on correlational research and another focused on intervention research. First, to what extent is teachers' provision of classroom structure associated with students' academic engagement, disengagement, competence beliefs, and achievement? Second, to what extent do components of the structure construct and characteristics of the

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setting, students, outcome, or research methods explain variability in those relationships?

Defining teachers' provision of classroom structure

Structure in the classroom reflects teachers' attempts to create an organized and predictable environment that helps students effectively achieve desired outcomes (Evertson & Weinstein, 2006; Skinner et al., 1998). Structure reflects strategies to support learning and instruction, regardless of the particular content or focus to instruction (Brophy, 1988). Although the term 'structure' comes from researchers studying students' academic outcomes from a motivational perspective, namely, self-determination theory (e.g., Jang et al., 2010; Skinner & Belmont, 1993), structure is also studied in instructional quality and teacher education literatures under the label of classroom organization (e.g., Ponitz et al., 2009) or classroom management (e.g., Evertson & Weinstein, 2006). However, regardless of the particular term used or the scholarly literature from which it originates, conceptual and operational definitions are largely synonymous with subtle points of divergence. Leading scholars have defined classroom management broadly as any action a teacher takes to create an environment that supports and facilitates both academic and social-emotional learning (e.g., Evertson & Weinstein, 2006). Similarly, self-determination theory scholars have defined structure as teachers' practice of supporting students' competence by providing clarity of information and ongoing guidance regarding ways of effectively achieving desired outcomes (e.g., Aelterman et al., 2019; Jang et al., 2010; Skinner et al., 1998). In this research synthesis, we favor the term "structure' given our focus on academic engagement, disengagement, competence beliefs, and achievement outcomes, as the term "classroom management" is often associated with a primary focus on shaping appropriate behavioral conduct of students in the classroom (e.g., Oliver et al., 2011), which is not the focus in this synthesis.

Classroom structure can be characterized by a variety of specific practices teachers use, often in combination. From a self-determination theory perspective, these have typically included communicating and maintaining clear expectations, rules, and goals, framing students' activity with explicit directions, guidance, routines, or schedules, creating an organized space and materials, providing clear, organized activities, monitoring progress, and giving encouragement and feedback about how students can accomplish desired outcomes (e.g. Aelterman et al., 2019; Jang et al., 2010; Skinner & Belmont, 1993). Much like the practices emphasized in the motivation literature, instructional quality and teacher education scholars focused on classroom management define structure as primarily involving teachers anticipating students' need to understand how to competently navigate the environment by proactively communicating desirable behavior, creating clear expectations, rules, and routines, eliciting students' involvement in the design or implementation of structures in the classroom, and providing relevant ongoing guidance (e.g., Brophy, 1986; Emmer & Stough, 2001; Evertson & Weinstein, 2006). However, structure, particularly as defined in the classroom management literature, can also include strategies that reflect surveillance and responsiveness to students' behavior. These can include monitoring of students' activity in the classroom and providing signals for behavior, feedback, praise and encouragement, rewards, intervention in problematic behavior, and punishment as necessary (e.g., (e.g., Emmer & Stough, 2001; Evertson & Weinstein, 2006; Kounin, 1970; Brophy, 1999). Many of these more responsive strategies are also included in the motivation literature on structure, particularly feedback, monitoring, encouragement, and praise, while others, particularly rewards, intervention, or punishment, are not. These practices often come with caveats about lower effectiveness (Emmer & Stough, 2001) and greater potential to be experienced as controlling (Aelterman et al., 2019), a topic we return to later. Self-determination theory has explicitly framed the logical opposite of structure as chaos, in which teachers are confusing, contradictory, or disorganized and may actively thwart competence (Jang et al., 2010). Framing chaos as the opposite of classroom management and organization has also been noted in the teacher education literature on classroom management (e.g., Marzano et al., 2003) and the instructional quality literature (e.g., Ponitz et al., 2009). In sum, creating structure is a multifaceted endeavor that involves a diverse assortment of teacher practices that can be used independently or in various combinations, as well as to various extents, and are all intended to organize and guide students' school-relevant behavior in the process of learning in the classroom. Table 1 provides definitions relevant to the current synthesis.

Theoretical perspectives on classroom structure

From teacher education and instructional quality perspectives of classroom management that draw from a variety of developmental, cognitive, social, and ecological theories, organizational classroom strategies are critical because students must be engaged in instructional activities and on-task for learning to occur (e.g., Brophy, 1986; Cameron et al., 2005; Rimm-Kaufman et al., 2009; Walberg & Paik, 2000). For students to be on-task, they must understand the nature, goals, and boundaries of tasks and their activity in the classroom, making classroom management a necessary condition for student learning (Brophy, 1999; Emmer & Stough, 2001). However, beyond setting the stage for learning, teachers' provision of structure may also socialize students' thoughts, behaviors, and emotions (e.g., McCaslin et al., 2014; Schwab & Elias, 2014). Across various theoretical perspectives, effective classroom structure influences academic outcomes because the process of communicating, modeling, and reinforcing norms for social, emotional, and academic behavior leads students to develop healthy social, emotional, and academic self-regulatory skills.

From motivational perspectives, particularly self-determination theory (e.g., see Ryan & Deci, 2017 for a review), teachers' provision of structure in the classroom has consequences for students' academic motivation, engagement, and

Table 1. Definitions of structure and outcome variables applied to the current synthesis.

Structure/Outcome variable	Definition
Structure	An overall approach to creating a predictable classroom environment. Includes an assortment of practices implemented by teachers meant to organize and guide students' school-relevant behavior and in turn, support students' in effectively navigating the learning environment and accomplishing desired outcomes.
Components of Structure	
Expectation/goal-setting	Teacher communicates expectations or goals for what students will accomplish within lessons, activities, or for course more generally and/or provides guidance, scaffolding, or directions for meeting expectations or goals.
Establishing rules, routines, and procedures	Teacher discusses rules, policies, routines, schedules, and/or procedures for work and/or behavior in the classroom with students.
Organization of lessons and materials	Teacher presents lessons and/or materials in an organized, clear, or coherent manner and/or provides guidance and directions for lessons and using materials in the classroom.
Monitoring and signals	Teacher monitors student behavior or activity in the classroom or provides signals for behavior and transitions to new activities.
Feedback provision	Teacher provides evaluative information about student learning or behavior in the classroom.
Use of rewards and punishment	Teacher provides reinforcement or rewards for desired student behavior, including praise or encouragement, and/or intervenes to administer contingencies in response to disruptive or avoidant student behavior.
Eliciting student involvement	Teacher solicits student involvement in carrying out elements of classroom structure or assigns students classroom management responsibilities
Autonomy support	Instructional style in which teachers support students to feel that what they were doing in the classroom is self-endorsed or chosen. Includes the use of non-controlling language, giving choices or involving students in decisions, providing rationales to explain the personal value of rules, activities, or goals, and soliciting, acknowledging, or incorporating students interests, feelings, or perspectives. Can accompany or be combined with structure.
Emotional or relatedness support	General positive emotional climate or expressions of teacher caring, relationship building, or respect. Can accompany or be combined with structure.
Achievement	Academic performance, including course grades, unit tests, quizzes, standardized tests, and specific school task performance.
Engagement	Involvement in school or class, including behavioral, cognitive, emotional, or agentic (e.g., attempts to influence instruction or support for motivation) forms of engagement.
Behavioral engagement	Behavioral involvement in school tasks, including on-task behavior, attention, participation, and effort.
Emotional engagement	Emotional involvement with school tasks, including the experiences of positive affect, positive attitudes, interest, intrinsic motivation, and intrinsic value during/for school/class tasks or topics.
Cognitive engagement	Cognitive involvement in school tasks, including learning strategies, information processing, critical thinking, effort regulation, monitoring, elaboration, organization, or metacognition [i.e. awareness and understanding of one's own thought processes].
Competence beliefs	Positive beliefs about abilities, including perceived academic competence, academic self-concept, and academic self-efficacy.
Disengagement	Behavioral, cognitive, emotional, or agentic [i.e., intentional passivity] withdrawal from school or class.
Behavioral disengagement	Behavioral withdrawal from school tasks, including off-task behavior, inattention, or disruption.
Emotional disengagement	Emotional withdrawal from school tasks, including the experience of negative affect, apathy, and anxiety during/for class/school tasks or topics.
Cognitive disengagement	Cognitive withdrawal from school tasks, absence of strategies to regulate learning, or use of disorganized strategies.

achievement because it has the potential to support their psychological need for competence, or the need to experience efficacy in one's behavior (e.g., Mabbe et al., 2018). According to this perspective, satisfying the need for competence, as well as other needs for autonomy and relatedness, is theorized to be a necessary condition for optimizing motivation and learning. Moreover, social-contextual conditions that provide people with the opportunity to satisfy their basic needs lead to enhanced motivation, regulation, and psychological well-being, whereas environmental factors that thwart these basic needs result in the opposite (e.g., Ryan & Deci, 2017). Thus, teacher-provided structure is proposed to support motivation, engagement, and achievement because it helps students to support a sense of competence or efficacy and control in the classroom (e.g, Skinner et al., 2008; Stroet et al., 2013).

However, there is a caveat. Namely, self-determination theory acknowledges the confusion between *structure* and *control* that sometimes occurs in teachers' practice (e.g., Aelterman et al., 2019; Jang et al., 2010). When teacher practice goes beyond providing information about how to interact effectively within the environment to being controlling and involving a set of demands and sanctions intended to pressure students to act only in teacher-determined ways, psychological needs, motivation, and achievement will be thwarted. Whereas control constrains others to act in specific ways that they may not otherwise choose, structure provides competence-relevant information about behavior that allows students to self-regulate their behavior and feel competent doing so (e.g., Aelterman et al., 2019; Sierens et al., 2009). The benefits of teachers' provision of structure can be constrained because sometimes teachers compliment structure with controlling practices or apply structure in a controlling manner (e.g., Aelterman & Vansteenkiste, 2023).

The relationship between classroom structure and educational outcomes

Classroom structure has been studied in both correlational and intervention designs. In correlational studies, researchers have

either observed the extent to which teachers used structure practices or have asked teachers or students to report on the extent to which teachers implemented practices and then linked practices with students' educational outcomes. In interventions with experimental designs, researchers have either directed or trained teachers to implement one or many structure practices and then observed the effects of that intervention on their students compared to the students of teachers who were not trained or directed to use structure.

Kounin's classic work on the management of the classroom environment (e.g. Kounin, 1970; Kounin & Obradovic, 1968) was one of the earlier attempts to explicitly identify effective practices for providing structure in the classroom. Through coded observations of videotapes of early elementary classrooms, he identified a set of teacher behaviors and lesson characteristics, including withitness, smoothness, momentum, overlapping, and group alerting, that were associated with students' work involvement. Other research in the 1970s and 80s using observation and examining training programs reinforced these initial findings and suggested that effective teachers provided information about expectations for behavior and guidance to help students prepare to work on classroom activities, circulated throughout the lesson, and monitored students' progress in order to provide guidance (Anderson et al., 1980; Emmer et al., 1980; Evertson, 1985, 1989; Evertson et al., 1983; Good & Grouws, 1977; Helmke & Schrader, 1988). Importantly, this research suggested that reactive strategies in response to students' misbehavior did little to differentiate teachers who were more from less effective at supporting student engagement and achievement.

More recently, researchers have explored classroom structure from a diverse set of theoretical perspectives and examined a wide variety of student academic outcomes. Classroom structure has been linked to students' emotional engagement and interest, cognitive engagement and self-regulation, and perceived competence (e.g., Kunter et al., 2007; Rimm-Kaufman et al., 2009; Seidel et al., 2005; Sierens et al., 2009; Skinner et al., 2008; Skinner & Belmont, 1993; Tucker et al., 2002; Vansteenkiste et al., 2012). For example, Skinner et al. (e.g., Skinner, Furrer, Marchand, & Kindermann, 2008; Skinner & Belmont, 1993) showed that elementary and middle school students had enhanced behavioral and emotional engagement when their teachers had been observed or reported to provide highly structured learning environments in the form of clear expectations, consistent responding, offering help, and adjusting teaching strategies to the child earlier in the school year. Sierens et al. (2009) showed that teacher-provided structure, defined as clear expectations, guidance, and feedback on tasks, was associated with high school students' self-regulated learning in the classroom.

Moreover, a variety of interventions targeting classroom structure have emerged. Programs such as the Good Behavior Game (Barrish et al., 1969), Classroom Organization and Management Program (Evertson et al., 1983), Consistency Management & Cooperative Discipline (CMCD) program (Freiberg et al., 2009), and Incredible Years Teacher Classroom Management (Reinke et al., 2014) combine many of the strategies that emerged as effective in correlational research into teacher training programs. Evidence suggests that many of these interventions are effective for supporting students' engagement and achievement, though inconsistent results have sometimes emerged.

Several prior reviews have selectively synthesized aspects of the research base. For example, Wang, Haertel, and Walberg (1993) synthesized research across numerous research reports, meta-analyses, and handbook chapters to produce a list of variables affecting student achievement. Across the cumulative evidence, classroom management emerged as a factor with the largest relationship with student achievement. More recently, Simonsen, Fairbanks, et al. (2008) conducted a systematic best evidence review to identify evidence-based practices in classroom management to inform research and practice using criteria for "evidence-based" similar to the What Works Clearinghouse standards (2022). Results of their evaluation of 81 studies identified 20 general practices that fell into 5 broad categories that met the criteria for evidence-based: (1) maximize structure and predictability; (2) post, teach, review, and provide feedback on expectations; (3) actively engage students in observable ways; (4) use a continuum of strategies to acknowledge appropriate behavior; and (5) use a continuum of strategies to respond to inappropriate behavior. Marzano (2003) and Oliver et al. (2011) meta-analyzed the literature on classroom management, with Oliver et al. limiting their review to interventions in particular. However, both of these syntheses focused on disruptive behavior and made little attempt to synthesize the work on engagement or achievement. Coming from a motivation perspective, Stroet et al. (2013) conducted a narrative review of studies appearing between 1990 and 2011 on the relationships between needs supportive teaching, including 23 studies focused on structure, and early adolescents' motivation and engagement. This review concluded that there were positive relationships between structure with motivation and engagement, particularly based on student perceptions of structure rather than teacher reports or observation. However, conclusions about which particular components of structure were most central to yielding benefits were limited by mixed findings, the small number of studies, and the narrative synthesis approach. Finally, most recently, Kopershoek et al. (2016) conducted a rigorous meta-analysis of 54 interventions appearing between 2003 and 2013 examining the effects of classroom management programs, including those that focused solely on developing positive teacher-student relationships and students' social-emotional learning, on primary school students' academic, behavioral, social-emotional and motivational outcomes. This meta-analysis suggested that primary school classroom management programs had a small, statistically significant effect ($g = 0.08$ to 0.39) on most outcomes, with stronger effects emerging for interventions focused on social-emotional development and teacher development.

Despite the obvious value of these prior review efforts, a comprehensive and systematic synthesis and meta-analysis that makes use of the extensive research across grade levels and designs, and that specifically examines the links between

teachers' observed or perceived practice of classroom structure and students' academic engagement, disengagement, competence beliefs, and achievement is needed. Our synthesis provides a useful contribution by intentionally maintaining a focus on classroom structure as a set of practices implemented by teachers with the intent to organize and guide students' school-relevant behavior. As such, this synthesis allows for precise conclusions regarding the effects of structure, as effects observed in prior meta-analyses may also have been partially driven by the inclusion of factors (e.g., positive student-teacher relationships) that go beyond structure (e.g., e.g., Kopershoek et al., 2016). Moreover, this synthesis is broader than prior reviews in terms of the target sample (e.g., Kopershoek et al., 2016; Stroet et al., 2013), methods (e.g., Oliver et al., 2011), and outcomes (Marzano, 2003). In contrast to some prior attempts (e.g., Simonsen et al., 2008; Stroet et al., 2013), this synthesis used meta-analysis. As such, this synthesis had the opportunity to formally test a variety of moderators that prior reviews could not test. In sum, this synthesis is the first to comprehensively meta-analyze evidence on the associations between classroom structure and preschool through high school students' (dis)engagement, competence beliefs, and achievement. In particular, this comprehensive synthesis provided an opportunity to better understand heterogeneity and put to test various theoretically guided hypotheses regarding the extent to which structure effects depend on the nature of outcomes, the practices included, how it is delivered, and to whom it is delivered to.

Factors that may influence the relation between structure and outcomes

Theory and research suggest that there are a number of factors that influence the relation between structure and students' educational outcomes. These factors fall into five broad categories. The categories include components of the structure and characteristics of the setting, sample, outcome, and methods.

Components of the structure variable

The nature and content of classroom structure is likely to influence the relationship between structure and students' academic outcomes. First, variation in *how the classroom structure variable has been conceptually and operationally defined* is likely to explain heterogeneity. A large portion of research on classroom structure operationalizes it as multiple teacher practices used in combination in order to support effective student behavior in the process of learning (e.g., Aelterman et al., 2019; Evertson & Weinstein, 2006; Jang et al., 2010). However, the particular combination of practices has varied across studies, with some correlational research focused on specific practices separately (e.g., Baek & Choi, 2002; Emmer et al., 1980; Helmke et al., 1986; Kunter et al., 2007). Overall, early research on instructional quality and classroom management in ecological psychology suggested that management strategies that were preventative, anticipatory, or proactive and provided clear rules, expectations, and routines, allowing students to effectively self-regulate behavior, were more consistently related to students' outcomes than strategies like rewards, intervening, and punishment that were responsive and intended to curtail undesired behavior (e.g., Emmer et al., 1980; Kounin, 1970). Somewhat in line with those findings, tenets of self-determination theory suggest that guiding and clarifying strategies like communicating expectations and procedures, creating organized lessons and materials, and providing ongoing guidance and feedback are essential to structure and supporting students' competence and engagement (e.g., Aelterman et al., 2019; Jang et al., 2010). However, other strategies that respond to and intervene in students' behavior, like monitoring, the use of signals to direct behavior, or the use of praise, encouragement, rewards and punishment are less effective because they have the potential to make students to feel controlled, even while they somewhat facilitate competence by providing information about how to successfully navigate the classroom environment and accomplish goals (e.g., Aelterman et al., 2019; Reeve, 2009; Ryan & Deci, 2017). Because of this potential to be controlling, some of these responsive strategies from a classroom management perspective, like rewards, intervening, and punishment, are not typically included at all in structure from a self-determination theory perspective. The responsive strategy of giving feedback is particularly ambiguous in its proposed effects from a self-determination perspective, as it is considered central to structure and supporting students' competence and learning but runs the risk of backfiring and lowering students' sense of competence and making students feel controlled, especially if it is negative, normative, and fails to provide sufficient information for improvement or growth (e.g., Fong et al., 2019). Given theory and prior research, the current synthesis explored whether the relationship between structure and student outcomes varied depending on the inclusion or exclusion of specific strategies. see Table 1 for strategy categories and their definitions.

The relation between classroom structure and academic outcomes might also vary depending on the extent to which it is *aligned with other separate but related supportive elements*. More specifically, motivation and classroom management scholars alike suggest that teachers' structure practices will be more likely to be perceived as support for students' competence rather than merely control of their behavior, and therefore, will be more effective, when they are delivered in an autonomy-supportive manner or with positive teacher emotions and caring (e.g., Emmer & Stough, 2001; Ryan & Deci, 2017; Sierens et al., 2009; Vansteenkiste et al., 2012). Engagement and learning emerge not only when students feel competent because they understand the structure of their environment, but also when they feel they have autonomous and cared for. Research suggests that providing structure in an autonomy or emotionally supportive way or within a broader context that includes practices like choice opportunities or expressions of caring to support students' feelings of autonomy or connectedness are more effective because students are less likely to feel controlled and more likely to adopt the

expectations, goals, guidance and rules of teachers that they believe care about them and respect their perspectives (e.g., Cheon et al., 2020). For example, Vansteenkiste et al. (2012) found that students whose teachers *both* communicated clear expectations and supported autonomy by emphasizing student choices had the most positive self-regulation and motivation outcomes relative to students whose teachers supported either just structure, just autonomy, or neither. Along the same lines, some of the classroom structure interventions that have demonstrated positive effects on students' academic behavior and performance emphasize that teachers should establish a caring climate and include students in decision-making about rules and expectations as they implement classroom structure (e.g., Freiberg, Stein & Huang, 1995; Freiberg et al., 2009). Thus, in this synthesis, we expected to find that structural practices that are delivered within a broader context of autonomy or emotional support would be more effective than practices that are not accompanied by this broader support.

Characteristics of the setting or sample

Theory and research might also suggest that the strength of the relationship between classroom structure and student outcomes varies depending on characteristics of the sample. Self-determination theory scholars have repeatedly asserted the notion of universality without uniformity (e.g., Soenens et al., 2015). When applied to structure this suggests that all students will benefit from structure. However, there may also be individual differences in how students from different backgrounds or ages appraise or experience classroom structure. On the one hand, students with special needs, including learning differences, behavioral disorders, or emotional disturbances, or with a history of poor prior achievement could be particularly likely to benefit from classroom structure, given a greater tendency toward off-task behavior and need for support that maintains on-task behavior (e.g., Lane et al., 2006). Research suggests that students with special needs or at-promise students (e.g., students who may fail to reach academic standards and have a history of poor prior achievement due to a variety of social or economic reasons) require more or higher frequencies of structural supports from teachers. It is also well-documented that students coming from low socioeconomic status homes and under-resourced urban public schools experience opportunity gaps in the form of poorer instructional quality, less effective teachers, and limited support for motivation, including in the form of structure (e.g., Darling-Hammond, 1995; Murdock, 1999; Solomon et al., 1996), that contribute to lower achievement and engagement (e.g., Murdock, 1999; Qi & Kaiser, 2003; Sirin, 2005). Moreover, there is some evidence suggesting that a variety of non-instructional practices intended to support students' experience of competence and motivation may be particularly effective for students from economically deprived backgrounds (e.g., Means et al., 1991; Tucker et al., 2002). Taken together, one possible hypothesis is that stronger desirable effects of teachers' provision of structure might emerge for *at-promise and special needs students,* who require more structure, and for *students from low income backgrounds,* who may particularly benefit from structure because it fills an important need in the context of limited overall environmental support.

Alternatively, we might also entertain the opposite predictions about the varied benefits of structure across student populations after considering how the broader context might influence students' perceptions of structure. Students from low income backgrounds and at promise students are more likely to be exposed to less positive teacher-student relationships (e.g. Murdock, 1999), poorer quality feedback (e.g., Yeager et al., 2017), more emphasis on performance (e.g., Patall et al., 2023), less support for autonomy and interests (Solomon, Battistich, & Hom, 1996), and harsher disciplinary action (e.g., Okonofua & Eberhardt, 2015). Within a broader context that may be motivationally lacking, structure may actually have fewer benefits because it may be more likely to be interpreted by students as attempts to control their behavior rather than support their competence.

Finally, although the same general principles of classroom structure are expected to apply across grade levels (e.g., Emmer et al., 1980; Everston & Emmer, 1982), developmental research suggests that students' *grade level* will moderate the strength of its relationship with student outcomes. Specifically, prior research indicates that younger students have less developed cognitive skills and behavioral control, possibly necessitating a greater need for classroom structure (Bjorklund, 2000). In contrast, adolescence is marked by an increased need to develop independence and experience a sense of self-reliance and autonomy (Erikson, 1968; Zimmer-Gembeck & Collins, 2005). Given these developmental differences and in line with self-determination theory's notion of universality without uniformity (e.g., Soenens et al., 2015), we predicted that preschool and elementary age students may benefit more from classroom structure compared to middle and high school student outcomes, though all students are expected to benefit.

Aside from these sample characteristics, we also thought it was important to explore setting characteristics. We thought it was important to explore whether the country that the research was conducted in was related to variation and whether the era in which the research was conducted might explain heterogeneity in effects, though we had no specific predictions. For era, we used publication/production year to group studies based on the following landmark reports and legislation: the emergence of *A Nation at Risk* report in 1983, the Improving America's Schools Act in 1994, and the No Child Left Behind Act of 2001. These landmark events reflected an increasing social sentiment that schools were failing and in turn, placed greater emphasis on accountability and the implementation of a variety of reform measures through acts of the United States Congress. We explored the extent to which these characteristics were related to differences in the structure-academic outcome link to appropriately contextualize findings.

Characteristics of the outcome

Theory and research suggest that classroom structure has different effects depending on the outcome (e.g., Emmer &

Stough, 2001; Jang et al., 2010). Most basically, classroom structure yields positive effects on desirable outcomes like engagement, competence beliefs, or achievement (e.g., Aelterman et al., 2019; Cadima et al., 2010; Ryan & Deci, 2017). However, it has negative effects on undesirable outcomes like disengagement (e.g., Aelterman et al., 2019; Hospel & Galand, 2016). This pattern of findings is supported by research findings (e.g. Aelterman et al., 2019; Fan, 2014; Oga-Baldwin & Nakata, 2015). Moreover, classroom structure is theorized to yield effects on outcomes such as performance and academic achievement because they have more proximal effects on outcomes such as perceptions of competence and engagement (e.g. Evertson & Weinstein, 2006; Ryan & Deci, 2017). This led to our prediction that there would be stronger relationships with *conceptually more proximal outcomes* such as engagement compared to more distal outcomes like achievement. In fact, Marzano et al. (2003) found in their preliminary meta-analysis that the effect of classroom management was stronger for engagement than for achievement. However, beyond these distinctions, the dual process model within a self-determination theory framework (e.g., Aelterman et al., 2019; Jang, Kim, & Reeve, 2016) asserts a differentiated view of teacher practice, student motivation, and student engagement. According to the dual process model, supportive practices like structure are theorized to be most strongly linked with desirable outcomes, including higher competence beliefs and engagement, rather than undesirable outcomes like disengagement. In contrast, the thwarting practices that define chaos are expected to be most predictive of undesirable outcomes like disengagement. We do not focus on chaos in this synthesis. However, in line with the dual process model, we expected to find stronger relationships between structure and engagement, competence beliefs, and achievement compared to between structure and disengagement in this synthesis. Aside from these outcome characteristics, we also thought it was important to explore whether subject domain for the outcome was related to variation in the relationships, though a theoretical reason for expecting variation was limited.

Characteristics of the methods

Finally, studies investigating the link between classroom structure and educational outcomes have varied in the methods used. Among the interventions, studies have varied in whether random assignments to conditions were used versus a quasi-experimental design with either an equivalent, through matching or equating, or nonequivalent control group. They also varied in whether pretest measures were taken and the level of assignment to conditions. Interventions also varied in whether features (e.g., confounds) that go beyond training teachers to implement structure were present and the extent to which control groups remained completely unexposed to aspects of the intervention (e.g., diffusion), potentially biasing results (e.g., Cook et al., 2002). We expected that smaller effects would be likely to emerge in studies that used random assignment, matching or equating, and included pretest measures, as nonequivalence in the design biases effects (Cook et al., 2002), often leading to larger effects because those who are inclined to use or benefit from structure volunteer to receive the intervention. We also expected stronger effects in studies without confounds or diffusion because, in the case of this research, we thought both were likely to dilute the extent to which the benefits of structure could be realized or detected. We also expected stronger effects in studies that assigned teachers or students rather than schools to condition, given the nature of the construct as a teacher practice, making it important to target the intervention to teachers and students in order for it to be most effective.

Central to the design characteristics of correlational data, studies varied in whether observational or survey measures of predictors and outcomes were used. Studies also varied in who provided information about classroom structure or student outcomes, whether it was students, teachers, or research observers, and the level of analysis used. Given the importance of personal perception in psychological experiences of motivation and engagement (e.g. Linnenbrink-Garcia & Patall, 2015), we expected stronger correlations when survey measures were used and when students were the respondent, particularly for (dis)engagement and competence beliefs. We did not expect that this pattern would necessarily emerge for achievement outcomes, given that the student achievement outcomes do not reflect personal perception. In fact, we expected that observation and teacher reports of structure might yield stronger correlations with achievement outcomes, assuming that more similar assessment methods are often more strongly correlated (Podsakoff et al., 2003). We also thought it was important to explore whether the unit of analysis might explain variation in correlations, though we did not make specific predictions.

The current meta-analysis

We conducted the first comprehensive, quantitative meta-analytical review of the relationship between teachers' provision of structure in the classroom and students' engagement, competence beliefs, disengagement, and achievement outcomes. We examined published and unpublished correlational and intervention research on classroom structure and tested theoretically and practically meaningful moderators to advance understanding of when and how structure relates to student outcomes. To ensure that subtle, but important, distinctions in the interpretation of findings from correlation versus intervention designs were not lost, we synthesized correlational and intervention research separately. This twofold synthesis approach allowed us to maintain the distinction in the questions being addressed by each design. Whereas correlational research addresses the extent of the association between teachers' provision of classroom structure practices as they naturally occur and student outcomes, intervention research addresses the extent to which classroom structure trainings and manipulations are effective in supporting students' desirable school outcomes. Moreover, this twofold synthesis approach allowed us to use the most natural metric for each design, correlations versus

standardized mean differences, and explore methodological moderators relevant to each specific design. Our review of the literature suggested a set of theoretical, practical, and methodological predictions and exploratory analyses that are summarized, along with the findings, in Table 2.

Method

Literature search procedure

We collected studies from multiple sources and included exhaustive search strategies meant to uncover both published and unpublished research. First, we searched for relevant reports in *ERIC*, *PsycINFO*, and *ProQuest Dissertation & Theses Full Text* electronic databases using a broad array of subject terms. See Table S1 in supplemental materials for a list of all terms and searches. We conducted searches in these databases initially in September 2016 and updated searches in April 2022. Preliminary review of the title and abstract for 17,592 non-duplicate documents retrieved from library electronic database searches were examined by the first author or one of four graduate student authors with expertise on classroom context and motivation. Researchers were overly inclusive at this stage and only excluded articles that were clearly on an irrelevant topic. From this search, we attempted to retrieve full texts for 1,649 reports, 272 of which we could not obtain. The first author examined all full texts for inclusion, with a graduate student independently checking decisions. In total, we retained 250 reports for coding from this search.

We conducted searches within *Social Science Citation Index* initially in April 2017 and again in May 2022 to retrieve reports that had cited 15 prominent papers or books on classroom structure (Anderson et al., 1980; Brophy, 1986; Emmer et al., 1980; Emmer & Stough, 2001; Evertson, 1985, 1989; Evertson et al., 1983; Evertson & Emmer, 1982; Evertson & Weinstein, 2006; Jang et al., 2010; Kounin, 1970; Kounin & Obradovic, 1968; Sanford et al., 1983; Skinner et al., 1998; Skinner & Belmont, 1993). This search yielded 2,787 reports for which titles and abstracts were examined by either the first author or one graduate student author instructed to be overly inclusive. Of these, we retained 492 non-duplicate reports that were unique relative to our electronic database search for full-text screening, of which 29 full texts could not be obtained. The first author examined all full texts for inclusion, with a graduate student independently checking decisions. In total, 50 new reports were retained from this search for coding.

We searched the reference sections of 7 relevant reviews (Emmer & Sabornie 2015; Emmer & Stough, 2001; Korpershoek et al., 2016; Marzano et al., 2003; Oliver et al., 2011; Sabey et al., 2017; Stroet et al., 2013) and all included reports. This search yielded 468 non-duplicate potentially relevant reports that were unique relative to prior searches. Full texts for 450 reports (18 could not be found) were retrieved and examined by the first author and a graduate student author. In total, we retained 50 new reports for coding from this search.

We sent solicitations for research to 13 professional organizations or divisions of organizations (i.e., American Educational Research Association Divisions C and K, American Educational Research Association Special Interest Groups on Classroom Management and Motivation in Education, American Psychological Association Division 7, 8, 15, and 16, The Society for Research on Educational Effectiveness, Society for Personality and Social Psychology, Society for Research on Child Development, Society for Research on Adolescence, Society of the Study of Motivation) in December 2017 and again in November 2022. We also sent solicitations for research to 39 productive researchers who had published two or more reports already included in our database in in June 2018 and November 2022. These searches yielded 71 unique reports, 30 of which we retained for coding after being examined by the first author.

In an initial phase of the project, we used several additional search strategies as well. We searched for relevant reports in *Google Scholar* using a broad array of subject terms (see Table S1 in supplemental materials). From this search, 5,800 partly unique and partly overlapping documents were examined by the first author or one of four graduate student authors, the full-texts of 31 of these documents was retrieved, and 6 were retained for coding. We also searched the funding archives of the William T. Grant Foundation, Spencer Foundation, and the Institute of Education Sciences in February 2017 using 90 different search terms to locate for relevant research projects (see Table S2 in supplemental materials for all search terms). This search yielded 777 projects, 19 of which were identified as potentially relevant by one graduate student author. We contacted principal investigators of these projects for reports. These investigators provided 12 additional reports, 4 of which were retained for coding as determined by the first author. We also sent solicitations for research to seven federally funded Regional Education Laboratories in March 2018 and 242 deans or department chairs in research-intense schools of education in March 2018, with no unique responses relative to other search strategies.

Across all search strategies, we examined 27,530 records or reports of studies for inclusion based on titles, abstracts, and full texts, of which we retained 422 for coding, including 32 reports obtained through the authors' personal reading. Of those, 223 met inclusion criteria and could be coded completely, 96 were determined at the coding stage to not meet inclusion criteria, and effect information was insufficient for 103 reports. Figure 1 provides a PRISMA flow diagram of the literature search process.

Inclusion criteria

To be included in the meta-analysis, a study needed to meet the following criteria. (a) Classroom structure, as previously defined, must have been measured or manipulated in an independent groups design that included a control condition. (b) The study must have involved students from preschool through high school and the provision of structure in

Table 2. Summary of support for hypotheses.

	Hypothesis Supported?	
Overall Hypotheses	Correlational Evidence	Intervention Evidence
1. Positive association between structure and:		
a. achievement	✓	✓
b. behavioral engagement	✓	✓
c. emotional engagement	✓	ns
d. cognitive engagement	✓	–
e. overall engagement	✓	✓
f. competence beliefs	✓	ms
2. Negative association between structure and:		
a. behavioral disengagement	ns	✓
b. emotional disengagement	ns	–
c. cognitive disengagement	–	–
d. overall disengagement	ms	✓

	Correlational Evidence				Intervention Evidence		
Moderator Hypotheses	A + E	ACH	ENG	CB	DISENG	A + E	ACH	ENG
3. Stronger association (relative to predicted direction) for:								
a. observations of structure for ACH	–	✓	–	–	–	–	–	–
b. surveys of structure for (DIS)ENG or CB	–	–	✓	ns	ns	–	–	–
c. teachers/researchers responded to structure measures for ACH	–	✓	–	–	–	–	–	–
d. students responded to structure measures for (DIS)ENG or CB	–	–	✓	ns	ns	–	–	–
e. students responded to outcome measures	–	–	ns	ns	ns	–	–	–
f. interventions assigning teachers/students to conditions	–	–	–	–	–	✓	ns	ms
g. includes anticipatory strategy (expectations/goals)	–	ns	✓	ns	✓	–	ns	ns
h. includes anticipatory strategy (rules/routines)	–	ns	ms	ns	ns	–	ns	ns
i. includes anticipatory strategy (lesson organization)	–	ns	✓	ns	ns	–	ns	ns
j. includes anticipatory strategy (elicit student involvement)	–	ns	ns	ns	ns	–	ns	ns
k. accompanied by autonomy/emotion support	–	✓	ns	ns	–	–	ns	ns
l. elementary age students	–	ns	ns	ns	ns	–	ns	ns
4. Weaker association (relative to predicted direction) for:								
a. interventions using random assignment	–	–	–	–	–	–	ns	ns
b. interventions with matching or equating	–	–	–	–	–	–	ms	ns
c. interventions with pretest	–	–	–	–	–	–	ns	✓
d. interventions with confounds	–	–	–	–	–	–	ns	ns
e. includes responsive/controlling strategy (monitoring/signals)	–	ns	cs	ns	ns	–	ns	✓
f. includes responsive/controlling strategy (feedback)	–	ns	ns	✓	ns	–	ns	ns
g. includes responsive/controlling strategy (rewards/punishment)	✓	ns	ns	ns	✓	–	ns	ns
Exploratory Moderators								
5. Unit of analysis (student versus teacher/class/school)	–	ns	ns	ns	ms	–	–	–
6. Low income students	–	ms	✓	ns	ns	–	ms	ns
7. At-promise or special needs students	–	ns	ns	–	ns	–	ns	ns
8. Country moderates structure-outcome association	–	ns	ms	ns	ns	–	✓	ns
9. Era moderates structure-outcome association	–	ns	ns	–	ns	–	ns	✓
10. Subject domain moderates structure-outcome association	–	ns	ns	ns	–	–	ns	ns

Note. ✓= hypothesis supported ns = hypothesis not supported. ms = hypothesis not supported, but marginally significant. cs = counter support to hypothesis. Dashes indicate the moderator analysis was either irrelevant to the dataset or evidence was insufficient. A + E = Combination of achievement and engagement (desirable outcomes). ACH = Achievement. ENG = Engagement. CB = Competence beliefs. DISENG = Disengagement.

an authentic classroom by a teacher. (c) Studies must have assessed the relationship between classroom structure and students' engagement, disengagement, competence beliefs, or achievement outcomes. (d) Reports must have been written in English. Finally, (e) reports must have provided information to retrieve or calculate an effect size. Additional details related to the inclusion criteria can be found in Table 3.

Data extraction

Research assistants extracted a variety of information from each study identified as meeting our inclusion criteria. Coders were the first author, as well as graduate and undergraduate research assistants who participated in training to code for this meta-analysis. Training was a sequential process of discussing the meaning and conventions for each code, practice coding and comparisons as a group, and practice coding as individuals. Following training, coders were allowed to code independently after reaching 80% agreement with the first author or another master coder who had already established agreement. Two coders independently extracted information from all reports and/or the first author extracted codes that were verified by a second coder. Coders noted all discrepancies and resolved them through discussion and if necessary, consultation with the first and other authors. The average agreement rate prior to resolving disagreements through discussion was 90% across all correlational study codes and 86% across all interventions study codes. When effect size information was missing, we contacted authors to provide missing information.

The research team coded numerous different characteristics of each study. These characteristics encompassed seven broad distinctions among studies: (a) the research report, (b) the research design, (c) the setting, (d) the sample, (e) the predictor variable/intervention, (f) the academic outcome measure, and (g) the estimate of the relation between

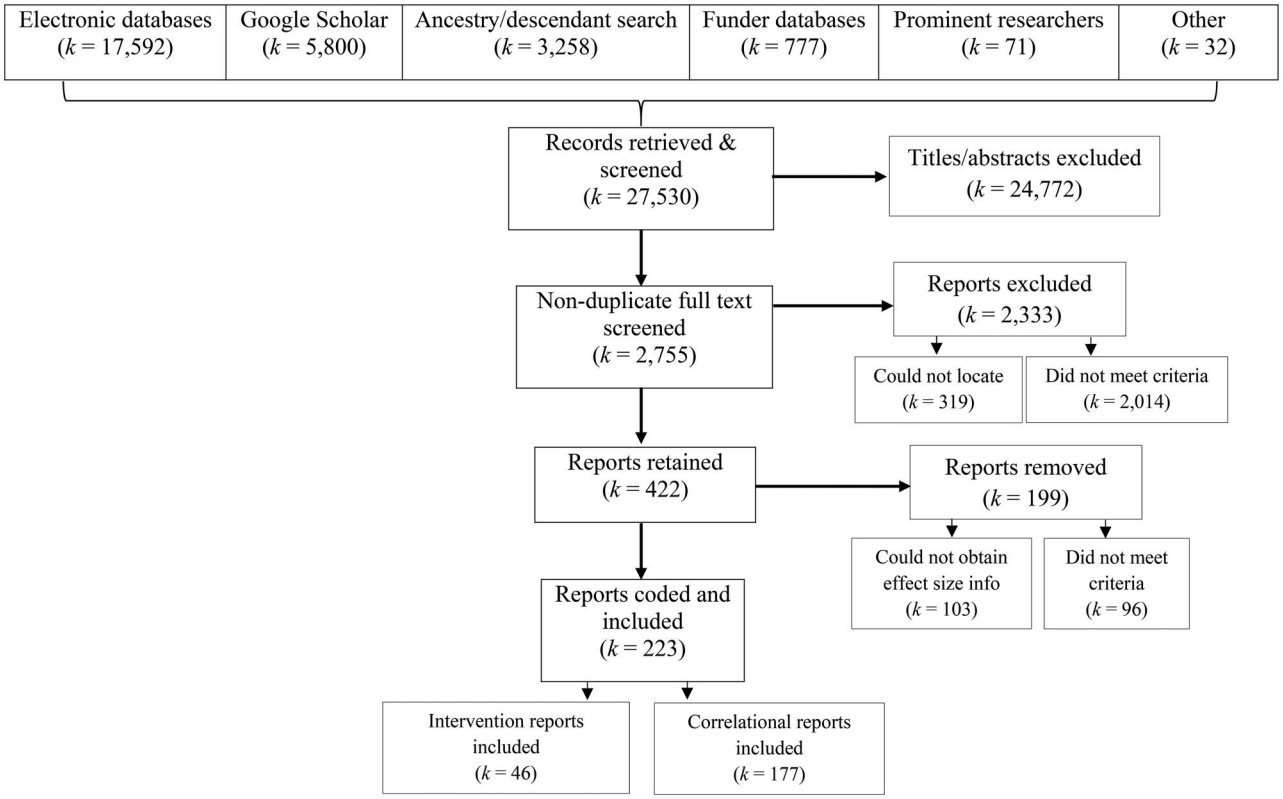

Figure 1. PRISMA chart.

classroom structure and the student academic outcome. If a single report included correlational and intervention findings, both sets of findings were coded to be included in meta-analyses of both datasets. Table S3 in supplemental materials lists all codes and response options. Below we describe key codes.

Research report

First, we coded basic information about the studies in our dataset, including the author, year in which the report was published or produced, type of report, and whether the research was funded. Type of report was recoded to group studies into published and unpublished for moderator analyses. Year was used to group studies into four categories for moderator analyses focused on political era.

Design

For intervention studies, we coded random assignment procedures, level of assignment, the presence of equating techniques. We also coded the presence and nature of confounds, contaminants, or diffusion. Each of these codes were used in moderator analyses.

Setting

For information related to setting, we coded the country and state, type of community, type of school, and the type of classrooms participating in the research. We also coded the percent of students receiving free or reduced lunch in the schools participating in the research. Country was used as a setting moderator in analyses.

Sample

For information related to the sample, we coded how students in the sample were described in terms of income or socioeconomic status, grade level of the sample, ability or prior achievement labels applied to the sample, and whether psychiatric labels were applied to the sample. We also collected information on the percentage breakdown of the sample by race, gender, and qualification for free or reduced-price lunch and attempted to collect information related to teacher characteristics and experience; variation was limited or information was infrequently reported for these codes. We recoded income/socioeconomic status of the sample to compare low to mixed, middle, or high income samples and grade level to compare preschool and elementary to middle and high school students in moderator analyses. Ability, achievement, and psychiatric label information were recoded and combined to compare students considered at-promise (e.g., low prior achievement history) or having special needs (e.g., low ability, learning difference, behavioral or emotional disorder) to others in moderator analyses.

Predictor/intervention

To capture the nature of the structure, we used the operational descriptions provided in reports of structure measures and structure interventions to code whether a variety of elements were assessed or manipulated and then collapsed

Table 3. Inclusion and exclusion criteria.

Category	Inclusion criteria	Details and exclusions
Participants	The study must involve students from preschool through high school.	• Studies conducted with postsecondary student samples were excluded.
Predictor/ Intervention	Classroom structure, defined by an assortment of practices intended to organize and guide students' school-relevant behavior, must have been measured or manipulated.	• Included observations, teacher reports, and measures of student perceptions of teacher behavior related to providing structure. • Structure measures needed to focus teacher behavior, that is, on what the teacher was doing to organize or guide students' school-related behavior. • To maintain the distinction between structure (as a set of observable teaching practices intended to organize and guide students' school-relevant behavior) from other related constructs (e.g., including teachers' emotional support, teacher caring, positive student-teacher relationships, positive classroom climate, teacher interest, teacher respect, and teacher expectations), we excluded measures of students' general sense of the emotional or motivational climate and measures of teachers' privately held beliefs or expectancies about students (e.g., Wentzel, 1997). • Excluded studies exclusively focused on classroom architecture, advance organizers, and perceptions of goal orientation structure without specific reference to teacher behaviors. • Interventions focused on social-emotional learning (SEL) interventions were included if they focused on manipulating teachers' practices related to creating structure in the classroom (e.g., Catalano et al., 2003), but excluded if the manipulation was focused on directly altering students' behavior (through curriculum or otherwise; e.g., Arda & Ocak, 2012).
Control/ Design	Intervention studies must use an independent groups design that included a control condition.	• Both correlational (including longitudinal) and intervention studies were included. • Both observational and survey methods were acceptable. • Intervention studies may have used either an experimental or quasi-experimental design in which an exogenous manipulation (one or more) intended to influence classroom structure was administered (e.g., teachers were provided instructions or training related to implementing structure) and educational outcomes were measured. • For all intervention studies, there needed to be at least one control condition that focused on business as usual, the absence of structure attempts and trainings on providing structure, or low levels of structure. • Intervention studies in which there was no control condition were excluded.
Outcomes	Studies must assess the relationship between classroom structure and students' academic motivation, engagement, or achievement outcomes.	• Academic engagement, disengagement, positive competence beliefs, or achievement outcomes were included. • Measures of engagement could have assessed specific components (behavioral, cognitive, emotional, agentic) of (dis)engagement or a combination of (dis)engagement components. Given its recent appearance in literature, only combined engagement measures included agentic engagement. • Outcomes could have been measured through student or teacher reports, observations, or school records. • Outcomes that could not be classified as any of the above engagement, disengagement, competence self-beliefs, or achievement outcomes were excluded.
Effects	Reports must provide information to retrieve or calculate an effect size.	• Studies in which correlations or effects could not be retrieved, even after contacting authors for information, were excluded.
Setting	The provision of structure must occur in an authentic classroom and be implemented by a teacher.	• To maintain a focus on authentic classroom practices, studies in which structure was implemented by a researcher, consultant, or counselor rather than a teacher were excluded, even if conducted within an authentic classroom.
Other	Reports must be written in English.	• Studies could be conducted in any country, but report must be written in English.

across these elements to create broader categories in analyses. We categorized the components of structure into the following groups: (1) expectation/goal-setting, (2) establishing rules, routines, and procedures, (3) organization of lessons and materials, (4) monitoring and signals, (5) feedback, (6) use of rewards and punishment, and (7) eliciting student involvement. See Table 1 for definitions of each component. We note that the last two categories, (6) and (7), are typically only included in research from classroom management perspectives. In addition, we coded whether structure was accompanied by support for autonomy or emotional support. As many studies combined a variety of approaches to structure, we examined whether structure contained each of the seven elements of structure in moderator analyses, as well as the explicit presence of either support for autonomy or positive emotion versus not. We also coded whether the target of structure was behavior or learning, whether structure was provided within the context of whole class instruction, individual work, or group work, and the procedural and cognitive complexity of the tasks for which structure was provided. However, the target of structure was often mixed or ambiguous, the focus of nearly all studies was whole class instruction, and information about complexity was rarely reported.

For correlational research specifically, we coded how structure was measured, whether the report explicitly indicated that the measure was validated, the measure respondent, and information about the reliability of the measure.

After taking into account variability and missing information, correlational moderator analyses focused on the structure measure respondent and comparing survey/written measures to observations. For intervention research, we also coded information about the nature of the training teachers received, time devoted to training, whether the report indicated that the intervention met criteria for good treatment fidelity, and the nature of the control condition. However, we did not include intervention characteristics moderators given the availability and variability of data related to these factors.

Academic outcome

We coded the nature of the academic outcome with great specificity and then collapsed into categories for analyses. Outcomes were organized around the following categories: (1) academic achievement, (2) behavioral engagement, (3) emotional engagement, (4) cognitive engagement, (5) behavioral disengagement, (6) emotional disengagement, (7) cognitive disengagement, and (8) competence beliefs. See Table 1 for definitions of each outcome category. This categorization was guided by existing theory that distinguishes engagement from disengagement (e.g., Skinner et al., 2008), conceptualizes engagement and disengagement each as broad constructs that include multiple distinct subtypes (e.g., Fredricks et al., 2004), and distinguishes (dis)engagement from achievement and self-beliefs (e.g., Skinner et al., 2008). We also note that we chose to include intrinsic motivation and intrinsic value within the emotional engagement category, despite distinct theoretical traditions (e.g., Eccles & Wigfield, 2023; Ryan & Deci, 2017) relative to the literature on engagement (e.g., Fredricks et al., 2004). The common focus on interest related to schoolwork across these outcomes and challenges associated with distinguishing measures of intrinsic motivation, interest, and emotional engagement informed this choice. We also coded the outcome domain, how achievement outcome was obtained, how the non-achievement outcomes were measured, whether the report indicated the measure was validated, the measure respondent, and information about the reliability of the measure.

We examined correlations and intervention effects for each outcome category separately, as well as for engagement and disengagement collapsed across components. We coded outcomes that were a combination of engagement or disengagement types and included those in the synthesis when examining engagement or disengagement outcomes all together, but did not include these in analyses of specific outcome categories. We recoded domain into the following categories: general or mixed academics, science or math, language arts, physical education, and other domains. However, we compared only science or math to language arts in moderator analyses, as these were two largest discrete domains, with other discrete domains having few studies. Moderator analyses with correlational studies also focused on outcome measure respondent.

Effect size

We extracted a variety of statistical information from primary studies including bivariate correlations (r) for correlational studies and pre- and post- intervention means, standard deviations, pre-post measure correlations, and sample sizes on outcomes for both groups in intervention studies. We captured a variety of information from statistical tests in intervention studies to compute effect sizes if descriptive information was missing. In addition, we coded the length of time between the structure intervention or measure and the outcome measure and the unit of analysis for the effect/correlation, the latter of which was used in moderator analyses.

Computing effect sizes

For the correlational studies, we extracted Pearson's product moment correlation (r). We used Fisher's z scale in order to stabilize the sampling distribution of the effect sizes and then back-transformed Fisher z scale estimates to the scale of Pearson correlations for reporting and interpreting the results. As necessary, when a correlation was not reported, we attempted to calculate r based on the information reported in primary studies using relevant transformation formulae (e.g., Borenstein et al., 2011).

We calculated effect sizes for intervention studies as standardized mean differences (SMD) on outcome measures between structure and control groups. We calculated effect sizes directly from the means, standard deviations, and sample sizes for the intervention and control groups whenever possible. When effect sizes were not able to be calculated this way, we computed them from F ratios, t-statistics, or chi-square statistics (see Lipsey & Wilson, 2001 for conversion formulas). For studies that included multiple structure conditions compared to a single control condition, we calculated the effect size for each intervention condition separately.

We converted effect size estimates for the different experimental designs to the independent groups' (IG) metric (Morris & DeShon, 2002). Many studies assessed an intervention's effect on student outcomes using an independent groups' (IG) posttest only design. However, others used an IG repeated measures (RM) design that required the use of alternative formula that involves taking the difference between separate RM effects computed for intervention and control groups (Morris & DeShon, 2002). For studies reporting ANCOVA results, we used the equations in Borenstein (2009). Formulas for repeated measures designs require the correlation between pre- and post-test measures. We used the median estimate of this value reported in other included studies for studies that did not provide it. We converted all intervention effect sizes to small sample bias corrected Hedge's g (Hedges, 1981). Some intervention studies' results were based on datasets that involved the assignment of conditions to clusters of students within classrooms or teachers/classrooms within schools. Ignoring the clustered structure may result in underestimated standard errors for the associated effects. Thus, we adjusted the effect sizes and the

variances using formulae introduced in Hedges (2007) and later corrected in Taylor, Pigott, and Williams (2022) and the What Works Clearinghouse Procedures Handbook v. 5.0 (2022). For this correction, an intraclass correlation coefficient (ICC) estimate is required, but it is not always reported by primary studies. When not reported, we imputed the median ICC estimate of the class and school levels reported from other studies in our dataset. Regardless of the specific formula, a positive *g* value indicated that the outcome was greater in the structure condition compared to the control condition.

Across all designs, we coded effects separately for studies with multiple samples or multiple outcomes. We computed the effect size estimates in R statistical software (R Core Team, 2023) either directly or using the metafor R package (Viechtbauer, 2010). Prior to analysis, we also examined the distribution of effect sizes for correlational and intervention studies separately to determine if any studies contained outliers. We detected 13 outliers among the correlational studies and 3 outliers among the intervention studies using Tukey's definition (values more than 1.5 times the interquartile range from the quartiles). However, we left outliers as is because their magnitude might be explained by moderators in meta-regression.

Analysis strategy

To maintain important distinctions, we meta-analyzed correlational and intervention data separately using the *metafor* and *clubSandwich* R packages (Pustejovsky, 2022; Viechtbauer, 2010). We used random-effects modeling throughout the analyses. To account for the dependency between multiple effect size estimates within studies and guard against potential model misspecification, we adopted multi-level modeling approach in conjunction with robust variance estimator (RVE; Pustejovsky & Tipton, 2022). Specifically, we used correlated and hierarchical effects (CHE) type working model for RVE that entails both correlated and hierarchical dependency structure among effect size estimates. The CHE working model is appropriate to choose when there is little information about correlations between effect size estimates (Pustejovsky & Tipton, 2022).

We fitted different random-effects models to estimate the pooled effect sizes for (a) each outcome category (i.e. achievement, behavioral engagement, competence beliefs, etc.), (b) across engagement outcomes (i.e., behavioral engagement, cognitive engagement, behavioral engagement, mixed/general engagement, etc.), and (c) across all disengagement outcomes (i.e., behavioral disengagement, emotional disengagement, cognitive disengagement). We also assessed the heterogeneity among effect sizes, indicated by Q, $\tau^{2,}$ and I^2 statistics. We reported 95% confidence intervals (CI) and 95% prediction intervals (PI) for each weighted average effect (Borenstein et al., 2011). For both CI and PI, we incorporated cluster-robust variance estimation (CRVE) for the standard errors and a small sample correction for the critical values (Tipton, 2015).

To further explain heterogeneity in the effect size estimates, we utilized mixed-effects meta-regression models for achievement, engagement (across types), competence beliefs, and disengagement (across types) outcomes separately. For the structure intervention dataset, we only examined moderators for achievement and engagement, given the small number of intervention studies contributing to the average effects for disengagement and competence beliefs. We opted to examine moderators across multiple types of engagement and disengagement to maintain high statistical power and because we expected a similar pattern and direction of moderation across (dis)engagement outcomes. We examined the effect of each moderator in separate models that included only the focal moderator and covariates to control for indicators of methodological quality. For the moderator analyses with correlational data, we included three methodological covariates, publication status, unit of analysis, and structure measure respondent. For the moderator analyses with interventions, we included four methodological covariates, publication status, assignment/matching procedure, adjustment by pretest, and the presence of confounds or diffusion. In cases where the pattern of moderation for a specific factor was the same across achievement and engagement outcomes and promising ($p \leq .20$) despite low statistical power, we conducted a follow-up moderator analysis for the factor that collapsed across achievement and engagement outcomes. Finally, we examined the possibility of publication bias and funnel plot asymmetry by conducting a modified version of Egger's regression (Egger et al., 1997) that accounted for the dependent effect sizes (Rodgers & Pustejovsky, 2020). This meta-analysis was not pre-registered. However, the coding guides, data, and analysis scripts for all analyses can be found at https://osf.io/v8p7s/.

Results

We identified 223 total articles (182 published and 41 unpublished). Of these, we identified 177 reports (146 published and 31 unpublished) of 165[1] correlational studies containing 191 samples and 1,497 correlation coefficients and 46 reports (36 published and 10 unpublished) of 46 intervention studies containing 71 samples and 309 effect sizes. The authors, sample sizes, and effect sizes for these studies are listed in Table S4 and S5 of the supplemental materials, along with other study characteristics. Correlational studies appeared between 1968 and 2022 and intervention studies appeared between 1972 and 2022. For correlational studies, the sample sizes ranged from 8 to 61,879, with the total sample size of 260,339. For intervention studies, the sample sizes ranged from 11 to 3,188, with the total sample size of 25,577.

[1]We note that the number of correlational studies was less than reports because some reports ($N = 16$ overlapping reports) were reporting on the same datasets ($N = 4$ independent datasets across 16 reports). In cases where we had multiple reports of the same study/sample, we consolidated information from all reports as one study.

Overall correlations and effects for structure

In line with hypotheses (see Table 2, hypotheses 1a through 1f), the pooled average correlation for structure was positive and statistically significant for all of the desirable outcomes: achievement ($r = .11$, $p < .001$), behavioral engagement ($r = .23$, $p < .001$), emotional engagement ($r = .22$, $p < .001$), cognitive engagement ($r = .23$, $p < .001$), and competence beliefs ($r = .22$, $p < .001$). Based on the interventions, the pooled average effect size of the difference between structure interventions and control groups was positive and statistically significant for both achievement ($g = 0.33$, $p < .001$) and behavioral engagement ($g = 0.42$, $p < .002$). These are medium size effects of education interventions (e.g., Hattie, 2009). The average effect size for the difference between structure interventions and control groups was positive and statistically significant for cognitive engagement as well; however only one study contributed to the effect. Contrary to predictions, the average structure intervention effect was not statistically significant for emotional engagement ($g = 0.26$, $p = .14$) and was marginally statistically significant for competence beliefs ($g = 0.26$, $p = .08$). Collapsing across subtypes, the average correlation was positive and statistically significant for combined engagement ($r = .28$, $p < .001$), as was the average effect of structure interventions on combined engagement ($g = 0.46$, $p < .001$).

Contrary to our hypotheses (see Table 2, hypotheses 2a through 2d), the pooled average correlation for structure was statistically non-significant for both behavioral disengagement ($r = .10$, $p = .21$) and emotional disengagement ($r = -.08$, $p = .23$). The average correlation was statistically significant for cognitive disengagement; however only one study contributed to the average correlation. Based on the interventions, the average effect size of the difference between structure intervention and control groups was negative and statistically significant for behavioral disengagement ($g = -0.38$, $p < .04$). There was only one intervention that assessed emotional disengagement and none assessed cognitive disengagement. The average correlation was negative, but not statistically significant for combined disengagement ($r = -.08$, $p = .07$). However, the effect of structure interventions on combined disengagement was negative and statistically significant ($g = -0.37$, $p < .03$). Overall pooled correlations and effects are summarized in Table 4 and a graphical summary the support for hypotheses can be found in Table 2.

Publication bias among structure correlations and structure intervention effects

The results from the modified Egger's regression model suggested that there was no evidence of funnel plot asymmetry for the correlational dataset ($b = .53$, $SE = .45$, $t(36.95) = 1.17$, $p = .25$). Likewise, the moderator analysis comparing published and unpublished reports indicated that the pooled correlations did not statistically significantly differ by publication status for achievement, engagement, or positive self-belief outcomes (see Tables 5–7). Effects did differ by publication status for disengagement, with the average negative correlation being statistically significantly stronger for unpublished studies ($r = -.35$) than published studies ($r = -.08$; $b = -.28$, $p < .05$). However, there were only 3 unpublished studies.

Likewise, the results from the modified Egger's regression model suggested that there was no evidence of funnel plot asymmetry for the intervention dataset ($b = -0.003$, $SE = .52$, $t(16.67) = -0.006$, $p = .996$). We also tested for article status (published vs. unpublished) as a between-study moderator among interventions. The average effect did not statistically significantly differ by publication status for either achievement or engagement outcomes (see Tables 5 and 6).

Moderator analyses

The results of all moderator analyses are reported in Tables 5, 6, and 7. Limited variability and missing information prevented a reliable analysis with sufficient statistical power for some moderators. We did not report results for moderator analyses that involved fewer than three studies in a subgroup. A graphical summary of the extent to which hypotheses were supported in moderator analyses can be found in Table 2.

Study methods and measurement moderators

We examined whether characteristics of the study methods and measurement explained heterogeneity in structure correlations and structure intervention effect size estimates. For correlational studies, the moderators we examined included: (1) unit of analysis, (2) type of measurement for the structure variable, (3) respondent to the structure measure, and (4) respondent to the outcome measure (see Table 2, hypotheses 3a through 3e and exploratory moderator 5). For interventions, we examined: (1) whether random assignment was used, (2) whether matching or equating was used, (3) whether effects were adjusted by pretest outcomes, (4) level of assignment, and (5) whether confounds or diffusion were present in either the intervention or control condition (see Table 2, hypotheses 3f and 4a through 4d).

Among those moderator analyses, type of structure measure and respondent to the structure measure explained statistically significant differences in the correlations with both achievement and engagement outcomes. Whether the effect was adjusted by a pretest score explained statistically significant differences in the effects of structure interventions on engagement outcomes. No other methods moderators were statistically significant when examined separately for each outcome (e.g., achievement, engagement, etc). However, we found that level of assignment explained statistically significant differences in the effects of structure interventions on student achievement and engagement outcomes when the two outcomes were examined together in the same analysis.

More specifically, consistent with our hypotheses, the correlation between structure and achievement was statistically significantly greater when the structure measure was an observation ($r = .15$) compared to a survey ($r = .06$; $b = -.09$, $p < .05$; see hypothesis 3a in Table 2) and when researchers observed structure in the classroom ($r = .15$) compared to when students reported on structure ($r = .06$; $b = .10$, $p < .05$; see hypothesis 3c in Table 2). The average

Table 4. Overall average correlations between structure and outcomes and average effects of structure interventions.

Correlations

Outcome	*k*	N_S	N_{ES}	*r*	95% CI Low/High	τ^2	I^2	*Q*	95% PI Low/High
Achievement	80	96	506	.11***	.06/.17	0.03	98.70	138,724.00***	−.20/.41
Behavioral engagement	67	75	275	.23***	.16/.31	0.03	98.70	138,724.00***	−.08/.51
Emotional engagement	58	58	189	.22***	.16/.29	0.03	98.70	138,724.00***	−.10/.50
Cognitive engagement	24	24	103	.23***	.16/.30	0.03	98.70	138,724.00***	−.11/.52
Competence beliefs	43	44	160	.22***	.17/.27	0.03	98.70	138,724.00***	−.10/.50
Behavioral disengagement	21	25	130	.10	−.06/.27	0.03	98.70	138,724.00***	−.26/.45
Emotional disengagement	17	19	48	−.08	−.21/.06	0.03	98.70	138,724.00***	−.43/.29
Cognitive disengagement	1	1	2	−.27***	−.33/-.21	0.03	98.70	138,724.00***	−.67/.25
Combined engagement	112	124	601	0.28***	0.24/0.31	0.03	99.00	56,250.91***	−.08/.57
Combined disengagement	32	36	180	−0.08†	−0.16/0.006	0.02	99.18	19,415.79***	−.36/.22

Interventions

Outcome	*k*	N_S	N_{ES}	*g*	95% CI Low/High	τ^2	I^2	*Q*	95% PI Low/High
Achievement	31	44	153	0.33***	0.22/0.45	0.04	90.66	3,513.63***	−0.09/0.75
Behavioral engagement	21	26	62	0.42***	0.18/0.65	0.04	90.66	3,513.63***	−0.07/0.90
Emotional engagement	7	13	25	0.26	−0.13/0.64	0.04	90.66	3,513.63***	−0.41/0.92
Cognitive engagement	1	1	4	1.09***	1.08/1.09	0.04	90.66	3,513.63***	−1.40/3.57
Competence beliefs	5	7	10	0.26†	−0.05/0.57	0.04	90.66	3,513.63***	−0.40/0.92
Behavioral disengagement	11	12	36	−0.38*	−0.72/-0.04	0.04	90.66	3,513.63***	−0.94/0.19
Emotional disengagement	1	1	1	0.20	−0.19/0.59	0.04	90.66	3,513.63***	−0.91/1.31
Combined engagement	29	38	94	0.46***	0.27/0.65	0.06	91.93	3,840.11***	−0.06/0.98
Combined disengagement	11	12	37	−0.37*	−0.69/-0.05	0.05	91.15	3,593.18***	−0.97/0.23

Note. *k* = number of studies. N_S = number of samples. N_{ES} = number of effects. *r* = correlation (pooled average correlation converted from Fisher's *z* metric). *g* = Hedges' *g* (average pooled effect). CI = confidence interval. PI = prediction interval. Low = lower estimate. High = upper estimate. †$p \leq 0.10$, *$p < .05$, **$p < .01$, ***$p < .001$.

correlation between structure and achievement was not statistically significantly different comparing studies in which students versus teachers ($r = .03$) reported on structure ($b = -.02$, $p = .76$) or comparing when researchers observed structure to when teachers reported on structure ($b = -.12$, $p = .18$). Also consistent with our hypotheses, the correlation between structure and engagement was statistically significantly greater when the structure measure was a survey ($r = .33$) compared to an observation ($r = .20$; $b = .14$, $p < .001$; see hypothesis 3b in Table 2) and when students reported on their teachers' provision of structure in the classroom ($r = .33$) compared to when teachers reported on structure ($r = .14$; $b = -.20$, $p < .001$) or researchers observed structure ($r = .20$; $b = -.14$, $p < .001$; see hypothesis 3d in Table 2). The average correlation between structure and engagement was not statistically significantly different comparing studies in which researchers observed structure to those in which teachers reported on structure ($b = -.06$, $p = .35$).

Consistent with our hypotheses, intervention studies in which the effect of structure interventions on engagement was adjusted by a pretest measure of the outcome ($g = 0.35$) yielded a statistically significantly weaker average positive effect on engagement compared to studies in which effects on engagement were not adjusted by a pretest measure of the outcome ($g = 0.70$; $b = -0.34$, $p = .03$; see hypothesis 4c in Table 2). Finally, consistent with our hypotheses, we found in a follow-up analysis that studies in which participants were assigned to conditions at the school level ($g = 0.34$, 95% CI [0.07, 0.61], $k = 16$) yielded a statistically significantly weaker average positive effect of structure on desirable (achievement and engagement) outcomes compared to studies in which participants were assigned to condition at the teacher level ($g = 0.60$, 95% CI [0.22, 0.98], $k = 22$; $b = -0.26$, $p < .02$) or the student level ($g = 0.75$, 95% CI [0.34, 1.16], $k = 4$; $b = -0.40$, $p < .04$; see hypothesis 3f in Table 2). There was no statistically significant difference in the average effect of studies in which participants were assigned to condition at the teacher/class level compared to those in which individual students were assigned to condition ($b = -0.14$, $p = .33$).

Structure moderators

Next, we examined whether components of structure explained differences in correlations and intervention effects across studies. We first examined if correlations and intervention effects varied (1) whether or not the structure variable included: (a) expectation/goal-setting, (b) establishing rules, routines, and procedures, (c) organization of lessons and materials, (d) eliciting student involvement (e) monitoring and signals, (f) feedback, and (g) use of rewards and punishment (see Table 2, hypotheses 3 g through 3j and 4e through 4 g). We also examined whether correlations varied depending on (2) if structure was implemented with additional support for autonomy or positive emotion (see Table 2, hypothesis 3k).

For the correlational research, the implementation of structure with support for autonomy or positive emotion explained statistically significant differences in the correlations with achievement. The inclusion of expectations or goal-setting, organization of lessons or materials, and monitoring and signals explained statistically significant differences in correlations with engagement. The inclusion of feedback explained statistically significant differences in the correlations with competence beliefs. Finally, the inclusion of goal/expectation setting and use of rewards or

Table 5. Results of moderator analyses with achievement outcomes.

	Correlations							Interventions						
Moderator	*k*	N_S	N_{ES}	*b(SE)*	*r*	95% CI Low/Hi	95% PI Low/Hi	*k*	N_S	N_{ES}	*b(SE)*	*g*	95% CI Low/Hi	95% PI Low/Hi
Publication status														
Published	58	73	354	–	.06	.00/.12	−.20/.30	24	33	114	–	0.34	−0.08/0.77	−0.25/0.94
Unpublished	17	18	135	.05(.07)	.11	−.07/.27	−.20/.39	7	11	39	−0.01(0.15)	0.34	−0.14/0.81	−0.30/0.97
Study Methods and Measurement Moderators														
Unit of analysis														
Student	47	56	279	–	.06	.00/.12	−.20/.30	–	–	–	–	–	–	–
Teacher/class/school	30	37	210	.00(.05)	.06	−.04/.15	−.21/.31	–	–	–	–	–	–	–
Structure measurement type														
Observation	34	44	321	–	.15	.08/.22	−.10/.39	–	–	–	–	–	–	–
Survey	43	50	144	−.09(.04)*	.06	.00/.12	−.19/.30	–	–	–	–	–	–	–
Structure respondent														
Student	31	36	107	–	.06	.00/.12	−.20/.30	–	–	–	–	–	–	–
Researcher	34	44	331	.10(.04)*	.15	.08/.22	−.11/.39	–	–	–	–	–	–	–
Teacher	15	17	61	−.02(.08)	.03	−.13/.20	−.28/.34	–	–	–	–	–	–	–
Random assignment														
Not random	–	–	–	–	–	–	–	23	32	122	–	0.36	−0.09/0.80	−0.25/0.97
Random	–	–	–	–	–	–	–	8	12	31	−0.15(0.21)	0.20	−0.34/0.74	−0.48/0.88
Matching procedure														
Matched	–	–	–	–	–	–	–	15	20	97	–	0.34	−0.08/0.77	−0.25/0.94
Random	–	–	–	–	–	–	–	12	16	44	0.00(0.16)	0.35	−0.01/0.70	−0.20/0.89
Non-matched	–	–	–	–	–	–	–	4	8	12	0.58(0.25)†	0.92	0.31/1.53	0.10/1.75
Effects adjusted by pretest														
No	–	–	–	–	–	–	–	15	23	77	–	0.34	−0.08/0.77	−0.25/0.94
Yes	–	–	–	–	–	–	–	20	25	76	−0.03(0.11)	0.32	0.02/0.61	−0.19/0.82
Intervention assignment														
Student	–	–	–	–	–	–	–	2	–	–	NA	–	–	–
Teacher	–	–	–	–	–	–	–	15	22	93	–	0.41	−0.22/1.04	−0.36/1.18
School	–	–	–	–	–	–	–	13	18	46	−0.19(0.13)	0.22	−0.21/0.66	−0.38/0.83
Confounds/Diffusion														
No	–	–	–	–	–	–	–	21	33	113	–	0.34	−0.08/0.77	−0.25/0.94
Yes	–	–	–	–	–	–	–	10	11	40	−0.12(0.15)	0.23	−0.01/0.46	−0.25/0.70
Structure Moderators														
Includes goals/expectations														
No	49	57	233	–	.05	−.01/.11	−.21/.30	12	14	61	–	0.51	0.13/0.89	−0.03/1.05
Yes	39	51	256	.02(.03)	.07	−.004/.15	−.19/.32	20	30	92	−0.27(0.11)†	0.24	−0.26/0.75	−0.39/0.87
Includes rules/routines/ procedures														
No	61	68	290	–	.06	−.001/.12	−.20/.31	14	24	92	–	0.46	−0.16/1.07	−0.26/1.17
Yes	30	41	199	−.02(.02)	.04	−.04/.11	−.22/.29	17	20	61	−0.22(0.15)	0.24	−0.20/0.68	−0.31/0.79
Includes lesson/material organization														
No	56	63	241	–	.04	−.02/.10	−.20/.28	22	30	114	–	0.37	−0.10/0.83	−0.25/0.99
Yes	31	41	248	.05(.04)	.09	.01/.17	−.16/.33	10	14	39	−0.13(0.09)	0.24	−0.19/0.67	−0.34/0.83
Includes monitoring and signals														
No	61	72	317	–	.06	−.01/.12	−.20/.31	20	27	101	–	0.44	−0.14/1.01	−0.25/1.13
Yes	29	41	172	−.01(.04)	.05	−.03/.13	−.21/.30	12	17	52	−0.16(0.10)	0.28	−0.16/0.72	−0.29/0.85
Includes feedback														
No	63	78	377	–	.05	−.01/.11	−.21/.30	20	24	89	–	0.37	−0.01/0.74	−0.20/0.93
Yes	33	40	112	.02(.03)	.07	−.002/.14	−.19/.32	12	20	64	−0.05(0.15)	0.32	−0.22/0.86	−0.37/1.01
Includes rewards or punishment														
No	57	66	219	¯	.08	01/.15	−.19/.33	17	28	107	–	0.35	−0.08/0.78	−0.26/0.95
Yes	36	44	270	−.07(.05)	.01	−.07/.09	−.25/.27	14	16	46	−0.08(0.15)	0.27	−0.24/0.77	−0.38/0.91
Includes eliciting student involvement in structure														
No	72	87	407	–	.06	−.004/.12	−.20/.30	27	39	133	–	0.31	−0.15/0.77	−0.30/0.92
Yes	13	18	82	−.01(.05)	.04	−.07/.15	−.23/.31	5	5	20	0.13(0.13)	0.45	0.12/0.77	−0.07/0.96
Includes autonomy or emotion support														
No	70	82	468	–	.04	−.02/.11	−.21/.29	24	37	128	–	0.25	−0.20/0.71	−0.28/0.78
Yes	4	8	13	.13(.04)*	.17	.05/.29	−.20/.50	7	7	25	0.31(0.17)	0.56	0.13/1.00	0.05/1.07
Setting and Sample Moderators														
Publication year														
Pre 1983	5	7	42	–	.21	−.57/.79	−.61/.81	4	8	20	–	0.76	−0.09/1.62	−0.20/1.72
1983–1993	5	7	49	−.07(.30)	.15	−.11/.39	−.25/.50	3	3	13	−0.54(0.33)	0.23	−0.45/0.90	−0.60/1.06
1994–2001	4	8	18	−.09(.30)	.13	−.14/.38	−.33/.54	5	8	46	−0.37(0.35)	0.39	−0.16/0.94	−0.32/1.11
Post 2001	61	69	380	−.17(.30)	.05	−.01/.11	−.19/.29	19	25	74	−0.47(0.33)	0.29	−0.04/0.63	−0.23/0.81
United States sample														
No	31	36	160	¯	.08	−.01/.14	−.17/.32	7	9	32	–	0.65	0.18/1.12	0.18/1.12
Yes	43	54	325	−.06(.05)	.02	−.08/.12	−.24/.28	23	33	119	−0.39(0.16)*	0.26	−0.11/0.63	−0.11/0.63
Grade level														
Preschool/ Elementary	42	53	362	–	.06	−.03/.15	−.23/.34	22	30	84	–	0.49	0.16/0.82	−0.08/1.06
Middle/High	27	29	87	.01(.05)	.07	−.01/.15	−.21/.33	7	11	35	0.12(0.22)	0.61	0.13/1.09	−0.06/1.28

(*continued*)

Table 5. Continued.

	Correlations							Interventions						
Moderator	*k*	N_S	N_{ES}	*b(SE)*	*r*	95% CI Low/Hi	95% PI Low/Hi	*k*	N_S	N_{ES}	*b(SE)*	*g*	95% CI Low/Hi	95% PI Low/Hi
Sample Income														
Middle, High, Mixed	15	22	109	–	.15	−.06/.35	−.24/.49	7	12	27	–	0.29	0.04/0.54	0.04/0.54
Low	18	19	149	−.19(.10)†	−.04	−.23/.14	−.41/.34	11	13	49	0.25(0.11)†	0.54	0.19/0.89	0.19/0.90
At-Promise/Special needs														
No	71	84	453	–	.06	.00/.12	−.19/.30	26	40	110	–	0.39	0.03/0.76	−0.15/0.94
Yes	7	7	35	−.05(.05)	.01	−.14/.15	−.33/.34	6	7	48	−0.14(0.17)	0.26	−0.33/0.84	−0.48/0.99
Outcome Moderators														
Domain														
English/Language Arts	33	42	219	.–	.09	−.01/.20	−.22/.40	17	21	65	–	0.34	−0.43/1.11	−0.57/1.24
Math/Science	41	46	192	−.06(.06)	.04	−.06/.14	−.27/.35	19	28	48	0.22(0.13)	0.56	−0.13/1.25	−0.24/1.37

Note. *k* = number of studies. N_S = number of samples. N_{ES} = number of effects. *b* = unstandardized regression slope coefficient (moderator effect). SE = standard error. *r* = correlation (pooled average correlation converted from Fisher's z metric). *g* = Hedges' *g* (average pooled effect). CI = confidence interval. PI = prediction interval. Low = lower estimate. Hi = upper estimate. For correlational data, each moderator was tested in separate models that included three covariates (publication status, unit of analysis, and structure measure respondent). For intervention data, each moderator was tested in separate models that included four covariates (publication status, assignment/matching procedure, adjustment by pretest, and the presence of confounds/diffusion). Covariate results are omitted from tables. Analyses with all dashes (–) represent instances with limited variability in the dataset or missing information (we omitted moderator analyses in which k < 3 for a subgroup). Dashes (–) were also used in *b(SE)* column for reference category of moderator analyses. NA = Not applicable. †$p = 0.05$, *$p < .05$, **$p < .01$, ***$p < .001$.

punishment explained statistically significant differences in the correlations with disengagement. For intervention research, the inclusion of monitoring and signals explained statistically significant differences in the intervention effects on engagement outcomes. No other structure characteristic moderators were statistically significant when examined separately for each outcome. However, we found in a follow-up analysis that inclusion of rewards or punishment explained statistically significant differences in correlations between structure and desirable student outcomes when achievement and engagement outcomes were combined and examined together in the same analysis.

More specifically, consistent with our hypothesis that support for autonomy and positive emotion would bolster the benefits of structure, the average correlation between structure and achievement was statistically significantly stronger ($b = .13$, $p < .05$) when structure was accompanied by support for autonomy or positive emotion ($r = .17$) compared to when these additional elements were not present ($r = .04$; see hypothesis 3k in Table 2). In fact, the correlation between structure and achievement was not statistically significantly different from zero when support for autonomy or positive emotion were not present.

Consistent with our hypothesis that more desirable relationships would emerge with the inclusion of anticipatory strategies for providing structure, we found statistically significantly stronger correlations with engagement when expectations or goal-setting ($r = .36$; $b = .07$, $p < .05$; see hypothesis 3 g in Table 2) and organization of lessons and materials ($r = .38$; $b = .09$, $p < .05$; see hypothesis 3i in Table 2) were included compared to when these strategies were not included (*r*s = .30 and .30). Moreover, the average negative correlation between structure and disengagement was statistically significantly stronger ($b = -.14$, $p < .05$) when structure included expectation/goal-setting ($r = -.18$) compared to when this component was not included ($r = -.04$; see hypothesis 3 g in Table 2).

Consistent with our hypothesis that desirable relationships would be attenuated with the inclusion of responsive strategies or strategies that could be experienced as controlling, we found a statistically significantly weaker correlation with competence beliefs ($b = -.06$, $p < .05$) when structure included feedback ($r = .21$) compared to when it did not ($r = .27$; see hypothesis 4f in Table 2). Moreover, the average negative correlation between structure and disengagement was statistically significantly weaker ($b = .14$, $p < .01$) when structure included rewards or punishment ($r = -.01$) compared to when this component was not included ($r = -.14$; see hypothesis 4 g in Table 2). In a follow-up analysis, we also found that the average correlation between structure and desirable student outcomes, that is, engagement and achievement combined, was statistically significantly weaker ($b = -.06$, $p < .04$) when structure included rewards or punishment ($r = .24$, 95% CI [.13/.34], $k = 67$) compared to when it did not ($r = .29$, 95% CI [.20/.38], $k = 113$; see hypothesis 4 g in Table 2). For intervention research, also consistent with this hypothesis, the average effect of a structure intervention on engagement was statistically significantly weaker ($b = -0.40$, $p < .03$) when structure included monitoring and the use of signals ($g = 0.50$) compared to when this component was not included ($g = 0.90$; see hypothesis 4e in Table 2). However, there was one finding in contrast to hypotheses. We found that the average correlation between structure and engagement was statistically significantly stronger ($b = .07$, $p < .05$) when structure included monitoring and the use of signals ($r = .38$) compared to when it did not ($r = .31$; see hypothesis 4e in Table 2).

Setting, sample, and outcome moderators

Next, we examined whether characteristics of the setting or sample explained heterogeneity in the correlations and intervention effects, including whether correlations or effects varied depending on (1) the era (e.g., year) in which the study was published, (2) if the setting was in the USA or not, (3) grade level, (4) whether the student sample was from a low income background compared to middle, high, and mixed

Table 6. Results of moderator analyses with engagement outcomes.

	Correlations							Interventions						
Moderator	*k*	N_S	N_{ES}	*b(SE)*	*r*	95% CI Low/Hi	95% PI Low/Hi	*k*	N_S	N_{ES}	*b(SE)*	*g*	95% CI Low/Hi	95% PI Low/Hi
Publication status														
Published	91	102	492	–	.33	.28/.37	.03/.58	23	29	56	–	0.70	0.34/1.05	−0.10/1.50
Unpublished	16	17	75	−.01(.06)	.32	.21/.42	−.01/.59	6	9	38	−0.12(0.27)	0.58	−0.19/1.35	−0.51/1.67
Study Methods and Measurement Moderators														
Unit of analysis														
Student	76	85	357	–	.33	.28/.37	.03/.58	–	–	–	–	–	–	–
Teacher/class/school	37	40	210	.08(.05)	.39	.31/.47	.09/.63	–	–	–	–	–	–	–
Structure measurement type														
Observation	45	53	273	–	.20	.12/.27	−.13/.48	–	–	–	–	–	–	–
Survey	65	70	293	.14(.04)***	.33	.28/.37	.03/.58	–	–	–	–	–	–	–
Structure respondent														
Student	56	60	242	–	.33	.28/.37	.03/.58	–	–	–	–	–	–	–
Researcher	45	53	273	−.14(.04)***	.20	.12/.27	−.13/.48	–	–	–	–	–	–	–
Teacher	11	12	51	−.20(.05)**	.14	.02/.25	−.24/.48	–	–	–	–	–	–	–
Outcome respondent														
Researcher	29	35	159	–	.37	.22/.51	.02/.65	–	–	–	–	–	–	–
Student	70	70	325	−.06(.08)	.33	.28/.37	.03/.57	–	–	–	–	–	–	–
Teacher	17	22	53	−.04(07)	.34	.27/.41	.02/.60	–	–	–	–	–	–	–
Random assignment														
Not random	–	–	–	–	–	–	–	20	27	75	–	0.63	0.21/1.05	−0.20/1.46
Random	–	–	–	–	–	–	–	9	11	19	0.13(0.23)	0.76	0.20/1.32	−0.27/1.80
Matching procedure														
Matched	–	–	–	–	–	–	–	16	22	72	–	0.70	0.34/1.05	−0.10/1.50
Random	–	–	–	–	–	–	–	10	13	17	0.20(0.23)	0.89	0.47/1.32	0.09/1.70
Non-matched	–	–	–	–	–	–	–	3	3	5	0.23(0.22)	0.93	0.08/1.77	−0.52/2.37
Effects adjusted by pretest														
No	–	–	–	–	–	–	–	14	21	47	–	0.70	0.34/1.05	−0.10/1.50
Yes	–	–	–	–	–	–	–	16	20	47	−0.35(0.08)*	0.35	0.02/0.68	−0.42/1.12
Intervention assignment														
Student	–	–	–	–	–	–	–	2	–	–	NA	–	–	–
Teacher	–	–	–	–	–	–	–	16	21	64	–	0.78	0.38/1.19	0.02/1.55
School	–	–	–	–	–	–	–	10	14	25	−0.36(0.17)†	0.42	0.04/0.80	−0.29/1.13
Confounds/Diffusion														
No	–	–	–	–	–	–	–	20	28	62	–	0.70	0.34/1.05	−0.10/1.50
Yes	–	–	–	–	–	–	–	9	10	32	−0.30(0.19)	0.39	0.09/0.70	−0.36/1.15
Structure Moderators														
Includes goals/expectations														
No	62	68	298	–	.30	.25/.34	.005/.54	11	13	29	–	0.63	0.23/1.03	−0.16/1.42
Yes	63	71	269	.07(.03)*	.36	.31/.42	.08/.59	18	25	65	0.13(0.25)	0.75	0.26/1.25	−0.15/1.65
Includes rules/routines/ procedures														
No	93	99	450	–	.32	.27/.37	.02/.57	15	24	63	–	0.76	0.31/1.22	−0.11/1.64
Yes	38	46	117	.07(.04)†	.38	.31/.45	.08/.62	14	14	31	−0.16(0.18)	0.61	0.27/.94	−0.18/1.39
Includes lesson/material organization														
No	81	86	355	–	.30	.26/.34	.02/.54	21	27	55	–	0.76	0.40/1.12	−0.03/1.55
Yes	47	55	212	.09(.03)*	.38	.32/.44	.11/.61	9	11	39	−0.29(0.07)†	0.47	0.12/0.82	−0.33/1.26
Includes monitoring and signals														
No	87	94	419	–	.31	.26/.36	.02/.56	14	18	43	–	0.90	0.61/1.19	0.28/1.52
Yes	48	58	148	.07(.03)*	.38	.32/.43	.09/.61	16	20	51	−0.40(0.09)*	0.50	0.20/0.81	−0.08/1.08
Includes feedback														
No	89	99	413	–	.33	.28/.38	.03/.58	19	24	59	–	0.64	0.26/1.02	−0.22/1.49
Yes	50	55	154	−.01(.02)	.32	.27/.38	.02/.57	11	14	35	0.21(015)	0.85	0.35/1.34	−0.05/1.74
Includes rewards or punishment														
No	81	88	378	–	.34	.29/.38	.04/.58	10	16	54	–	0.85	0.35/1.35	0.01/1.68
Yes	46	51	189	−.04(.03)	.29	.23/.36	−.01/.55	19	22	40	−0.23(0.19)	0.61	0.32/0.91	−0.07/1.30
Includes eliciting student involvement in structure														
No	106	118	519	–	.33	.28/.37	.02/.58	24	30	77	–	0.78	0.44/1.12	−0.02/1.58
Yes	19	22	48	.03(.04)	.35	.27/.43	.03/.61	6	8	17	−0.18(0.16)	0.59	0.19/1.00	−0.22/1.41
Includes autonomy or emotion support														
No	101	109	522	–	.32	.27/.36	.00/.58	25	34	81	–	0.68	0.30/1.06	−0.16/1.52
Yes	9	13	38	.24(.19)	.52	.15/.76	.02/.81	4	4	13	0.15(0.38)	0.83	−0.11/1.77	−0.38/2.04
Setting and Sample Moderators														
Publication year														
Pre 1983	6	8	60	–	.31	−.08/.62	−.24/.71	6	11	35	–	0.27	−0.27/0.81	−0.75/1.29
1983–1993	4	4	49	.02(.23)	.33	−.25/.73	−.41/.81	6	6	17	0.55(0.27)†	0.82	0.16/1.47	−0.34/1.97
1994–2001	3	7	9	.12(.22)	.41	−.21/.79	−.50/.89	3	3	6	0.07(0.28)	0.34	−0.39/1.07	−0.74/1.43
Post 2001	94	100	449	.02(.17)	.33	.28/.37	.02/.58	14	18	36	0.60(0.22)*	0.88	0.47/1.28	0.05/1.70
United States sample														
No	63	65	309	–	.35	.30/.39	.05/.59	8	10	39	–	0.86	0.28/1.44	−0.04/1.76
Yes	44	54	258	−.09(.05)†	.26	.15/.37	−.07/.54	21	28	55	−0.20(0.23)	0.64	0.25/1.06	−0.14/1.45

(*continued*)

Table 6. Continued.

Moderator	Correlations							Interventions						
	k	N_S	N_{ES}	*b(SE)*	*r*	95% CI Low/Hi	95% PI Low/Hi	*k*	N_S	N_{ES}	*b(SE)*	*g*	95% CI Low/Hi	95% PI Low/Hi
Grade level														
Preschool/ Elementary	41	51	258	–	.33	.22/.43	−.01/.60	21	27	79	–	0.70	0.34/1.06	−0.12/1.52
Middle/High	58	59	247	−.002(.06)	.32	.28/.37	.01/.58	8	11	15	−0.13(0.23)	0.57	0.01/1.14	−0.32/1.46
Sample Income														
Middle, High, Mixed	24	31	147	–	.34	.25/.43	.06/.57	5	6	11	–	0.47	−0.62/1.57	−1.38/2.32
Low	14	14	54	−.15(.07)*	.20	.05/.34	−.11/.48	7	9	33	0.52(0.51)	0.99	−0.18/2.16	−0.67/2.65
At-Promise/Special needs														
No	100	107	512	–	.33	.28/.37	.02/.58	23	30	80	–	0.69	0.40/0.98	0.00/1.38
Yes	10	11	52	−.02(.07)	.31	.15/.45	−.07/.61	8	8	14	0.11(0.12)	0.80	0.33/1.28	−0.08/1.68
Outcome Moderators														
Domain														
English/Language Arts	9	10	35	–	.37	.13/.57	−.15/.73	3	3	7	–	1.09	1.08/1.09	1.08/1.09
Math/Science	26	26	126	−.02(.10)	.35	.25/.45	−.08/.68	3	8	29	−0.09(0.23)	0.99	−1.88/3.86	−1.88/3.86

Note. *k* = number of studies. N_S = number of samples. N_{ES} = number of effects. *b* = unstandardized regression slope coefficient (moderator effect). SE = standard error. *r* = correlation (pooled average correlation converted from Fisher's z metric). *g* = Hedges' *g* (average pooled effect). CI = confidence interval. PI = prediction interval. Low = lower estimate. Hi = upper estimate. For correlational data, each moderator was tested in separate models that included three covariates (publication status, unit of analysis, and structure measure respondent). For intervention data, each moderator was tested in separate models that included four covariates (publication status, assignment/matching procedure, adjustment by pretest, and the presence of confounds/diffusion). Covariate results are omitted from tables. Analyses with all dashes (–) represent instances with limited variability in the dataset or missing information (we omitted moderator analyses in which k < 3 for a subgroup). Dashes (–) were also used in *b(SE)* column for reference category of moderator analyses. NA = Not applicable. $^{\dagger}p = 0.05$, $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$.

income samples, and (5) whether students were at-promise or had behavioral, emotional, or learning special needs (see Table 2, hypothesis 31 and exploratory moderators 6 through 9). We also examined whether the outcome domain explained differences in correlations or intervention effects (see Table 2, exploratory moderator 10). Sample income background explained statistically significant differences in the correlations with engagement and era explained statistically significant differences in the structure interventions effects on engagement. USA setting explained statistically significant differences in the structure intervention effects on achievement. No other sample or setting characteristic moderators were statistically significant.

More specifically, we found that the average correlation between structure and engagement was statistically significantly smaller ($b = -.15$, $p < .05$) for the studies conducted with students from low income backgrounds ($r = .20$) compared to those conducted with students from middle, high, or mixed income backgrounds ($r = .34$; exploratory moderator 6 in Table 2). For intervention research, the average effect of a structure intervention on achievement was statistically significantly weaker ($b = -0.39$, $p < .05$) for studies conducted in the USA ($g = .26$) compared to studies conducted outside the USA ($g = .65$; exploratory moderator 8 in Table 2). Moreover, the average effect of a structure intervention on engagement was statistically significantly stronger ($b = .60$, $p < .04$) in more recent studies conducted after 2001 ($g = 0.88$) compared to the oldest studies conducted before 1983 ($g = 0.27$; exploratory moderator 9 in Table 2). No other pairwise comparisons among studies of different eras were statistically significant.

Discussion

This article reports the first comprehensive research synthesis of the relationship between teachers' provision of classroom structure and students' engagement, disengagement, competence beliefs, and achievement, bringing together the results of both correlational and intervention evidence across grade levels and outcomes. Using the evidence provided in 165 correlational studies, consistent with our hypotheses based on teacher education and instructional quality literatures focused on classroom management, as well as self-determination theory (e.g., Brophy, 1999; Emmer & Stough, 2001; Ponitz et al., 2009; Skinner & Belmont, 1993), we found statistically significant positive relationships between classroom structure, as teachers use it without intervention, and students' achievement, behavioral engagement, emotional engagement, cognitive engagement, and competence beliefs. However, we did not find the average relationships between classroom structure and behavioral disengagement, emotional disengagement, or overall disengagement to be significantly different from zero. Similarly, using the evidence provided in 46 intervention studies, we found that teachers directed or trained to implement structure in the classroom had students with higher achievement, greater behavioral engagement, and less behavioral disengagement compared to students in classes whose teachers did not receive such training or instruction. However, we did not find that classroom structure interventions had a significant effect on students' emotional engagement or competence beliefs.

Using Cohen's (1988) measure of distribution overlap (U_3) as a means to help with interpretation of effect sizes from intervention studies, the average student who was in a class in which their teacher implemented structure had higher behavioral engagement than about 66% of students without a teacher who implemented structure and higher achievement than about 63% of students without a teacher who implemented structure. Moreover, we note that the two sets of evidence are relatively consistent in the magnitude of relationships observed (e.g., *g* of 0.42 is equivalent to a *r* of .21), with intervention evidence yielding slightly stronger effects.

Table 7. Results of moderator analyses with competence beliefs and disengagement outcomes for correlational studies.

	Correlations													
	Competence Beliefs							Disengagement						
Moderator	*k*	N_S	N_{ES}	*b(SE)*	*r*	95% CI Low/Hi	95% PI Low/Hi	*k*	N_S	N_{ES}	*b(SE)*	*r*	95% CI Low/Hi	95% PI Low/Hi
Publication status														
Correlations Published	35	36	134	–	.25	.15/.35	−.22/.63	27	31	153	–	−.08	−.16/−.01	−.16/−.01
Unpublished	6	6	17	−.11(.09)	.15	−.06/.35	−.44/.65	3	3	20	−.28(.05)*	−.35	−.56/−.09	−.56/−.09
Study Methods and Measurement Moderators														
Unit of analysis														
Student	34	35	129	–	.25	.15/.35	−.22/.63	23	26	101	–	−.08	−.16/−.01	−.16/−.01
Teacher/class/school	8	8	22	.09(.10)	.33	.12/.52	−.25/.74	8	9	72	.31(.14)†	.22	−.10/.51	−.10/.51
Structure measurement type														
Observation	11	12	73	–	.19	.05/31	−.38/.66	9	11	89	–	−.09	−.46/.30	−.46/.30
Survey	31	31	78	.06(.04)	.25	.15/36	−.22/.63	22	24	84	.01(.10)	−.08	−.16/−.01	−.16/−.01
Structure respondent														
Student	29	29	67	–	.25	.15/.35	−.22/.63	20	22	75	–	−.08	−.16/−.01	−.16/−.01
Researcher	11	12	73	−.06(.04)	.19	.06/.31	−.38/.66	9	11	89	−.01(.10)	−.09	−.46/.30	−.46/.30
Teacher	3	3	11	.00(.14)	.25	−.43/.75	−.81/.93	2	–	–	NA	–	–	–
Outcome respondent														
Researcher	–	–	–	–	–	–	–	7	8	70	–	.17	−.41/.65	−.41/.65
Student	35	36	132	–	.25	.15/.35	−.25/.65	22	24	87	−.26(.22)	−.09	−.17/−.01	−.17/−.01
Teacher	3	3	6	−.02(.11)	.23	−.12/.53	−.53/.79	4	4	16	−.12(.27)	.05	−.33/.43	−.33/.43
Structure Moderators														
Includes goals/expectations														
No	21	22	91	–	.24	.15/.32	−.24/.62	18	21	111	–	−.04	−.11/.03	−.11/.03
Yes	27	27	60	.03(.04)	.27	.14/.38	−.21/.64	20	22	62	−.14(.04)*	−.18	−.25/−.11	−.25/−.11
Includes rules/routines/ procedures														
No	36	37	123	–	.24	.14/.34	−.23/.62	27	30	139	–	−.08	−.16/.01	−.16/.01
Yes	12	12	28	0.07(.04)	.31	.19/.41	−.19/.68	9	11	34	.04(.06)	−.05	−.20/.11	−.20/.11
Includes lesson/material organization														
No	31	32	118	–	.25	.16/.34	−.23/.63	23	26	135	–	−.07	−.15/.02	−.15/.02
Yes	16	16	33	0.004(.05)	.25	.11/.38	−.24/.65	11	13	38	−.08(.05)	−.15	−.23/−.06	−.23/−.06
Includes monitoring and signals														
No	34	35	127	–	.24	.14/.34	−.23/.62	24	28	135	–	−.08	−.16/.00	−.16/.00
Yes	14	14	24	.05(.02)	.29	.19/.38	−.20/.66	12	14	38	−.02(.07)	−.10	−.23/.04	−.23/.04
Includes feedback														
No	33	33	81	–	.27	.17/.36	−.21/.64	27	31	130	–	−.09	−.19/.00	−.19/.00
Yes	18	19	70	−.06(.03)*	.21	.10/.32	−.27/.61	12	14	43	.10(.15)	.01	−.29/.30	−.29/.30
Includes rewards or punishment														
No	32	33	120	–	.24	.14/.34	−.24/.63	25	27	102	–	−.14	−.22/−.07	−.22/−.07
Yes	13	13	31	.07(.04)	.30	.20/.39	−.21/.68	12	16	71	.14(.04)**	−.01	−.10/.08	−.10/.08
Includes eliciting student involvement in structure														
No	40	41	139	–	.25	.15/.34	−.22/.63	30	34	157	–	−.08	−.16/−.01	−.16/−.01
Yes	5	5	12	.04(.03)	.29	.16/.41	−.29/.71	3	6	16	.02(.05)	−.07	−.33/.21	−.33/.21
Includes autonomy or emotion support														
No	39	40	142	–	.24	.15/.33	−.20/.60	–	–	–	–	–	–	–
Yes	3	3	5	.22(.21)	.44	−.35/.86	−.61/.93	–	–	–	–	–	–	–
Setting and Sample Moderators														
Publication year														
Pre 1983	1	–	–	–	–	–	–	3	4	22	–	−.11	−.71/.58	−.71/.58
1983–1993	2	–	–	–	–	–	–	3	3	18	.07(.25)	−.04	−.29/.22	−.29/.22
1994–2001	1	–	–	–	–	–	–	1	–	–	NA	–	–	–
Post 2001	37	–	–	–	–	–	–	23	26	132	.02(.26)	−.08	−.16/.00	−.16/.00
United States sample														
No	27	27	92	–	.25	.15/.35	−.24/.64	19	22	103	–	−.08	−.16/−.00	−.16/−.00
Yes	14	15	59	.00(.11)	.25	.02/.46	−.30/.68	11	12	70	.02(.09)	−.07	−.29/.16	−.29/.16
Grade level														
Preschool/ Elementary	14	14	61	–	.28	.05/.48	−.27/.69	13	14	80	–	.06	−.21/.33	−.32/.43
Middle/High	22	22	45	−0.07(.11)	.22	.11/.32	−.26/.61	17	20	63	−.23(.13)	−.16	−.25/−.08	−.40/.09
Sample Income														
Middle, High, Mixed	9	9	29	–	.12	−.12/.34	−.65/.76	6	6	23	–	−.18	−.32/−.04	−.32/−.04
Low	7	7	14	.15(.58)	.26	−1.0/1.0	−1.0/1.0	3	3	8	.03(.05)	−.15	−.15/−.15	−.15/−.15
At-Promise/Special needs														
No	39	–	–	–	–	–	–	27	31	144	–	−.08	−.16/−.003	−.16/−.003
Yes	2	–	–	–	–	–	–	3	3	24	−.09(.10)	.004	−.40/.41	−.40/.41
Outcome Moderators														
Domain														
English/Language Arts	4	4	6	–	.41	−.58/.91	−.76/.95	2	–	–	–	–	–	–
Math/Science	10	11	72	−.09(.29)	.34	.18/.47	−.25/.75	4	–	–	–	–	–	–

Note. *k* = number of studies. N_S = number of samples. N_{ES} = number of effects. *b* = unstandardized regression slope coefficient (moderator effect). SE = standard error. *r* = correlation (pooled average correlation converted from Fisher's z metric). CI = confidence interval. PI = prediction interval. Low = lower estimate. Hi = upper estimate. For correlational data, each moderator was tested in separate models that included three covariates (publication status, unit of analysis, and structure measure respondent). Covariate results are omitted from tables. Analyses with all dashes (–) represent instances with limited variability in the dataset or missing information (we omitted moderator analyses in which k < 3 for a subgroup). Dashes (–) were also used in *b(SE)* column for reference category of moderator analyses. NA = Not applicable. †$p = 0.05$, *$p < .05$, **$p < .01$, ***$p < .001$.

Consistency and variation in relationships with teachers' provision of classroom structure

This meta-analysis makes three broad contributions to the current literature. First, it establishes a consistent link between teachers' provision of classroom structure with behavioral engagement and achievement, and tentative links with emotional engagement, competence beliefs and disengagement, as discussed above. Second, it demonstrates the breadth of the classroom structure effects such that the relationship with student outcomes generalizes across many forms of structure, methods, settings, and samples. Third, it highlights a number of important circumstances in which the magnitude of the relationship varies. We provide more details on these contributions next.

Consistency, particularly across school level

Results suggest that classroom structure effects, particularly for students' engagement, are relatively consistent across many forms of structure, methods, settings, and samples. There was no instance, regardless of what moderator we considered, in which the relationship between classroom structure and either student engagement or competence beliefs was negative. Moreover, there was no instance in which classroom structure interventions had a negative effect on achievement. Although the relationship varied under some circumstances, it generally remained positive. In particular, we think that it is noteworthy that the relationship between classroom structure and students' outcomes was consistent across grade levels. Classroom management has typically been emphasized as a key classroom strategy for younger students (e.g., Kopershoek et al., 2016) more so than for older students. Indeed, we predicted in line with the notion of universality without uniformity (e.g., Soenens et al., 2015) that even if structure was predictive of outcomes at all grade levels, the magnitude of effects would differ given reasons to suspect younger students might benefit more from classroom structure by supporting their emerging cognitive and behavioral skills (e.g., Bjorklund, 2000) and adolescents might be more resistant, given developmental milestones that emphasize autonomy and independence (e.g., Erikson, 1968). However, this meta-analysis provided evidence only consistent with the more general tenet of self-determination theory and the classroom management literature that the general principles for creating well-structured classrooms have benefits for students at various levels of education and can be applied broadly in a developmentally appropriate manner (e.g., Emmer & Stough, 2001; Jang et al., 2010). Students universally need predictable environments that support their attempts to experience and develop competence at all school levels (e.g., Aelterman et al., 2019; Ryan & Deci, 2017; Skinner et al., 2008). Nonetheless, there were circumstances under which the magnitude of the relationships between classroom structure and student outcomes varied. We discuss these circumstances next.

Variation across outcomes

In line with our hypotheses, both sets of evidence were consistent in suggesting that structure relates more strongly to proximal outcomes, particularly behavioral engagement, than distal achievement outcomes. Teacher education and instructional quality scholars focused on classroom management (e,g., Brophy, 1999; Emmer & Stough, 2001) have long posited that organizational classroom strategies that provide structure in the classroom are critical because students must be engaged and must know how to navigate the learning environment in order for learning to occur (e.g., Walberg & Paik, 2000). Similarly, self-determination theory scholars highlight how competence beliefs and engagement are key mechanisms by which structure predicts achievements (e.g., Skinner et al., 2008). Results are consistent with these perspectives, suggesting that structure may yield effects on achievement only to the extent that it more proximally influences engagement.

Of particular theoretical and practical importance, both sets of evidence were also consistent in suggesting that structure is more strongly tied to bolstering desirable engagement outcomes, relative to mitigating undesirable disengagement outcomes. The extent of this dichotomy was somewhat surprising. We had predicted that despite variation in the magnitude of effects, the relationships between structure and undesirable outcomes would still always be statistically significant, which was not the case. This trend of supportive environments being most strongly predictive of desirable outcomes, sometimes tagged as a dual process model of motivation and engagement, has been observed in self-determination theory research focused on supportive teacher practices (e.g., Aelterman et al., 2019; Jang et al., 2016; Patall et al., 2018). However, it has not typically been applied to understand the benefits of structure and rarely explicitly tested. This meta-analysis provides evidence that the dual process model of motivation extends to structure, with the theoretical and practical implication that structure is an educational approach better aligned with enhancing engagement than diminishing disengagement. Though not the focus of this meta-analysis, we would presume in line with the dual process model that thwarting classroom practices that define a chaotic and/or laissez faire environments are more strongly predictive of undesirable compared to desirable undesirable outcomes like disengagement, defiance, and amotivation (see Aelterman et al., 2019 for an example of this pattern for classroom structure and chaos).

Variation by component and approach: Emphasizing autonomy and relatedness, as well as competence, and limiting control

In line with the specific tenets of self-determination theory (Cheon et al., 2020), as well as consistent with the instructional quality literature that emphasizes the importance of emotional support (e.g., Curby et al., 2013), we hypothesized that the effects of classroom structure interventions and correlations between teachers' provision of classroom structure and desirable student outcomes would be 1) stronger when accompanied by support for students' autonomy, positive

emotion, or relatedness with the teacher. Consistent with self-determination theory and teacher education perspectives on classroom management (Emmer & Stough, 2001), we also predicted that structure correlations and intervention effects would be 2) stronger when practices included anticipatory strategies such as clarifying expectancies, goals, and rules and providing guidance. Likewise, in line with these theoretical perspectives, we predicted that structure correlations and intervention effects would be 3) weaker when they included responsive strategies or strategies that could be experienced as controlling, such as monitoring, signals, feedback, and rewards or punishment.

Consistent with these hypotheses, moderator analyses with the correlational studies revealed that the relationship between classroom structure and achievement was statistically significantly stronger when structure was delivered within the context of support for autonomy and positive emotion. In fact, in the absence of this additional motivation support, the relationship between structure and achievement was not statistically significantly different from zero. This pattern was consistent across the two datasets and outcomes, though it was only statistically significant for structure correlations with academic achievement. This result highlights an important theoretical principle that has only rarely best tested. Namely, structure is most effective when synergistically delivered within a broader context of support for motivation (e.g., Vansteenkiste et al., 2012). Anecdotally, teachers have often noted that structure and support for autonomy seem at face value to be at odds with one another, with teachers sometimes feeling like they need to prioritize communicating their own expectations, organizing, and guiding student behavior, while limiting students' choices and opportunities to influence learning activities, particularly when students misbehave or are at risk of poor achievement (Jang et al., 2010; Reeve, 2009). However, rather than being at odds with one another, it is important to recognize that the effects of structure vary to the extent that structure is open to interpretation depending on how it is delivered and in what broader context (e.g., Cheon et al., 2020; Ryan & Deci, 2017). Teachers can implement practices indicative of structure in many ways, including in an autonomy or emotionally supportive way, or alternatively, in a controlling or emotionally ambivalent or harsh way. Indeed, a broad evidence base that extends beyond the classroom context highlights that the benefits of structure overall, as well as that of specific practices like goal setting, feedback, guidance, and rules, are most notable when accompanied by support for autonomy and relatedness (e.g., Carpentier & Mageau, 2013; Cheon et al., 2020, Eckes et al., 2018, Mouratidis et al., 2010; Vansteenkiste et al., 2012). Along with this broader evidence, this meta-analysis reinforces the theoretical assertion that structure should not be conceptualized as an academic success tool that is separate from or antagonistic with other forms of support in the classroom. It is important that scholars and educators continue to move toward *holistically* supporting students' competence, autonomy, and relatedness in classrooms.

We also found novel evidence that anticipatory strategies for structure were associated with greater academic benefits and responsive strategies were associated with attenuated academic benefits. Consistent with our hypotheses, moderator analyses revealed that the positive correlation between teachers' provision of classroom structure and students' engagement was stronger when the structure measure included two anticipatory strategies, namely, the expectation or goal-setting and the organization of lessons and materials. Moreover, the desirable negative correlation between structure and disengagement was notably stronger when the structure measure included the anticipatory strategy of communicating expectations and goals. These findings provide support for a rarely tested key principle from perspectives on classroom management and motivation, namely, that good classroom structure guides students in planning and self-regulating their own behavior, helping them to know how to act effectively within the classroom environment (e.g., Emmer & Stough, 2001; Skinner & Belmont, 1993). Self-determination theory has routinely highlighted that structure is only effective when defined by a proactive, interpersonal demeanor of guiding and clarifying, and not an interpersonal style of demanding compliance or asserting power to force students to act in particular ways (e.g., Aelterman et al., 2019). That is, students will be most engaged in learning when the support they receive allows them to predict for themselves the most effective ways to act in the classroom and focuses on nurturing their ability to make progress independently or with help as needed. Moreover, a particularly novel implication of the current synthesis is that the anticipatory strategy of expectation setting and goal guidance is key to directing students away from disengaging from learning activities, perhaps especially when frustrated or bored (e.g., Pekrun, 2006).

For responsive strategies, moderator analyses revealed that the correlations between teachers' provision of classroom structure and students' outcomes were attenuated when the structure measure included two responsive strategies, namely, the provision of feedback or the provision of rewards and consequences for behavior. The positive correlation between structure and competence beliefs was weaker when feedback was included in structure. The inclusion of rewards and consequences in structure yielded a statistically significantly weaker correlation with the combined engagement and achievement outcome. The desirable negative correlation with disengagement was also notably weaker when the structure measure included rewards or consequences. One interpretation is that these correlational results reflect a student-to-teacher effect, in contrast with a teacher-to-student effect. That is, teachers may use these responsive strategies particularly with students who are disengaged or struggling. However, that may be only part of the story, as responsive strategies also attenuated effects of structure interventions. Namely, the intervention effect on students' engagement was also stronger when the intervention did not include an emphasis on monitoring and signals. Taken together, these findings are consistent with classroom management perspectives that emphasize that good classroom structure should include but not rely exclusively on responsive strategies that correct or reinforce behavior and should

rather emphasize strategies that help students plan and self-regulate their own behavior (e.g., Emmer & Stough, 2001). Taking a slightly stronger position, self-determination theory has routinely emphasized that well-intended strategies for supporting learning like rewards and surveillance can backfire because they have potential to be experienced as pressure or attempts to control students, even as they simultaneously provide information about competence (e.g., Reeve, 2009; Deci et al., 2001). For feedback in particular, some readers may be surprised to learn that weaker correlations with competence beliefs were found for structure correlations that included feedback. However, we see all these findings as additional evidence of a consistent theoretical theme. Namely, structure tends to be heterogeneous in its benefits because it can vary in the extent to which it independently and synergistically taps multiple resources for students' learning and overall functioning. For feedback in particular, there is a long history of tension regarding the benefits versus risks of providing feedback (e.g., Fong et al., 2019; Hattie & Timperley, 2007). The cumulative literature on feedback suggests that although it is necessary for learning and developing competence, feedback can sometimes backfire and reduce competence beliefs, motivation, and engagement, especially if it is negative, normative, and fails to provide sufficient information for improvement or growth. Overall, this research provides support for the notion that students benefit when they have structure as a roadmap for learning and pressure is minimized.

Continuing this theme, we note one point of tension in the findings of this meta-analysis that conflicted with our hypotheses. Specifically, we found the positive correlation between structure and engagement was stronger when monitoring and signals were included in structure. This finding was in direct contrast to the finding based on intervention studies suggesting that the effect of structure interventions on students' engagement was stronger when the intervention did not include an emphasis on monitoring and signals. For these findings, we offer a consistent message: without accounting for how structure may be offered in such a way that it avoids an experience of pressure, control, and anxiety, and synergistically taps multiple resources for students' learning, the effects of structure can be mixed. This is especially true of practices like monitoring and feedback. Both of these strategies are instrumental to supporting students' success by helping teachers know when help is needed and redirect students toward more effective learning behaviors. Indeed, disengaged or struggling students may prompt teachers to use more responsive strategies in an attempt to bring about students' success (Reeve, 2009). However, these strategies can be experienced by students as controlling and demotivating if delivered in an emotionally ambivalent or harsh way or within a broader context of teacher strategies that privilege mere compliance above students' self-regulation of their own behavior. That said, we emphasize again that the link between structure and students' engagement and competence beliefs were consistently positive, regardless of which specific practices were included. Thus, we encourage readers to interpret these findings in terms of which strategies should be used with more care for how they are implemented, and *not* in terms of which strategies should be used frequently versus never.

The importance of considering who benefits and why

To consider who benefits most from structure, we begin by noting the previously unexamined finding that structure was more weakly correlated with engagement for students from low income backgrounds compared to students from mixed, middle, or high income backgrounds. There was also a marginally statistically significant trend with the same pattern for the correlation between structure and achievement. Although we did not have firm predictions for how structure associations might vary depending on students' income background, we believe this finding can also be understood by considering the broader context within which many low income students are provided with structure. Low income students are more likely not only to experience less structure and support for their competence, but also less support for their autonomy, less positive relationships with teachers, and more control (e.g., Murdock, 1999; Okanofua & Eberhardt, 2015; Patall et al., 2023; Solomon et al., 1996). As we have noted, structure is open to interpretation by students who may see it more as support or more as control, depending on the broader context of support. That is, the less supportive context that low income students tend to experience overall renders the interpretation of structure more heterogeneous and the associations with student outcomes weaker. In contrast to naturally occurring correlations between structure and student outcomes, structure interventions may be less likely to be associated with such risks to the extent that they train teachers to use structure effectively, often with consideration for students' autonomy and relationships with the teacher and other students (e.g., Cheon et al., 2020; Freiberg et al., 2009). As such, they may often be filling a holistic teacher practice gap that is greater at schools serving students from low compared to more mixed, middle, or high income backgrounds (e.g., Darling-Hammond, 1995). This is likely a reason why we did not observe the same pattern with the intervention data and even noted a marginally significant trend for achievement in which low income background students benefited in terms of their achievement more from structure interventions. Overall, this finding implies that it is important for teachers to remain mindful that they are implementing structure in non-coercive ways.

Our finding that the global setting mattered was also unique to this research synthesis. Moderator analyses revealed that the positive effect of structure interventions on achievement was stronger from studies conducted with non-USA samples than USA samples. There was also marginally statistically significant trend with the same pattern for the correlation between structure and engagement. We did not specify predictions for the role of country in which the research was conducted. However, we believe the higher emphasis on individualism within the USA relative to nearly all other countries (Hofstede, 2001) likely dampens the benefits of teachers' provision of structure among students residing within the USA. Again, we come back to our consistent theme that targeting practices that help students

know how to navigate the learning environment is not always sufficient to bring about benefits for students' learning experiences. There must be simultaneous consideration for multiple factors that contribute to students' motivation, engagement, and learning.

The importance of study methods and centering students and teachers

Moderator analyses with the intervention data revealed, as predicted, that classroom structure effects on students' desirable outcomes (i.e., engagement and achievement combined) were stronger for interventions that were assigned at the teacher or student level compared to the school level. We believe this finding represents the importance of centering teachers' and students' experiences to impart the benefits of structure. To reveal the greatest benefits, teachers and their practices need to be targeted when designing and implementing structure interventions. We assert that the assignment decision likely reflects a diluting effect in the nature and focus of the intervention itself, with interventions in which entire schools could be assigned to condition being more likely to target practices relevant across the entire school and staff rather than focus only on the most proximal predictors of student experiences and outcomes, teacher classroom practices. Given that nearly 40% of included interventions targeted the school level, it bears mentioning that this research synthesis reinforces the notion that effective interventions for classroom practices require effective professional development for teachers that includes a deep content-focus, active learning, collective participation, and sufficient duration (Desimone, 2009; Main et al., 2015). That is, teachers are more efficacious and more likely to implement new approaches that they understand deeply and that they have had a chance to actively engage and analyze independently and with peer teachers in a professional learning community. Ensuring that professional development is high quality is always a challenge and becomes more so as the participants become more diverse in their roles and content needs to be diversified.

However, other methodological factors are also important to consider. For example, consistent with hypotheses, we also found that weaker effects on engagement were revealed for intervention studies that adjusted outcomes by a pre-intervention measure, highlighting the importance of ensuring well-controlled interventions rule out alternative explanations. The type of structure measure and respondent also explained variation. Consistent with our hypotheses, moderator analyses with the correlational data revealed that positive correlations between teachers' provision of classroom structure and students' engagement were stronger when surveys, instead of observations, of structure were used and when students reported on classroom structure rather than teachers or research observers. In contrast, the positive correlations between teachers' provision of classroom structure and achievement was stronger when observations, instead of surveys, of structure were used and when teachers or researchers served as respondents regarding structure in the classroom. We believe these findings highlight the importance of matching methods to focal outcomes. Stronger relations are revealed when assessments align, that is, when observations/researcher reports of structure are used to predict relatively objective achievement outcomes and student surveys of structure are used to predict students' psychological experiences like engagement. This pattern is consistent with bias that can result from common method variance (e.g., Podsakoff et al., 2003). The former findings also highlight the importance of centering students' perspectives when trying to understand the effects of structure on students' psychological experiences. Though not without bias, asking students themselves about their perceptions of the environment reveals the strongest associations between structure and engagement. This is consistent with a long history of motivation scholarship that has emphasized that the effect of environmental factors on students' motivation, emotion, and learning experiences are filtered through student perception (e.g., Wigfield et al., 1998).

Limitations and avenues for future research

As with every research synthesis, we are limited to the data provided by past researchers. Across both intervention and correlational datasets, the outcomes most commonly examined were achievement and behavioral engagement. Other forms of engagement, competence beliefs, and disengagement were less frequently examined. This produced challenges in terms of having adequate power to test average effects and explore moderators within outcome categories, particularly for the intervention data. We encourage researchers to intentionally expand the range of outcomes that are examined when considering the effects of teachers' provision of classroom structure on students' outcomes so that we have a fuller picture of how students are impacted by practices that we would argue are foundational to defining the learning environment.

Readers should also be cognizant of challenges associated with examining whether the nature or type of structure is differentially connected with outcomes. Many researchers simultaneously manipulated or measured multiple practices falling under the classroom structure umbrella, with the exact combination of practices varying from one study to the next. This led to our approach of exploring variation in the nature of structure by examining the inclusion versus exclusion of each feature in the structure intervention or measure. However, this approach is limited for providing information about how various practices or features of structure compare to each other. Moreover, given the limitations in the structure type moderator and statistical power, we did not explore whether the relationships between each type of structure and outcomes varied depending on the grade level of students. Although we did not find any grade level differences in the relationships between structure and outcomes overall, it remains possible that differential effects of particular types of structure or ways of implementing structure may emerge depending on grade level. As such, we encourage researchers to be intentional about comparing the effects of various types and features of structure in future

research across grade levels in order to better decipher which practices and approaches are essential to creating an optimally structured classroom depending on the school level context.

Similarly, it is also important to note caution in interpreting moderators related to demographic characteristics of the student sample. Sample demographics such as income background, race, and gender, among other characteristics were often missing from reports, limiting our ability to test hypotheses about for whom structure is more or less beneficial. This was also true for teacher characteristics, which we initially attempted to collect. We would encourage researchers to be diligent about collecting and reporting such demographics, as well as explore the extent to which the benefits and limitations of providing structure generalizes across students and teachers of various cultural and social identities. It is critical that education researchers take strategic steps to understand the universalities inherent in teachers' providing structure in the classroom, as well as the ways that structure may work differently depending on the context of the teacher implementing it and the experiences of the student it targets. Finally, for moderator analyses in all research syntheses, it is also important to note that synthesis-generated evidence should not be misinterpreted as supporting statements about causality. Our findings should be taken to provide meaningful directions for future research in pre-registered, well-controlled designs with large samples.

Practice and policy implications

Based on the results of this research synthesis, we suggest several guidelines for educators and education policy makers. First, elementary and secondary teachers can use practices to facilitate structure in the classroom across *grade levels* and across domains for the purpose of improving students' behavioral engagement and achievement. Structure may also support emotional and cognitive engagement, positive beliefs about competence, and reduce behavioral disengagement. However, educators should be aware that the evidence for the benefits of structure are most robust for behavioral engagement and achievement compared to other outcomes.

Second, on average across many conditions, interventions that train teachers to provide structure are effective and thus, may be helpful to schools seeking external support and training related to creating structure in the classroom. Interventions that target schools as a whole may have more diluted effects than interventions that target specific teachers and their students.

Third, a variety of strategies for creating structure in the classroom seem to be connected with desirable students' outcomes. However, taken as a whole, the evidence suggests that teachers should give priority to anticipatory practices that focus on providing early, ongoing, and meaningful guidance for competent behavior *while* also considering how students' broader psychological functioning is supported holistically in the classroom. We recommend that practices included in structure are most effective if provided by caring teachers who combine structure with support for students' autonomy, relatedness, and positive emotion.

Fourth, and relatedly, the evidence suggests that teachers should carefully and selectively use responsive practices that have the potential to be experienced as controlling. Again, it is important for teachers to recognize that structure only sometimes or in some ways support students' competence and engagement. Other times or in other ways it can make students feel controlled if executed in the absence of more holistic support for students' motivation and well-being. Teachers may find it useful to reflect on the ways their attempts to provide structure can sometimes backfire.

Fifth, we would especially encourage USA teachers working with students from lower income backgrounds to very carefully consider how structure can be delivered within a broader context of support for students' autonomy and relatedness. We think this is important advice given two pieces of evidence from this meta-analysis. First, we think this important advice given our evidence that classroom structure had weaker effects in studies conducted in the USA, where individualism and autonomy is particularly emphasized relative to other countries. And second, we think this is important advice given the finding that structure correlations were weaker among studies that targeted low income students, who have historically been exposed to less supportive and more controlling school environments compared to counterparts.

Conclusions

The current meta-analysis shows that classroom structure and interventions designed to enhance it are moderately related to students' outcomes, with stronger or more consistent effects for desirable and more proximal outcomes, like behavioral engagement, than undesirable or more distal outcomes like disengagement and achievement. Taken together, results highlight the theoretical and practical importance of recognizing the heterogeneous nature of classroom structure effects, minimizing its controlling aspects, and contextualizing structure within a broader environment of support for students' needs, particularly for the students in the USA who may be least likely to attend schools with high quality motivation support. Methodologically, results highlight the importance of centering teachers and students for the target of intervention, as well as ensuring rigorous design features and measurement alignment in order to observe the greatest effects. We hope that the findings of this research synthesis provide some guidance for current practice, as well as future investigations that can further illuminate the underlying dynamics of teachers' provision of classroom structure that effectively support students' motivation, engagement, and learning.

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