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The Impact of Positive, Supportive Classroom Environments for Young Autistic Children: Positive Reinforcement and Student-Teacher Relationships

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ABSTRACT OF THE DISSERTATION

The Impact of Positive, Supportive Classroom Environments for Young Autistic Children: Positive Reinforcement and Student-Teacher Relationships

by

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Young students on the autism spectrum are at risk for poor social-emotional and behavioral functioning at school. Better quality student-teacher relationships (STRs) have been associated with improved student outcomes across social-emotional, behavioral, and academic domains. Teachers who use more positive reinforcement strategies may promote better student-teacher interactions and closer STRs that could mitigate some of this risk. The present study investigates a path by which teachers' use of positive reinforcement strategies promotes closer STRs, which in turn lead to improved social-emotional and behavioral functioning in a sample of 145 young (age 4-7 years) autistic students. The model was a close fit (χ^2 (18, N = 145) = 18.4, p = .43, TLI = 1.0, CFI = 1.0, RMSEA = .01), with teachers who reported using more positive reinforcement strategies having significantly closer STRs, and closer STRs significantly predicting student academic engagement, social skills, and social integration. Student outcomes in academic engagement and social integration persisted into the following school year. Strategies that teachers reported using most frequently were praising good behavior,

commenting on good behavior, and rewarding good behavior with incentives. Factors contributing to teachers' reported frequency of using positive reinforcement strategies were also explored. Of all teacher variables examined (e.g., years of experience, general education v. special education, perceived preparedness to teach autistic students), teachers' perceived usefulness of positive reinforcement strategies and regular trainings in autism were the only significant contributors to frequency of positive reinforcement strategy use. Findings underscore the protective role that teachers' use of positive reinforcement and close STRs plays for young autistic students, and highlight teachers' perceived usefulness and regular trainings in autism as critical factors for implementation of positive reinforcement strategies.

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The early elementary classroom environment provides a critical context for students' learning and success across not only academics, but also in social-emotional and behavioral domains (Cadima et al., 2015; Hamre & Pianta, 2001; Korpershoek et al., 2016; Rimm-Kaufman & Pianta, 2000; Thomas et al., 2011; Wang et al., 2020). Guided by Bronfenbrenner's biopsychosocial model of development, interactions between children and their environments over time (i.e., "proximal processes") are key driving forces in development (Bronfenbrenner & Morris, 1998). Schools are environments in which students spend much of their time and they subsequently play a large role in student outcomes across domains (Fraser, 1989; MacAulay, 1990). A supportive, positive classroom environment enables students to benefit maximally from instruction and from the school social context more broadly (Barksdale et al., 2019).

Teachers play an integral role in creating a positive classroom environment that is conducive to students' learning by developing a sense of physical and emotional safety through predictability, consistency, and support in the classroom (Furrer & Skinner, 2003; Skinner & Belmont, 1993). For example, teachers can employ behavior management strategies such as positive reinforcement to create predictable, consistent classrooms with many opportunities for positive social interactions. Building a positive, supportive classroom environment ultimately promotes students' social-emotional and behavioral success in addition to their academic growth.

During the transition into general education elementary school, the classroom environment is especially critical for successful adjustment and outcomes (Pianta et al., 1995; Rimm-Kaufman & Pianta, 2000; Silver et al., 2005). This is true for students with

disabilities and their parents, for whom the transition into school is a vulnerable period of change and adaptation to a new service delivery system and environment (Fowler et al., 1991; McIntyre et al., 2006; Eisenhower et al., 2015b). This new environment may include challenging elements such as higher behavioral expectations, greater child-to-adult ratios, and/or more group instruction (Wolery, 1999; La Paro et al., 2000). Thus, for students with disabilities in the early school years (grades K-2), teachers' use of positive classroom behavior management strategies and emphasis on developing high-quality relationships may be particularly influential.

Young children on the autism spectrum[1] are one specific group of students who are at heightened risk for poor school adjustment and outcomes (Ashburner et al., 2008; Ashburner et al., 2010; Blacher et al., 2014; Matson & Nebel-Schwalm, 2007; Troyb et al., 2014). Students on the spectrum face social communication and behavioral challenges that can create additional barriers to school adaptation, functioning, and success, particularly within general education settings (American Psychiatric Association, 2013). Teachers' behaviors and strategies are critical for creating a classroom environment that is positive, supportive, and promotes the success of students on the spectrum during the vulnerable transition period into early school (Hauser-Cram et al., 1993; Elledge et al., 2016; McGrath & Van Bergen, 2015).

[1] Identity-first language (i.e., "autistic person") or "person on the autism spectrum" is used in place of person-first language (i.e., "person with autism spectrum disorder") throughout the manuscript to reflect emerging perspectives and preferences from the autistic community (e.g., Botha et al., 2021; Bottema-Beutel et al., 2020; Kenny et al., 2016; Vivanti, 2020).

Theoretical Framework

The significance of the classroom environment in shaping students' learning experiences has theoretical roots beyond Bronfenbrenner's biopsychosocial framework. Sociocultural theory (Vygotsky, 1978), attachment theory (Ainsworth et al., 1978; Bowlby, 1969), and behaviorism (Skinner, 1938/1966) also lend support to the importance of creating a safe, supportive, and positive social learning environment that emphasizes close, warm relationships marked by prosocial behaviors. First, sociocultural theory posits that learning and cognitive development occur within social interactions and within the context of shared social processes and cultural tools (e.g., language). Through this lens, adults often provide the scaffolding and support that children need in order to develop new skills. Within a classroom setting, teachers impart cultural tools through reciprocal, supportive interactions with students that enable students to master new skills (e.g., Kovalainen & Kumpulainen, 2007). For example, teachers' language, behavior towards students, and selection of academic content can serve as models of culturally appropriate and relevant language, social interactions, and academic topics. In this sense, teachers and the classroom environment serve as mediators for children's learning and development. Accordingly, student-teacher interactions have been referred to as the "engine of development" (Bronfenbrenner & Morris, 1998) or as the "conduit through which the educational and developmental resources offered by programs" benefit children (Howes et al., 2008, p. 30).

The importance of these student-teacher interactions and relationships for children's development and learning is further emphasized by attachment theory.

Attachment theory suggests that children's relationships with caregivers influence their development across social, emotional, behavioral, and academic domains (Ainsworth et al., 1978; Bowlby, 1969; Kennedy & Kennedy, 2004). Caregivers enable opportunities for children's exploration and learning by being accessible, responsive, and sensitive, thereby providing a "secure base" (Ainsworth et al., 1978; Bowlby, 1969; Kennedy & Kennedy, 2004). Although most often used as a framework for caregiver-child interactions and relationships, attachment theory has also been widely applied to student-teacher interactions and relationships (Bergin & Bergin, 2009; Birch & Ladd, 1997; Pianta & Steinberg, 1992; Riley, 2009; Verschueren & Koomen, 2012). Outside of their relationships with caregivers, children's relationships with their teachers have been cited as the most significant adult-child relationships in their development (e.g., Kesner, 2000). Further, research has drawn connections between young children's attachment styles with parents and their relationships with teachers, emphasizing the applicability of attachment theory to classroom contexts (Buyse et al., 2011; Rydell et al., 2005). Through an attachment theory lens, students rely on their teachers to be a "secure base" providing physical and emotional safety by being predictable, consistent, accessible, and supportive while also maintaining reasonably high expectations and goals to enable learning (Riley, 2009).

As part of creating a "secure base" for students that is predictable, consistent, and safe, teachers must utilize classroom behavior support strategies that promote prosocial behaviors (e.g., functional communication, adaptive skills) and minimize challenging behaviors (e.g., aggression, inattention) that can become a negative group contagion for a

class (Buyse et al., 2008; Pianta, 2006; Wubbels et al., 2014). Buyse and colleagues (2008) found that kindergarten classrooms with high average rates of behavior problems tended to have poorer-quality student-teacher relationships (STRs; N = 4035) with more conflict and less closeness. This highlights the close ties between social relationships in the classroom and classroom behavior management, an aspect of overall classroom management that is aligned with the theory of behaviorism. Broadly, behaviorism posits that observable behaviors are learned based on what occurs in the environment before and after a behavior (Skinner, 1938/1966). In this sense, what a teacher does in the classroom before and after different student behaviors shapes the likelihood of students displaying those behaviors in the future. Thus, behaviorism suggests that the classroom environment heavily influences students' behaviors and related outcomes by establishing and maintaining behavioral contingencies, or the relations between behaviors and their controlling environmental variables (Cooper et al., 2007).

Systematic applications of behaviorism and behavioral principles to promote positive, prosocial behaviors and minimize challenging behaviors can be conceptualized under the umbrella of Applied Behavior Analyses (ABA; Baer et al., 1968; Cooper et al., 2007). The positive behavior support (PBS) model at the classroom level is one application of ABA and the principles of behaviorism within a classroom behavior management context (e.g., Scott et al., 2007). PBS aims to promote positive, prosocial behaviors (i.e., behaviors that are socially acceptable and helpful) and prevent challenging behaviors (i.e., behaviors that hinder success) to make the social classroom environment more positive, predictable, structured, and safe to enable learning for all

students. On both a class-wide and an individual level, when students exhibit more prosocial behaviors and fewer challenging behaviors, they are more likely to be academically successful and socially successful in interactions and relationships with both peers and teachers (Buyse et al., 2008; Caprara et al., 2000; Eisenhower et el., 2015a; Van Lier & Koot, 2010).

Although sometimes pitted against one another, sociocultural theory, attachment theory, and behavioral theory together build a framework for the importance of the classroom environment on students' successful school functioning and development. These theories underscore the role of teachers in creating social classroom environments that are physically and emotionally supportive, predictable, and that create opportunities for positive social interactions and relationships while minimizing relational conflict and negative social interactions. In turn, positive social interactions between teachers and students within the classroom allow teachers to scaffold students' learning and development by being responsive and sensitive to their individual needs. Students who feel more emotional closeness and comfort with their teachers are able to learn and grow without heightened anxiety or avoidance of stressors in the classroom, similar to how children who develop a "secure" attachment with their caregivers are able to explore their environments with confidence that their caregivers will be there to support them as needed (Bergin & Bergin, 2009; Riley, 2009; Roorda et al., 2011).

Defining a Positive, Supportive Classroom Environment for all Children

The concept of a warm, supportive, and positive classroom environment is a multidimensional construct that has been defined in many ways across the literature. For

example, the term *classroom climate* is often used to describe the degree of warmth and positivity present within the social system of the classroom (Fraser, 1989; Walberg & Anderson, 1968). The classroom climate is sometimes conceptualized as the ambience, tone, or atmosphere of the classroom as a whole (Fraser, 1989). Pianta and colleagues (2012, p. 373) define a positive classroom climate as "the degree to which students experience warm, caring relationships with adults and enjoy the time they spend in the classroom." In this sense, a *positive classroom climate*, which we will refer to as a *positive classroom environment*, is dependent upon teachers (1) developing high-quality relationships with their students and (2) creating an enjoyable school experience, which work hand-in-hand (Birch & Ladd, 1997; Danielsen et al., 2010; Davis & Dupper, 2004; Gest et al., 2005; Hughes et al., 2008).

Achieving these two goals relies on effective classroom management, which has broadly been defined as teachers' behaviors to create an effective learning environment for all students (Brophy, 2006). Many classroom management strategies aiming to foster a positive classroom climate can be grouped into two broad categories: (1) creating emotional warmth and supportive social interactions and (2) promoting positive student behaviors while preventing challenging behaviors (Brophy, 2006; Evertson & Weinstein, 2013; Korpershoek et al., 2016; Marzano et al., 2003; Oliver et al., 2011). Here, these two elements of classroom management for creating a supportive, positive classroom environment were conceptualized as (1) *emotional warmth and positive relationships* (i.e., positive, close STRs) and (2) *positive classroom behavior management* (e.g., positive reinforcement strategies). These two elements of classroom management are

intertwined, such that promoting prosocial behaviors facilitates positive social interactions and STRs that are critical to learning and engagement, whereas challenging behaviors can create barriers to those positive social interactions.

A recent meta-analysis by Korpershoek and colleagues (2016) further supports this two-element definition of classroom management and provides empirical support for classroom management broadly as a key element in student success. The authors synthesized 54 studies examining the impact of classroom management strategies in primary grades on various student outcomes. They defined classroom management strategies as "…tools that teacher can use to help create [an inviting and appealing environment for student learning], ranging from activities to improve teacher-student relationships to rules to regulate student behavior" (Korpershoek et al., 2016, p. 645). Some of these strategies examined included behavior(al) management, group contingency/contingencies, and social-emotional learning. To be included in the analysis, studies also had to report on student academic, behavioral, social-emotional, motivational, or other relevant outcomes and employ an experimental or quasi-experimental design with control groups. A large majority of the interventions focused on students' behavioral and/or social-emotional development. Overall, the authors found small but significant effect sizes (average $g = 0.22$) of the classroom management interventions on student academic, behavior, and social-emotional (e.g., recognizing and managing emotions, establishing positive relationships) outcomes.

Emotional Warmth and Positive Relationships in the Classroom

Emotional support and warmth in the classroom centers on the quality of interactions and relationships between students and teachers. In accordance with attachment theory, the way in which teachers interact with students can establish a "secure base" from which students can learn, grow, and explore without heightened stress, anxiety, or avoidance in the classroom (e.g., Bergin & Bergin, 2009; Riley, 2009; Verschueren & Koomen, 2012). Positive STRs, which create the foundation for this "secure base," are characterized by high levels of closeness and low levels of conflict (Birch & Ladd, 1997, Pianta & Steinberg, 1992). Closeness refers to feelings of warmth, openness, affection, and support in the relationship, whereas conflict refers to feelings of hostility, negativity, and/or discord in the relationship (Birch & Ladd, 1997; Sabol & Pianta, 2012).

Positive STRs comprised of higher levels of closeness have been associated with improved outcomes across academic (Birch & Ladd, 1997; Furrer & Skinner, 2003; Konishi et al., 2010), behavioral (Birch & Ladd, 1997; Decker et al., 2007; Furrer & Skinner, 2003), and social-emotional arenas (Arbeau et al., 2010; Berry & O'Connor, 2010; Birch & Ladd, 1997; Decker et al., 2007; Furrer & Skinner, 2003; Murray & Zvoch, 2011). On the other hand, early STRs marked by higher levels of conflict have been associated with negative academic (Birch & Ladd, 1997), behavioral (Drugli et al., 2011) and social-emotional outcomes (Birch & Ladd, 1997; Hamre & Pianta, 2001; Marengo et al., 2018; McGrath & Van Bergen, 2015; Zeedyk et al., 2016). In a seminal study with 206 typically developing (TD) kindergarten children, Birch and Ladd (1997)

found that STRs with high levels of closeness were associated with better academic outcomes, school liking, and self-directedness, whereas STRs characterized by high levels of conflict were associated with less school liking, self-directedness, and participation and more school avoidance. In another example, Hamre and Pianta (2001) conducted a longitudinal study with 179 TD children, following the children from kindergarten to eighth grade. They found that poorer-quality kindergarten STRs were associated with poorer academic and behavioral outcomes (e.g., positive work habits) in eighth grade above and beyond other contributors, including cognitive ability and behavior ratings. Roorda and colleagues (2011) conducted a meta-analysis of 99 studies examining the impact of STR quality on student achievement and engagement. They found significant medium to large effects of STR quality on student engagement and significant small to medium effects of STR quality on student achievement. Although the majority of studies focused on teacher perspectives of STR quality, particularly for students in early elementary grades, studies that have included student perspectives have mirrored the importance of STRs on students' positive school functioning (Prewett et al., 2019).

Further, STR quality has been found to be quite stable across school years, underscoring the importance of developing positive STRs with early elementary (grades K-2) students (Blacher et al., 2009; Jerome et al., 2009; Pianta & Stuhlman, 2004). Importantly, in the meta-analysis on STRs and student outcomes conducted by Roorda and colleagues (2011), the authors found stronger effects of negative STRs for elementary school than in later school grades. These results suggest that it is particularly

important for teachers in earlier grades to set a positive tone for students' experiences at school and relationships with teachers.

STR quality is closely tied to social-emotional support and warmth in the classroom, one of the key elements of positive classroom management and a positive classroom environment. Research suggests that classrooms with more overall social-emotional support and warmth are associated with more positive STRs from both teacher and student perspectives. For example, Moen and colleagues (2019) examined the impact of classroom climate (defined as general classroom practices and quality of interactions) on teacher-rated STR quality for 267 young children ages 3-4 years with developmental risk factors. They found that teachers' emotional support (i.e., "…awareness, responsiveness, and sensitivity to students' academic, social, and behavioral concerns," p. 333) in the classroom significantly predicted STR closeness. Similarly, Prewett and colleagues (2019) integrated student perspectives of their STRs among 336 students in fifth and sixth grade. They found that the strongest predictors of student-rated STR quality were students' perceptions of their teachers' prosocial classroom behaviors and social-emotional support. These studies illustrate the connected nature of social-emotional support and warmth in the classroom (i.e., one facet of classroom management) and STR quality from the perspectives of both teachers and students.

Positive Classroom Behavior Management

The second aspect of classroom management for creating a positive, supportive classroom environment involves classroom behavior supports and interventions to promote prosocial behaviors and reduce challenging behaviors. In order to accomplish

this, teachers can use strategies that align with a PBS approach (Sugai et al., 1999). As previously mentioned, a PBS approach is derived from ABA and underscores the importance of environmental factors and building on students' strengths rather than viewing student challenges through a lens of pathology and deficits (Carr et al., 2002). In an extensive research synthesis of 107 studies examining the effects of PBS interventions broadly, Carr and colleagues (1999) found that PBS interventions led to substantial decreases in challenging behavior outcomes. This same sample was quantified in a meta-analysis conducted by Marquis and colleagues (2000), who calculated large effect sizes for PBS-based interventions on positive behavior outcomes. These results have been replicated by more recent reviews and meta-analyses focusing specifically on PBS-based approaches for both individuals and school-wide systems, indicating significant positive effects on student behavior and academic achievement outcomes (e.g., Goh & Bambara, 2012; Lee & Gage, 2020; Solomon et al., 2012). Regardless of whether a fully structured PBS model is implemented at a school-wide level, teachers can employ specific strategies and approaches derived from PBS for behavior management in their classrooms.

Positive reinforcement is a hallmark component of PBS that refers to providing something desirable in response to a behavior that increases the likelihood that the behavior will occur again in the future (Cooper et al., 2007). A large body of evidence supports the use of verbal praise and positive reinforcement at both the class-wide and individual levels for promoting positive classroom functioning and student outcomes (Chaffee et al., 2017; Kennedy & Jolivette, 2008; Lysakowski & Walberg, 1981; Partin et al., 2009; Spivak & Farran, 2012; Wheatley et al., 2009). Further, research consistently

finds reinforcement strategies more effective for long-term positive behavior change than punishment strategies, which can lead to behavioral escalation, exclusion, or temporary change, as well as inequities in exclusionary practices for students of color (Costenbader & Markson, 1998; Maag, 2001; Skiba et al., 2012). In addition to verbal praise and encouragement, another form of positive reinforcement in the classroom that is supported by the literature to improve student behavior is tangible rewards or incentives (e.g., token economy; Pfiffner et al., 1985; Simonsen et al., 2008). In their systematic review of classroom management practices, Simonsen and colleagues (2008) supported the use of a continuum of strategies to acknowledge appropriate behavior, including (1) specific, contingent praise, (2) group reinforcement, (3) behavior contracts that specify behavior expectations and outcomes (i.e., contingencies), and (4) token economies.

Furthermore, teachers' use of positive reinforcement strategies may also help teachers develop better relationships with their students. When teachers utilize more positive, strength-based strategies that promote and reinforce prosocial behaviors, students are provided with more opportunities for positive interactions with their teachers (e.g., positive attention) and fewer negative, conflictual, and/or hostile interactions (Conroy et al., 2009; Reinke & Herman, 2002; Wubbels et al., 2014). Van Tartwijk and colleagues (2009) illustrated the connected nature of these two elements of positive classroom management in their qualitative study of teachers' perceptions of classroom management. They interviewed 12 teachers and found that teachers considered the impact of classroom management strategies on the quality of their STRs when selecting strategies to use. Responses underscored the importance of utilizing positive feedback not

only for behavior management, but also for developing positive, trustful STRs. In addition to teacher perspectives on the related nature of behavior management and STR quality, previous research also suggests that students perceive a positive effect of classroom behavior supports on their relationships with teachers. Mitchell and Bradshaw (2013) conducted a study with 1902 elementary students, finding that teachers' use of classroom-based positive behavior supports predicted students' perceptions of school climate, including STR quality.

One example of an established classroom management intervention that addresses both emotional warmth and positive relationships as well as positive behavior management is the Incredible Years Teacher Classroom Management Program for teachers of students ages 3-8 (IY TCM; Webster-Stratton et al., 2001). The IY TCM includes a large teacher training component that focuses on providing teachers with strategies for class-wide positive behavior management, as well as promoting students' positive social-emotional functioning (e.g., anger management, problem-solving). Training workshop topics include *Building Positive Relationships with Students* (e.g., sharing positive feelings with students, building positive relationships with difficult students), *The Importance of Teacher Attention, Coaching, and Praise* (e.g., using praise and encouragement more effectively, understanding the importance of both whole-group praise and individual praise), and *Motivating Children Through Incentives* (e.g., group or classroom incentives, setting up individual incentive programs). Carlson and colleagues (2011) found that teachers who received the IY TCM training reported using positive

classroom management strategies with a significantly higher frequency, including using significantly more praise and incentives, which maintained at follow-up.

The IY TCM intervention has demonstrated positive effects on student behavioral and social-emotional outcomes across studies (e.g., Webster-Stratton et al., 2001; Murray et al., 2018; Reinke et al., 2018). For example, in a recent group randomized control trial of the IY TCM Program, Reinke and colleagues (2018) examined the effects of the positive classroom management intervention in a sample of 1817 students in kindergarten to third grade. Their results suggested that the intervention had significant positive effects on students' prosocial behavior, social competence, and emotional regulation. Importantly, they did not demonstrate reductions in disruptive behaviors, although the district was already implementing a structured Positive Behavioral Interventions and Supports (PBIS) system with high fidelity; thus, disruptive behaviors may have started at a low baseline rate (i.e., floor effects). Aasheim and colleagues (2018) explored the IY TCM on STR quality in a quasi-experimental pre-post study with a sample of 1518 students ages 6-8 years. They found that the program led to STRs with more closeness and less conflict. They also reported a moderating effect of the intervention, in which the intervention was significantly more effective at reducing STR conflict for students at risk of poorer-quality STRs. This suggests that the positive, supportive classroom management strategies that teachers learn in the IY TCM may serve as a protective, moderating factor for students at risk of developing poorer-quality STRs.

Teachers' Perceived Usefulness of Supportive Classroom Strategies

With the aforementioned benefits of employing positive classroom behavior support strategies (e.g., positive reinforcement), it is critical that we understand factors that may influence teachers' likelihood to utilize such strategies. One such factor is their perceived usefulness. Here, usefulness is conceptualized as how helpful and/or effective a given strategy is deemed. Perceived usefulness, effectiveness, or helpfulness of an intervention or strategy fall under the umbrella of the intervention's social validity. Social validity refers to subjective perceptions of the general social importance and acceptability of an intervention by those involved in its implementation (Wolf, 1978). Social validity provides a framework for program improvement and problem-solving barriers to implementation. Social validity of interventions is most often assessed in research studies using questionnaires, although the value of more nuanced qualitative data is helpful (Finn & Sladeczek, 2001; Leko, 2014).

Social validity and perceived usefulness are particularly critical considerations for school practices because teachers and schools are operating within the confines of very limited resources (e.g., Miramontes et al., 2011). Marchant and colleagues (2013) discuss the importance of teacher buy-in for intervention implementation and fidelity of school-based behavioral interventions, explaining that the social validity of a school-based intervention is a key indicator in its likelihood of being successfully applied in classrooms. Much like student academic motivation and engagement impact student achievement and outcomes, teacher motivation and engagement in classroom strategies

and practices impact the likelihood of those techniques being implemented fully and/or with quality (Dijkstra et al., 2017; Wehby et al., 2012).

In a study of teacher effects of the IY TCM, Carlson and colleagues (2011) assessed teachers' perceived usefulness of positive classroom management strategies pre- and post-intervention with 24 preschool teachers. They utilized the Teacher Strategies Questionnaire (TSQ; Webster-Stratton et al., 2001) rating scale in which teachers rated their frequency of using specific classroom management strategies and their perceived usefulness of those strategies on a Likert scale. The authors found positive, significant correlations between teachers' reported frequency of strategy use and perceived usefulness for the positive classroom management strategies across all time points, suggesting that when teachers perceived a strategy to be more useful, they were more likely to report implementing that strategy at a higher frequency. Thus, teachers' perceived usefulness of positive classroom management strategies (i.e., one facet of social validity) may be a helpful indicator of their likelihood to implement those strategies in their classrooms.

Considerations for Autistic Students

Children on the autism spectrum comprise a large percentage of the population of students in schools in the United States. According to recent data from the United States Department of Education, in the 2018-19 school year over 750,000 students aged 3-21 in the United States were eligible for special education services under the classification of Autism (Department of Education, 2019). Autism was the fourth largest category of disability, behind only Specific Learning Disability (SLD), Speech or Language

Impairments (SLI), and Other Health Impairments (OHI). Clearly, outside of special education, the prevalence of ASD has been steadily increasing; current estimates from the Centers for Disease Prevention and Control (CDC) are set at 1 in 54 children (Maenner et al., 2020).

In accordance with the Individuals with Disabilities Education Improvement Act (IDEA, 2004), all students have a right to free, appropriate public education (FAPE) in the least restrictive environment (LRE). This corresponds to students with disabilities having the right to be educated alongside TD peers and to have access to the general education curriculum to the extent possible that is appropriate for their learning. As a result, students with disabilities, including students on the spectrum, are spending more time in inclusive classroom settings. Although inclusive settings provide opportunities for students with disabilities to interact with TD peers and to access the general education curriculum, they can create barriers to successful inclusion and engagement in the classroom for autistic students. Inclusive classroom settings often have high social communication demands that can be a mismatch for the social communication challenges and restricted and repetitive behaviors experienced by students on the spectrum (RRBs; American Psychiatric Association, 2013). Further, autistic students often have co-occurring behavior challenges that can impede a student's success in the classroom (Matson & Nebel-Schwalm, 2007).

Indeed, research suggests that autistic students in general education settings have poorer-quality STRs, peer relationships, and overall social functioning than both TD students and students with other disabilities (Blacher et al., 2014). Ashburner and

colleagues (2010) found that autistic students in inclusive classrooms tended to have poorer emotional regulation, behavioral regulation, and academic achievement than their TD classmates, despite similar cognitive abilities. Thus, teachers in inclusive settings have a critical role in offsetting the social-emotional and behavioral challenges faced by their autistic students that can negatively impact their school functioning and success. Facilitating and modeling positive interactions and relationships with students on the spectrum, as well as utilizing positive behavior supports such as positive reinforcement strategies may be particularly important for this population of students.

Emotional Warmth and Positive Relationships in the Classroom for Autistic Students

Students on the autism spectrum tend to have STRs marked by lower levels of closeness and higher levels of conflict than both TD peers and peers with other disabilities (Blacher et al., 2014; Longobardi et al., 2012). Challenging behaviors are one of the factors that likely contributes to these poorer-quality STRs and school functioning for students on the autism spectrum (Caplan et al., 2016). The co-occurring externalizing behavior problems that are common for autistic students often manifest in the classroom setting as disruptive or distracting behaviors (Jang et al., 2011; MacIntosh & Dissanayake, 2006; Matson et al., 2009; Ochs et al., 2001). These behaviors can create barriers to successful social relationships with peers and teachers (Blacher et al., 2014; Caplan et al., 2016; Eisenhower et al., 2015a; Lyons et al., 2011). Students with more externalizing behavior challenges likely have fewer opportunities for positive interactions with teachers and more opportunities for interactions with teachers that are marked by conflict. Together, the lack of positive interactions and increased negative interactions

with teachers can damage the "secure base" role of the teacher and lead to students' anxiety and avoidance of stressful classroom situations (Brown & McIntosh, 2012; Eisenhower et al., 2015b; Robertson et al., 2003). Students' challenging behaviors can also negatively affect teachers' instructional behavior and self-efficacy, suggesting a negative reciprocal interaction, or cycle, in which students' challenging behaviors negatively impact teachers' behaviors, which in turn leads to students exhibiting more challenging behavior (Carr et al., 1991; Zee et al., 2017).

Indeed, previous research across populations suggests that students who exhibit externalizing behavior problems, including inattention, aggression, and/or disruptive behaviors, are at particularly heightened risk for poorer-quality STRs, which can in turn lead to negative student school adjustment and social emotional and behavioral functioning (Fowler et al., 2008; Baker et al., 2008). In a sample of 44 students in kindergarten through sixth grade general education classrooms who were behaviorally at-risk, Decker and colleagues (2007) found that students with poorer-quality teacher-rated STRs had less optimal social and behavioral outcomes (e.g., more behavior referrals and suspensions, less school engagement). The authors hypothesized that teachers were perhaps less tolerant with students who had more negative STRs, underscoring the importance of STR quality for students at-risk for externalizing behavior problems (Decker et al., 2007). In a longitudinal study with 166 children on the autism spectrum ages 4-7, Eisenhower and colleagues (2015a) used cross-lagged panel analysis to demonstrate that students' externalizing behavior problems drove the development of

poorer-quality STRs that persisted into the following year with different classrooms and different teachers.

Despite these challenges, when teachers do successfully develop positive, close STRs with their students with challenging behaviors, including autistic students, they can have substantial positive effects on student outcomes (Arbeau et al., 2010; Decker et al., 2007; Elledge et al., 2016; McGrath & Van Bergen, 2015). In their systematic review of 92 peer-reviewed studies McGrath and Van Bergen (2015) described positive STRs as "powerful buffers" to protect against negative social-emotional, behavioral, and academic outcomes for students who enter school with pre-existing risk (e.g., behavioral difficulties). Elledge and colleagues (2016) examined the effect of STR quality on the relation between social risk (i.e., low peer acceptance or active peer rejection) and peer victimization for 361 children (grades 4-5). They found that positive STRs moderated the relation between peer rejection and later peer victimization, suggesting that STR quality may buffer the negative impacts of poor peer relations for elementary students. This also emphasizes that students who have negative peer relationships *and* negative STRs may be at particularly heightened risk for peer victimization. In a study of 127 autistic children, Zeedyk and colleagues (2016) found that STR quality was related to child-reported loneliness at a similar level to parent-reported social skills, supporting STR quality as a potential buffer against negative social-emotional outcomes for this particularly vulnerable population of students.

Positive Classroom Behavior Management for Autistic Students

In order to mitigate these barriers to developing positive, close STRs with students on the spectrum, teachers likely need to address behavioral challenges. Not surprisingly, teachers in inclusive settings have reported that one of the largest challenges to teaching students on the spectrum is understanding and managing behavior (e.g., Lindsay et al., 2013). Positive classroom behavior management is one approach to successfully overcoming this challenge. Additionally, IDEA (2004) requires that positive behavioral interventions and supports be considered for students whose behavior impedes his or her learning or that of others (§§1414(d)(3)(B)(i)). Particularly for autistic students in general education settings, teachers' use of positive classroom behavior management is a critical element of creating a supportive, positive classroom environment that enables learning and development through positive social interactions for students on the spectrum.

Positive reinforcement strategies are widely established as one such evidence-based support for promoting positive behaviors and skills (e.g., adaptive, communication) for autistic students, specifically (Machalicek et al., 2007; Matson & Boisjoli, 2009; Steinbrenner et al., 2020). In the most recent report on evidence-based practices (EBPs) for individuals on the autism spectrum from the National Clearinghouse on Autism Evidence and Practice (NCAEP), Steinbrenner et al. (2020) reviewed 221 articles (1990-2017) examining interventions for autism that met a set of criteria and quality indicators. To be considered an EBP, a practice had to have two or more high quality group design studies, five or more high quality single-case design studies, or have one high quality

group design and at least three high quality single-case design. They reviewed 106 studies utilizing reinforcement strategies broadly, finding them effective for promoting positive outcomes across domains including academic, communication, adaptive, and social, and reducing challenging/interfering behavior for school-aged autistic children.

The use of positive classroom support strategies more broadly, including emphases on both emotional support and relationships *and* behavior management, may also serve as a powerful protective factor for students at risk for poorer school adjustment and functioning (e.g., academic engagement), including students on the autism spectrum. For example, in a study of the impact of the IY TCM intervention for students with disabilities in kindergarten through third grade general education classrooms, including autistic students, Reinke and colleagues (2020) found that special education status moderated intervention effects, with students who were receiving special education services (while still in the general education classroom) benefitting significantly more from the intervention than their general education peers. These outcomes included reductions in concentration problems and emotion dysregulation, and increases in social competence. These results indicate that positive classroom management strategies employed by teachers, including positive reinforcement and relationship-building, may be particularly effective for students with disabilities, including students on the autism spectrum.

Rationale for Current Study

Overall, students on the autism spectrum often face behavioral challenges that create barriers to developing positive, close STRs. These poorer-quality STRs may, in

turn, lead to negative outcomes in social-emotional and behavioral functioning at school (e.g., overall social skills, social competence, academic engagement). Thus, classroom behavior management strategies that promote consistent behavioral contingencies, prosocial behaviors, and positive interactions and relationships may be effective for alleviating some of the early risk for poor school functioning faced by students on the spectrum.

Positive reinforcement strategies are one example of evidence-based behavior management for autistic students that may create more opportunities for positive social interactions and fewer negative social interactions, which together build a foundation for a more positive STR. However, there is a lack of research examining these connections between teachers' positive reinforcement use, STR closeness, and social-emotional and behavioral outcomes for young students on the spectrum. In their quasi-experimental study of the IY TCM program, Aasheim and colleagues (2018) demonstrated that teachers' positive behavior management strategy use *moderated* associations between student risk (e.g., behavior problems) and STR quality, such that a significantly higher impact of the classroom management intervention on STR quality was found for students with more behavior problems.

The present study aimed to examine the effect of teachers' use of positive reinforcement strategies on the development of close STRs and their combined impact (together comprising a positive, supportive classroom environment) on subsequent social-emotional and behavioral outcomes for N = 130 young students (ages 4-7) on the autism spectrum. In alignment with Aasheim et al. (2018), a moderation effect between teachers'

use of positive reinforcement strategies and student externalizing behavior problems (i.e., a key student risk factor for students on the spectrum) on STR quality was explored. Further, the present study examined the impact of teachers' perceived usefulness of positive reinforcement strategies, along with other teacher background factors (e.g., years of teaching experience, autism-specific training), on their reported frequency of strategy use. The following research questions were addressed:

1. Does teachers' use of positive reinforcement strategies contribute to the development of close STRs?
    a. Is teachers' use of positive reinforcement strategies more impactful on the development of close STRs for students who exhibit more externalizing behaviors?
2. What effects do positive, supportive classrooms (i.e., close STRs and more frequent positive reinforcement strategy use) have on social-emotional and behavioral outcomes (i.e., social skills, social integration, and academic engagement) for young students on the autism spectrum?
    a. Do these outcomes persist into the following school year?
3. Is perceived usefulness of strategies and/or teacher background factors (e.g., years of experience, autism-specific training) associated with teachers' reported frequency of positive reinforcement strategy use?
    a. What teacher factors contribute most to their reported use of positive reinforcement strategies?

It was hypothesized that teachers' use of positive reinforcement strategies would significantly contribute to STR closeness, and that this relationship would be significantly stronger for students who exhibit more externalizing behaviors (i.e., child externalizing behaviors would moderate the relationship between teachers' use of positive reinforcement and STR closeness). It was hypothesized that STR closeness would, in turn, predict student social-emotional and behavioral outcomes, with students who have a closer relationship with their teacher demonstrating better social skills and academic engagement and experiencing less social isolation. These outcomes were expected to remain stable into the following school year. Finally, it was hypothesized that teachers' perceived usefulness of positive reinforcement strategies would be significantly related to their reported frequency of use, above and beyond other teacher background factors (e.g., ASD-specific training, years of teaching experience).

Methods

Procedures and Participants

Participants (N = 145) were young students on the autism spectrum, their parents, and their teachers who were enrolled in a larger longitudinal, multi-site study examining transition into early school for autistic students in general education settings. Eligible students were those between the ages of 4 and 7 years, i.e., those enrolled in early elementary school (Pre-K to second grade) at entry to the study. Eligible students were also those diagnosed with ASD by a school and/or private evaluation, i.e., those who met criteria for autism or autism spectrum on the Autism Diagnostic Observation Schedule (ADOS; Lord et al., 2000; Lord et al., 2012). For children who only had a school

classification of autism (i.e., did not have a clinical diagnosis of ASD), the Autism Diagnostic Interview, Revised (ADI-R; Lord et al., 1994) was conducted with the primary caregiver to confirm a score in the autism or autism spectrum range. In order to participate in some study tasks, IQ eligibility was set at IQ $\geq$ 50, as assessed using a short form of the *Wechsler Preschool and Primary Scales of Intelligence, Third Edition* (WPPSI-III; LoBello, 1991; Wechsler, 2002). Children also completed the *Comprehensive Assessment of Spoken Language* (CASL; Carrow-Woolfolk, 1999) to characterize their spoken language skills, which vary substantially across individuals on the autism spectrum. Participants were recruited in the greater Boston and Southern California regions through online and print flyers, local school districts, clinicians, autism resource centers, intervention agencies, autism-related conferences, and parent support groups. All participating parents and teachers provided informed consent at the outset of the study; all study procedures were approved by the UCR IRB.

Data were collected from parents, teachers, and students at the following three time points over two school years: (1) Fall of Year 1, (2) Spring of Year 1, (3) Winter of Year 2 (see Table 1 for measures of interest in the current study). All students whose teachers completed the *Student-Teacher Relationship Scale* (STRS; Pianta, 2001) at Time 1 were included in this sub-study. Independent samples t-tests, each of which was conducted following Levene's test for equality of variances, revealed no significant differences between included participants and excluded participants in 7 out of 8 variables examined at Time 1: Child Age ($t(251) = .50$, $p = .62$), ADOS-2 Social Affect + RRBs Total Score ($t(194) = -1.52$, $p = .13$), CASL ($t(171) = 1.53$, $p = .13$), CBCL

Externalizing Problems T Score (t(179) = .34, p = .73), TRF Externalizing Problem T Score (t(143) = .17, p = .86), or SSIS Teacher Total Standard Score (t(138) = -1.90, p = .06). There was, however, a significant difference in FSIQ (t(185) = -3.42, p < .01), with included participants having a significantly higher FSIQ than those not included. Regardless, the present sample of included students represents a range of cognitive abilities (FSIQ = 46-139).

Table 1

Study Measures of Interest and Time Points

	Time 1 Fall of Year 1	Time 2 Spring of Year 1	Time 3 Winter of Year 2
Child Assessments	*WPPSI* *CASL* *ADOS*		
Teacher Measures	*Teacher Inventory* *Teaching Strategies Questionnaire* *STRS* *TRF*	*Academic Engagement Scale* *SCBE* *SSIS*	*Academic Engagement Scale* *SCBE* *SSIS*
Parent Measures	*CBCL*	*SSIS*	*SSIS*

Participant background information is presented in Table 2. Child race was identified using caregiver responses to the open-ended question, “What is/are your child’s race(s)?” which were later aggregated into the categories found in Table 1. Notably, the children in sample were predominantly male, which reflects disproportionate prevalence rates of ASD in males (Maenner et al., 2020). Most students (50.8%) spent at least 50%

of their school day in general education classrooms. Slightly over half of the sample identified as White (55.4%) and primary caregiver educational attainment, often used as a proxy for socioeconomic status (SES) was fairly high (65.4% had earned a bachelor's degree or higher). Teachers identified as predominantly female (88.4%) and majority White (67.7%), which reflects the underrepresentation of male teachers and teachers of color in the United States (Institute of Education Sciences, 2019).

Table 2

Participant Demographics (N = 145)

	% of Sample or Mean (SD)
Child Demographics	
Age at Eligibility Visit (Years)	5.5 (1.0)
Sex (% Male)	84.1%
Caregiver-Identified Race	55.9% White, 19.3% Bi/Multiracial, 10.3% Latinx, 4.1% Asian-American, 5.5% Other, 3.4% African American or Black, 1.4% Did Not Respond
School Setting (% Public)	75.2%
% Time Spent in General Education	53.8% Spent ≥ 50% of Day; 3.4% Did Not Respond
FSIQ (WPPSI-III)	89.2 (17.4); 13.8% FSIQ < 70
"Autism" vs. "Autism Spectrum" Classification (ADOS-2 Algorithm)	84.8%
Primary Caregiver and Household Data	
Gender (% Female)	91.7%
Parent Education (% Bachelor's Degree or Higher)	66.3%
Parent Relationship Status (% Married)	81.4%
Teacher Data	
Gender (% Female)	86.9%
Self-Identified Race	70.3% White, 14.5% Latinx, 5.5% Other, 4.1% Asian-American, 2.8% Black or African American, 0.7% American Indian/Alaskan Native, 2.1% Did Not Respond
Education (% Master's Degree)	67.6%
Years Taught	14.4 (range: 1- 44); 0.7% Did Not Respond
Classroom Setting (All that Apply)	54.5% General Education; 49.7% Special Education
How prepared does the teacher feel to teach autistic children?	33.8% Very Prepared; 32.4% Somewhat Prepared; 29.7% Pretty Prepared; 3.4% Not At All Prepared; 0.7% Did Not Respond
Does the school provide regular training in autism?	61.4% No; 36.6% Yes; 2.1% Did Not Respond

Measures

Key Independent Variables

Teacher Use of Positive Reinforcement Strategies.

Teacher Strategies Questionnaire (TSQ; Carlson et al., 2011; Webster-Stratton et al., 2001). The TSQ is a rating scale for teachers developed for use in conjunction with the Incredible Years Teacher Classroom Management Program (IY TCM; Webster-Stratton, 2001; Webster-Stratton, 2013) as an outcome measure of teachers' use of specific positive and negative classroom management strategies. It includes 34 items/teaching strategies for which teachers are asked to rate (1) how often they use the techniques (i.e., frequency of use) and (2) how useful they find each strategy for managing their classrooms (i.e., perception of usefulness). Each item is rated on a 5-point Likert scale for frequency of use (1 = Rarely/Never, 5 = Very Often) and on a 5-point Likert scale for perception of usefulness (1 = Not at All Useful, 5 = Very Useful). Responses result in four subscale scores: Praise and Incentives (6 items), Proactive Strategies (7 items), Limit-Setting Strategies (5 items), and Inappropriate Strategies (9 items). An additional 7 items are not included in any subscale (items 28-34). A Total Positive Strategy score can be calculated by summing the Praise and Incentives, Proactive Strategies, and Limit-Setting Strategies subscales. Webster-Stratton and colleagues (2001) reported good internal consistency for the Total Positive Strategy scale across both frequency ($\alpha = .75$) and perception-of-usefulness ($\alpha = .76$). This was replicated by Carlson and colleagues (2011), who found good internal consistency for the Total Positive Strategies frequency and ($\alpha = .79$) and perception-of-usefulness ($\alpha =$

.84) subscale scores. Carlson and colleagues (2011) also found that the measure was sensitive to significant changes in strategy use pre- and post-IY TCM intervention (2-3 months between questionnaire completion).

In the present study, the Praise and Incentives Frequency subscale was utilized as a measure of teachers' reported use of positive reinforcement strategies. Items in this subscale tap into teachers' use of verbal praise, positive verbal attention, and incentives in the classroom. Two of the additional seven items from the TSQ that are typically excluded from subscale or scale scores were found to correspond to the definition and theoretical underpinnings of positive reinforcement: "send notes home to report positive behavior" and "call parents to report positive behavior." A revised subscale score was calculated by summing the six existing items in the Praise and Incentives scale and the two additional positive reinforcement items. To assess that the added items were appropriately measuring the same construct as others in the Praise and Incentives scale, an Exploratory Factor Analysis (EFA) with all current scale items (27 items) and the two added items was conducted to confirm they loaded appropriately on the Praise and Incentives factor and did not load saliently onto any other factors. The Kaiser-Meyer-Olkin measure of sampling adequacy index was good (KMO=.70; Field 2009) and Bartlett's test of sphericity was significant (X^2 (406) = 1225.54, $p < .001$). In agreement with previous uses of the TSQ, four factors were supported based on inspection of the scree plot and initial eigenvalues. The four-factor solution was then rotated using varimax rotation. The four-factor model accounted for 41.7% of the variance. Loadings for both added items onto the expected Praise and Incentives factor were ≥ .50 ("send notes home

about positive behavior" = .61 and "call parents to report good behavior" = .50) and they did not load onto any other factors greater than .40 (Stevens, 1996).

Items and descriptive statistics are reported in Table 3. The revised subscale demonstrated good internal consistency in the current sample for both Frequency ($\alpha = .80$) and Usefulness ($\alpha = .79$).

Table 3

Descriptive Statistics for Praise and Incentives Subscale of TSQ (N = 145)

Item	Mean	Range	Standard Deviation	Missing (n)
1. Comment on Good Behavior				
a. Frequency of Use	4.8	3-5	.5	1
b. Perceived Usefulness	4.6	2-5	.6	2
2. Praise Good Behavior				
a. Frequency of Use	4.8	1-5	.6	3
b. Perceived Usefulness	4.6	1-5	.8	6
3. Reward Good Behavior with Incentives				
a. Frequency of Use	4.0	1-5	1.3	1
b. Perceived Usefulness	4.1	1-5	1.1	7
4. Set Up Individual Incentive Programs				
a. Frequency of Use	3.7	1-5	1.4	1
b. Perceived Usefulness	3.9	1-5	1.2	7
5. Use Special Privileges				
a. Frequency of Use	3.6	1-5	1.4	1
b. Perceived Usefulness	3.9	1-5	1.2	8
6. Send Notes Home about Positive Behavior*				
a. Frequency of Use	3.5	1-5	1.4	2
b. Perceived Usefulness	3.9	1-5	1.3	12
7. Use Group Incentives				
a. Frequency of Use	3.4	1-5	1.4	1
b. Perceived Usefulness	3.6	1-5	1.3	8
8. Call Parents to Report Good Behavior*				
a. Frequency of Use	2.6	1-5	1.4	3
b. Perceived Usefulness	3.3	1-5	1.4	18
Total Score (sum of items)				
a. Frequency of Use	30.9	17-40	5.6	12
b. Perceived Usefulness	31.9	11-40	5.9	22

**Added items*

Student-Teacher Relationship Closeness.

Student-Teacher Relationship Scale (STRS; Pianta, 2001). The STRS is a well-established and widely used measure of STR quality for individual student-teacher dyads. It consists of 28 items for which teachers rate each statement on a 5-point Likert scale (1 = definitely does not apply; 2 = does not really apply; 3 = neutral, not sure; 4 = applies somewhat; 5 = definitely applies) in accordance with their perspective about their relationship with the target student. The STRS results in a Total Relationship Quality Score and subscale scores for Closeness (11 items), Conflict (12 items), and Dependency (5 items). Closeness and Conflict are the most commonly utilized subscales of the STRS, as they have been most consistently reliable and linked to student outcomes across studies. In this study, the Closeness subscale was examined as a measure of a positive, warm, and supportive STR. Closeness generally refers to feelings of warmth, security, and openness in the relationship (e.g., "I share an affectionate, warm relationship with this child," "This child tries to please me," "If upset, this child will seek comfort from me"). The STRS has demonstrated adequate validity and reliability in the standardization sample (Pianta, 2001), as well as consistently in research studies with students who have developmental disabilities, including ASD (Blacher et al., 2014; Prino et al., 2016). In this sample, the Closeness subscale demonstrated adequate internal consistency ($\alpha = .71$). See Table 4 for full descriptive data.

Table 4

Descriptive Statistics

Scale/Subscale	Mean	Range	Standard Deviation	Missing (n)
Time 1				
1. TRF Externalizing	58.2	36-79	9.3	4
2. CBCL Externalizing	60.0	35-86	10.0	6
3. STRS Closeness	40.9	24-54	6.3	5
4. WPPSI	88.8	52-121	16.3	3
5. CASL	165.3	84-259	33.3	6
6. Praise and Incentives, Revised				
c. Frequency of Use	-3.0	-4.9 - -1.0	.9	12
d. Perceived Usefulness	-2.8	-4.7 - -1.0	1.0	23
Time 2				
1. SSIS Social Skills	86.1	48-123	14.6	26
2. SCBE	5.5	3.5-7.4	.9	29
3. AES	23.1	11-32	5.3	27
Time 3				
1. SSIS Social Skills	86.6	42-122	15.0	44
2. SCBE	30.6	10-60	9.8	42
3. AES	23.6	13-32	4.7	43

Note. Reflects the transformed values for Praise and Incentives, Revised and SCBE Time 2, and corrected scales after removal of outliers.

Teacher Background.

Teacher Inventory. As part of the study intake process, teachers responded to 16 items about their background, teaching setting, and teaching experience. There were 15 multiple choice items and one open-ended item asking about years of teaching experience. Items aimed to assess factors relevant to teachers' experiences teaching students on the autism spectrum (e.g., perceived preparedness to teach students on the spectrum, perceived administrative support, regular trainings) and their broader teaching experiences (e.g., years of experience, school setting, education).

To examine teachers' perceived preparedness to teach students on the spectrum, they were asked "How prepared do you feel to teach students with autism?" Choices were on a 4-point Likert scale (1 = Not at all Prepared, 2 = Somewhat Prepared, 3 = Pretty Prepared, and 4 = Very Prepared). Due to the relatively small sample size and limited variability, responses were collapsed into a less prepared group (1 or 2) and a more prepared group (3 or 4). Of these, 34.0% of the sample fell into the less prepared group and 63.4% were in the more prepared group (n = 1 response missing). Similarly, responses to the 4-point Likert scale question "overall, how do you assess the support you receive from school administrator for teaching children on the autism spectrum?" were collapsed into low support (responses of 1 = poor or 2 = fair) and high support (responses of 3 = good or 4 = excellent). Of these, 29.0% of teachers fell into the low support group and 69.0% fell into the high support group. Teachers were asked the yes/no question, "Does your school provide regular teacher training in autism?" 37.0% reported "yes" and 61.4% reported "no" (n = 3 responses missing). Education was determined by asking

teachers to check any of the following boxes that applied: high school degree, junior/community college/AA degree, undergraduate/BA or BS degree, Master's Degree, Ph.D., or other). Due to the relatively small sample size and limited variability, responses were collapsed into two groups: (1) Less than a Master's degree and (2) Master's degree or higher. Most (67.6%) of the sample had a Master's degree or higher (n = 1 missing). Teachers reported on the settings in which they teach: General education, special education, and/or resource room. Teachers who responded "yes" to teaching in a general education setting were placed in the general education group (54.5%) and teachers who responded "no" to teaching in a general education setting were placed in the special education group (42.1%; n = 5 missing). Teachers' self-reported ethnicity was collapsed into a BIPOC category (i.e., Black or African American, Asian, Latinx, Native American/Alaska Native, and Native Hawaiian or Other Pacific Islander) and a White category. 70.3% of the sample identified as White and 22.1% identified as one or more categories represented by the BIPOC group (*n* = 11 missing). Additional frequencies and descriptive statistics are reported in Table 2.

Student Risk Factor.

Externalizing Behaviors: Child Behavior Checklist (CBCL; Achenbach, 2007) **and** ***Teacher Response Form (TRF; Achenbach & Rescorla, 2001; Achenbach & Rescorla, 2000).*** The CBCL and TRF are widely used standardized scales of children's behavioral and emotional problems and competencies completed by children's parent/caregiver and teacher, respectively. Each item is completed on a 3-point Likert scale (0 = not true, 1 = somewhat or sometimes true, 2 = very true or often true). There

are distinct forms for children ages 6-18 years (i.e., school-aged form; 112 items) and children ages 1.5-5 years (i.e., preschool form; 99 items). Because children in the present study ranged from ages 4-7 at the time of entry, the version of the form that corresponded to the child's age was used. The CBCL and TRF provide T scores and percentiles for scales (e.g., Externalizing Problems, Internalizing Problems) as well as for Total Problems, which allows comparison of the target child's behavior to those obtained from a standardization sample of same-age peers. Higher scores are indicative of greater levels of problem behaviors.

The CBCL and TRF have consistently demonstrated strong validity (e.g., factor structure, discriminative validity) and reliability (e.g., test-retest reliability) across both TD populations and clinical populations, including children with developmental disabilities and children from diverse cultural backgrounds (e.g., Kendall et al., 2007; Leung et al., 2006; Sikora et al., 2008; Tehrani-Doost et al., 2011). For example, Pandolfi and colleagues (2012) examined the psychometric properties of the CBCL for a sample of 122 children ages 6-18 on the autism spectrum, confirming the factor structure with broad domains of Internalizing and Externalizing Problems and finding that the measure reliably discriminated autistic students + Emotional Behavioral Disorder (EBD) from autistic students without EBD. They conducted another study with the CBCL for children ages 1.5-5 years and found similar results supporting its psychometric strengths as a measure for assessing externalizing behavior problems in youth on the autism spectrum (Pandolfi et al., 2009).

The Externalizing Problems scale was utilized in the present study as an indicator of externalizing challenges observed by parents/caregivers and teachers using the CBCL and TRF, respectively. Both reports were used to capture behaviors across home and school settings, and because previous research suggests variable levels of concordance between parent and teacher behavioral ratings in samples of autistic children (Azad et al., 2016; Llanes et al., 2018). Indeed, in the present sample, correlations between parent and teacher reports on the Externalizing Problems subscale scores were not consistently significantly correlated across time points, ranging from $r = .11$ ($p = .27$) to $r = .22$ ($p < .05$). It was hypothesized that the TRF would be more likely related to other school functioning variables explored in this study because it captures children's behaviors at school as perceived by their teacher rather than in the home setting. For the preschool scale (ages 1.5-5), the Externalizing Problems scale summarizes scores from the Attention and Aggression subscales. However, for the school-aged form (ages 6-18), the Externalizing Problems scale summarizes scores from the Rule-Breaking and Aggression subscales, items more appropriate for school-aged children. Cronbach's alpha indicated strong internal consistency for the Externalizing Problems scale in the present sample for both the preschool form (CBCL: $\alpha = .92$; TRF: $\alpha = .92$) and the school-aged form (CBCL: $\alpha = .86$; TRF: $\alpha = .93$). On the CBCL, T scores of 69 or greater are considered to be in the clinically significant range, while scores between 65-68 are considered to be in the borderline clinical range. At study entry, 33% of the present sample was in the borderline or clinically significant range for Externalizing Problems on the CBCL (0.8%

Missing). On the TRF, 27% of the present sample was in the borderline or clinically significant range (2.8% missing). See Table 4 for full descriptive data.

Student Social-Emotional and Behavioral Outcomes.

Academic Engagement: Academic Engagement Scale (AES; Skinner et al., 2009). The AES is a teacher rating scale of academic engagement behaviors in school for individual students. The AES is comprised of 8 items, each of which teachers rate on a 4-point Likert scale (1 = not at all true, 4 = very true). From these ratings, composite scores for Behavioral Engagement (4 items) and Emotional Engagement (4 items) are generated. The Behavioral Engagement subscale captures the child's observable behaviors signifying engagement (e.g., effort, persistence, attention) and the Emotional Engagement subscale captures students' emotional motivation or engagement in learning (e.g., enthusiasm, interest in school, happiness at school). These two subscale scores are summed to determine an overall academic engagement score, with higher scores indicating greater levels of overall academic engagement. In its pilot sample of 1,018 students in grades 3-6, the AES demonstrated strong convergent validity with teacher-rated student involvement and behavioral observations of on-task behaviors, as well as satisfactory internal consistency and high cross-time stability (Skinner et al., 2009). Further, its short length makes it a feasible and socially valid measure for completion by teachers. In the present sample, internal consistency for the total score was good at Time 2 ($\alpha = .87$) and lower at Time 3 ($\alpha = .67$). See Table 4 for full descriptive data.

Social Skills: Social Skills Improvement System (SSIS; Gresham & Elliot, 2008). The SSIS is a standardized rating scale used to assess social skills, behavior

problems, and academic competence in children ages 3-18. There are both parent/caregiver and teacher forms, which allows for assessment across settings (i.e., home and school) and raters. Each item is rated on a 4-point Likert scale (1 = never, 2 = seldom, 3 = often, 4 = almost always). Ratings result in scores for 12 subscales in addition to a Total Social Skills Scale Standard Score, which is what was used as an indicator of overall social skills in the present study. The Total Social Skills Standard Score summarizes the Communication, Cooperation, Assertion, Responsibility, Empathy, Engagement, and Self-Control subscales. The SSIS has demonstrated adequate reliability and validity for classifying students with clinically significant social skills deficits, and has been used extensively with clinical populations, including students on the spectrum (Crosby, 2011; Gresham et al., 2011). Validity evidence includes strong convergent validity with the Behavior Assessment System for Children, 2nd Edition (BASC-2), the Vineland Adaptive Behavior Scales, 2nd Edition, and the Social Skills Rating System (Gresham & Elliot, 2008; Gresham et al., 2011).

For the present study, teacher-reported Total Social Skills scores were used as a measure of students' social skills at school as perceived by their teachers. Although both parent and teacher report were obtained, the two scores were consistently significantly correlated across time points, with correlations of $r = .33$ ($p < .001$) at Time 2 and $r = .32$ ($p < .01$) at Time 3. Because teacher report reflects children's behaviors and skills observed in the school context, which were of primary interest in the current study, teacher SSIS scores were used. Cronbach's alpha for the sample indicated excellent

internal consistency (Time 2: $\alpha = .96$; Time 2: $\alpha = .93$). See Table 4 for full descriptive data.

Social Isolation: Social Competence and Behavior Evaluation Inventory (SCBE-30; LaFreniere & Dumas, 1996). The SCBE-30 is a 30-item, norm-referenced teacher rating scale of young children's behavior problems (i.e., indicators of lack of social competence) and social competence for young children. Social competence has been broadly defined as an individual's ability to navigate social challenges and landscapes, including the ability to consider another person's perspective in a situation (Semrud-Clikeman, 2007, p. 1). Teachers rate each item on a 6-point Likert scale (1 = never occurs, 6 = always occurs). The SCBE has been used extensively with young preschool and kindergarten-aged children of different backgrounds in research contexts (Denham & Brown, 2010; Sheriden et al., 2010) to measure children's social and emotional competence. It has demonstrated convergent validity with the Teacher Report Form (TRF; Achenbach & Rescorla, 2001; Achenbach & Rescorla, 2000), high test-retest validity, good internal consistency, and factor analytic evidence for its factor structure across cultural groups (Dumas et al., 1998; LaFreniere & Dumas, 1996; LaFreniere et al., 2002). In the present study, the Isolated-Integrated scale (10 items) was used to measure the target student's level of social isolation, with higher scores indicating greater social isolation and lower scores indicating greater social integration. Items include, "does not respond to other children's invitations to play" and "remains apart, isolated from the group." Reverse-coded items include "delights in playing with other children," "works easily in groups," and "children seek him or her out to play with them." The SCBE

Isolated-Integrated scale demonstrated good internal consistency (Time 2: $\alpha = .90$; Time 3: $\alpha = .89$). See Table 4 for full descriptive data.

Data Analytical Plan

Preliminary Analyses

Prior to statistical hypothesis testing, assumptions of parametric testing were checked (Field & Miles, 2010). Using IBM SPSS Version 24.0 (IBM Corp, 2016), each variable was checked for normal distribution with visual analysis of box plots and histograms, and statistical tests of normality (i.e., Kolmogorov-Smirnov and Shapiro-Wilk tests). For any variables with non-normality, extreme value outliers were identified and removed. If variables displayed significant skew, the variable was transformed, which allows for achievement of a normal distribution without altering relationships between values (Bland & Altman, 1996; Field & Miles, 2010, p. 134; Hartwig & Dearing, 1979; Osborne, 2002; Stoto & Emerson; 1983).

Research Question 1: Positive Reinforcement and STR Closeness

Bivariate Pearson correlations were first examined between STRS Closeness, CBCL Externalizing, TRF Externalizing, and TSQ Praise and Incentives Frequency. Additional variables explored as potential covariates contributing to STR Closeness were student cognitive functioning (i.e., WPPSI-III score) and spoken language abilities (Caplan et al., 2016). Correlations provided information about general linear relationships between individual variables, including strength and directionality, which informed an initial multiple regression analysis. The multiple regression analysis then allowed for examination of relevant predictors concurrently, providing insight about their relative

contributions to STR closeness. Results informed the construction of a moderation model to test the potential moderation effect of child externalizing behavior problems (i.e., TRF or CBCL) on the relationship between teachers' frequency of positive reinforcement strategy (i.e., TSQ Praise and Incentives Frequency) use and STR Closeness (i.e., STRS Closeness), controlling for any potential covariates (e.g., WPPSI-III, CASL). Regression-based moderation analyses were carried out using the PROCESS macro for SPSS version 3.5 (Hayes, 2012; Hayes, 2017a; Hayes, 2017b). The moderation effect depicting an interaction term between child externalizing behaviors and teachers' positive reinforcement was considered significant if $p < .05$ (Hayes, 2017a).

Research Question 2: STR Closeness and Student Social-Emotional and Behavioral Outcomes

To address the second research question, bivariate Pearson correlations were examined between STR Closeness and student social-emotional and behavioral functioning at school (i.e., AES, SCBE Isolation, SSIS Social Skills), as reported by their teachers. Again, child factors that are not of interest but that may be contributing to these outcomes (e.g., WPPSI cognitive functioning, CASL language skills) were examined for significant correlations as potential covariates. In these analyses, relationships between predictors at Time 1 and outcomes at Time 2 were of primary interest, as these occurred in the same school year with the same teacher. The same outcome measures were examined at Time 3, indicating stability or instability of outcomes into the following school year.

Results from these initial correlational and regression analyses were used to construct a path model using Structural Equation Modelling (SEM) that includes paths between the predictors of interest (i.e., STRS Closeness and TSQ Praise and Incentives Frequency), any significant child risk factors (i.e., CBCL/TRF Externalizing Problems), and child social-emotional and behavioral outcomes (i.e., SCBE Isolation, SSIS Social Skills, AES), controlling for any significant child covariates (i.e., WPPSI and/or CASL). SEM is a multivariate statistical approach to analyzing empirical data that is well-established within the fields of education and psychology (Bowen & Guo, 2011; Khine, 2013). The SEM analyses were conducted using the Lavaan program for RStudio Version 1.3.1056. Full Information Maximum Likelihood (FIML), an established and robust method of estimating missing data in SEM, was employed for SEM analyses (Eisenhower et al., 2015; Enders & Bandalos, 2009; Schlomer et al., 2010). FIML uses the log-likelihood function to estimate individual missing variables based on all available data (Dong & Peng, 2013). The assumptions of FIML (i.e., missing values are either missing at random (MAR) or missing completely at random (MCAR) and normal distribution) were met for the variables in the present study. The model was assessed for fit using the following fit indices: Chi-Square (χ^2), Root Mean Square Error of Approximation (RMSEA; Browne & Cudeck, 1993), Standardized Root Mean Squared Residual (SRMR; Bentler, 1995), Comparative Fit Index (CFI; Bentler, 1990), and Tucker Lewis Index (TLI; Tucker & Lewis, 1973). Criteria for good fit includes a non-significant χ^2, RMSEA < .08, SRMR < .08, CFI > 0.95, and TLI > 0.95 (Hooper et al, 2008; Hu & Bentler, 1999).

Research Question 3: Factors Contributing to Teachers' Positive Reinforcement Strategy Use

To address Research Question 3, a bivariate Pearson correlation was examined between the TSQ Praise and Incentives Frequency and the TSQ Praise and Incentives Usefulness scales. A significant correlation indicates that teachers' perceived usefulness of strategies is related to their frequency of using those strategies. Mean scores across items were ranked from high to low in order to identify the most and least frequently used reinforcement strategies and the perceived most and least useful strategies, and whether these are aligned.

Independent samples t-tests explored potential group differences in frequency of using positive reinforcement strategies between teachers of different ethnicities (i.e., identifying as White v. identifying as BIPOC), classroom settings (i.e., special education v. general education), level of administrative support for teaching children on the spectrum (i.e., good or excellent support v. fair or poor support), education level (i.e., master's degree or higher v. less than master's degree), preparedness to teach students on the spectrum (i.e., pretty or very prepared v. not at all or somewhat prepared), and between teachers who reported receiving regular trainings in autism from their school and those who did not. Gender and school setting (i.e., private v. public) were not explored as potential factors due to the low number and proportion of male teachers (n = 16 male) and teachers in private school settings (n = 12) in the sample. Additionally, a bivariate Pearson correlation was examined between years of teaching experience and TSQ Praise and Incentives Frequency. Where multiple teacher factors were significantly correlated to

TSQ Praise and Incentives Frequency, a multiple regression analysis was conducted to further examine their combined contribution to variance in TSQ Praise and Incentives Frequency scores. Categorical variables were dummy coded prior to inclusion in multiple regression.

Results

Preliminary Analyses

Using box plots, histograms, and statistical test of normality, normal distribution was confirmed for the following variables: TRF Externalizing, CASL, AES Total at Times 2 and 3, SSIS Social Skills at Times 2 and 3, and SCBE Isolation at Time 3. For STRS Closeness, five outliers causing a slight negative skew were identified and removed (range: 18-23). Three outliers were identified and removed from the WPPSI (scores = 46, 133, and 139). Two outliers were removed from the CBCL Externalizing scores (both scores = 88). In order to achieve normality for SCBE scores at Time 2, scores were transformed using square root transformation and two remaining outliers were removed (transformed values = 3.16 and 3.32). Both the Praise and Incentives Frequency and Praise and Incentives Usefulness subscales of the TSQ demonstrated moderate negative skew, requiring transformation prior to parametric analysis. Because the skew was negative, reflection was conducted prior to square root transformation (Osborne, 2002; Watthanacheewakul, 2021). The reflection was conducted by subtracting each observation from a constant (constant = maximum observation value plus one = 41), which ensured that all values were greater than or equal to one, a critical consideration with square root transformation (Osborne, 2002). In reflecting the variable, higher

original scores became lower transformed scores and vice versa. For this reason, any results examining the relationship between these transformed variables and other non-reflected variables would indicate the opposite directionality of the actual relationship. In other words, positive relationships would be indicated by negative coefficients and negative relationships would be indicated by positive coefficients. To promote clarity of results and correct for this artifact of the transformation, a negative valence was given to the transformed variables before use in any statistical analyses. In sum, the full transformation employed to achieve normality prior to statistical analyses was $T(x) = -\sqrt{((\max + 1) - x)}$. Normal distribution was confirmed for all variables following these preliminary steps. Descriptive statistics were then generated for all variables (see Table 4).

Research Question 1: Positive Reinforcement and STR Closeness

Bivariate Pearson correlations were first generated between STR Closeness (i.e., STRS Closeness), child externalizing behaviors (i.e., TRF Externalizing and CBCL Externalizing), and teachers' frequency of using positive reinforcement strategies (i.e., TSQ Praise and Incentives, Revised). Correlations with child cognitive functioning (i.e., WPPSI) and spoken language (i.e., CASL) were also generated. Results are presented in Table 5. Teacher-reported TRF Externalizing, but not parent-reported CBCL Externalizing, was significantly correlated with STRS Closeness. Notably, the significance level of the correlation between STRS Closeness and TSQ Praise and Incentives Frequency was $p = .05$ ($r = .17$), so although not significant at a level of $p < .05$, the relationship was further explored in subsequent analyses.

Table 5

Bivariate Pearson Correlations with STRS Closeness and Potential Contributing Variables

Scale/Subscale	1	2	3	4	5
1. STRS Closeness	--	--	--	--	--
2. TSQ Praise and Incentives Frequency	.17	--	--	--	--
3. TRF Externalizing	-.22**	.05	--	--	--
4. CBCL Externalizing	.02	-.09	.21*	--	--
5. WPPSI	.17*	-.14	-.15	.15	--
6. CASL	.28**	-.15	-.22*	-.04	.72**

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

Next, a multiple linear regression was conducted using STRS Closeness as the outcome variable and TRF Externalizing and TSQ Praise and Incentives Frequency as the primary predictor variables. Because WPPSI and CASL were significantly correlated with STRS Closeness, they were included in the model as covariates. CBCL Externalizing was excluded from the model because it was not significantly related to STRS Closeness. Results of the multiple regression are presented in Table 6. Variable Inflation Factors (VIF) ranged from 1.06 to 2.01 and did not indicate evidence for multicollinearity. Notably, TSQ Praise and Incentives Frequency and CASL were the only variables that were supported as significant contributors to STRS Closeness. Higher TSQ Praise and Incentives Frequency scores and higher CASL scores indicated higher

STRS Closeness scores. TRF Externalizing and WPPSI were not significant contributors after accounting for TSQ Praise and Incentives Frequency and CASL scores.

Table 6

Multiple Linear Regression with Significant Correlates of STR Closeness

	R^2	F	b	β	t	Sig.
Model	.15	4.68				.002
TSQ Praise and Incentives Frequency			1.50	.21*	2.34	.021
TRF Externalizing			-.11	-.17	-1.83	.071
CASL			.06	.28*	2.30	.024
WPPSI			-.01	-.02	-.18	.859

*$p < .05$

To examine the hypothesized moderating role of children's externalizing behavior, a moderation analysis was conducted with TSQ Praise and Incentives Frequency as the independent variable, TRF Externalizing as the moderator variable, and STRS Closeness as the dependent variable. CASL was entered into the model as a covariate. The model was significant ($R^2 = .15$, F = 4.95; $p = .001$), but the moderation effect (i.e., interaction term) between TRF Externalizing and TSQ Praise and Incentives Frequency was not significant ($p = .86$). Thus, the hypothesized moderation effect was not supported.

Research Question 2: STR Closeness and Student Social-Emotional and Behavioral Outcomes

To further examine the impact of positive classroom factors on student social emotional and behavioral outcomes across time, bivariate Pearson correlations were first generated between STRS Closeness, SCBE, SSIS, and AES scores at both Time 2 and Time 3. WPPSI and CASL were also explored as potential covariates. Correlation results are presented in Table 7.

Table 7

Bivariate Pearson Correlations with Child Outcomes at Times 2 and 3

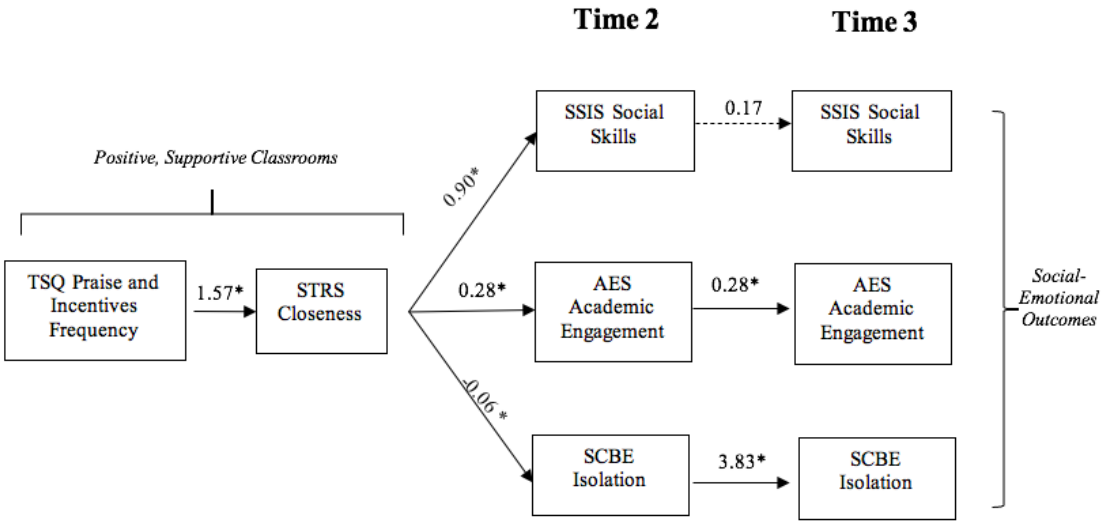
Scale/Subscale	1	2	3	4	5	6	7	8
Time 1								
1. STRS Closeness	--	--	--	--	--	--	--	--
2. WPPSI	.17*	--	--	--	--	--	--	--
3. CASL	.28**	.72**	--	--	--	--	--	--
Time 2								
4. SSIS Social Skills	.48**	.48**	.52**	--	--	--	--	--
5. SCBE Isolation	-.41**	-.36**	-.34**	-.70**	--	--	--	--
6. AES Total	.38**	.27**	.33**	.65**	-.61**	--	--	--
Time 3								
7. SSIS Social Skills	.30**	.39**	.53**	.46**	-.36**	.40**	--	--
8. SCBE Isolation	-.35**	-.30**	-.32**	-.54**	.52**	-.61**	-.72**	--
9. AES Total	.23*	.29**	.34**	.49**	-.39**	.50**	.70**	-.64**

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

Based on these results in conjunction with the results from Research Question 1, a Path model was constructed in order to examine the relationships between variables over time. CASL was included in the model as a covariate for STRS Closeness and both CASL and WPPSI were included as covariates of all child outcome variables. The model (see Figure 1) was a close fit to the data: χ^2 (18, N = 145) = 18.4, p = .43, TLI = 1.0, CFI = 1.0, RMSEA = .01, SRMR = .07. All regression paths in the model were significant (p < .01) in the expected direction with the exception of the regression path from Time 2 SSIS Social Skills to Time 3 SSIS Social Skills (p = .05). Teachers' positive reinforcement strategy use predicted STR closeness (β = 1.6, p < .01), which in turn predicted child social skills (β = .90, p < .001), academic engagement (β = .28, p < .001), and social isolation (negative relationship; β = -.06, p < .001), the latter two of which persisted into the following school year. Full regression coefficients are presented in Table 8 and covariance estimates are presented in Table 9.

Figure 1

SEM Path Model Results



*$p < .01$

Note. Covariance paths are not depicted in the diagram, although CASL and WPPSI were included as covariates in the model for all child social-emotional outcome variables and CASL was included as a covariate for STRS Closeness (see Table 9 for covariance estimates). Dashed lines indicate non-significant paths.

Table 8

SEM Path Model Regression Estimates

Regressions	*Estimate*	*Std. Error*	*Sig.*
STRS Closeness			
TSQ Praise and Incentives Frequency	1.6*	0.5	.007
CASL	.06*	.02	.000
Time 2 Academic Engagement			
STRS Closeness	.28*	.07	.000
CASL	.01	.02	.545
WPPSI	.05	.04	.224
Time 2 SSIS			
STRS Closeness	.90*	.17	.000
CASL	.04	.05	.418
WPPSI	.31*	.10	.001
Time 2 SCBE Isolation			
STRS Closeness	-.06*	.01	.000
CASL	.00	.00	.490
WPPSI	-.02*	.01	.002
Time 3 Academic Engagement			
Time 2 AES	.28*	.07	.000
CASL	.03	.02	.212
WPPSI	.02	.04	.656
Time 3 SSIS			
Time 2 SSIS Social Skills	.17	.09	.054
CASL	.13	.07	.053
WPPSI	.09	.13	.471
Time 3 SCBE Isolation			
Time 2 SCBE Isolation	3.83*	.78	.000
CASL	-.06	.04	.169
WPPSI	-.01	.08	.931

*$p < .01$

Table 9

SEM Path Model Covariance Estimates

Covariances	*Estimate*	*Std. Error*	*Sig.*
Time 2 Outcomes			
AES – SSIS Social Skills	26.5*	5.32	.000
AES – SCBE Isolation	-1.90*	.39	.000
SSIS – SCBE Isolation	-4.76*	.92	.000
Time 3 Outcomes			
AES – SSIS Social Skills	32.88*	6.23	.000
AES – SCBE Isolation	-17.97*	3.79	.000
SSIS Social Skills– SCBE Isolation	-69.12*	12.77	.000
Background Factors			
CASL - WPPSI	400.84*	12.77	.000

*$p < .01$

Research Question 3: Factors Contributing to Teachers' Positive Reinforcement Strategy Use

To explore the relationship between teachers' perceived usefulness of positive reinforcement strategies and their reported frequency of using those strategies, a bivariate Pearson correlation was first conducted between TSQ Praise and Incentives Frequency and TSQ Praise and Incentives Usefulness. Results supported a strong positive correlation between the two scales ($r = .77$, $p < .001$). Item pairs were all significantly positively correlated at a level of $p < .001$, with correlations ranging from $r = .32$ ("comment on good behavior") to $r = .79$ ("reward good behaviors with incentives"). Seven of the eight item pairs had correlations $r > .60$ and five of the eight had correlations $r > .70$. The highest mean scores across items for both Frequency of Use and Perceived Usefulness were the items "comment on good behavior" and "praise good

behavior" (Frequency mean = 4.8; Usefulness mean = 4.1). The lowest mean score for both Frequency and Usefulness were for the items "call parents to report good behavior" (Frequency mean = 2.6; Usefulness mean = 3.3) and "use group incentives" (Frequency mean = 3.4; Usefulness mean = 3.6). When the scales were ranked from highest to lowest mean scores, item frequency and usefulness were matched (see Table 3; note, this table reflects scores prior to transformation for clarity).

Results of independent samples t-tests revealed that teachers who received regular trainings in autism reported using positive reinforcement strategies significantly more frequently than teachers who did not receive regular trainings in autism ($t(129) = -3.53$, $p < .01$). Teachers who reported feeling pretty or very prepared to teach students on the spectrum reported using positive reinforcement strategies significantly more frequently than teachers who reported feeling less prepared (i.e., not at all prepared or somewhat prepared; $t(130) = 2.13$, $p < .05$). Teachers in general education settings reported using a significantly lower frequency of positive reinforcement strategies than teachers in special education settings ($t(126) = 2.18$, $p < .05$). There was not a significant difference in frequency of positive reinforcement use for teachers with higher level of administrative support ($t(129) = .91$, $p = .36$), for teachers with different ethnicity identities ($t(123) = -.51$, $p = .61$), or for teachers with a master's degree or higher ($t(130) = -1.23$, $p = .22$). There was not a significant correlation found between years of teaching experience and frequency of using positive reinforcement strategies ($r = -.05$, $p = .59$).

A multiple linear regression with the three teacher factors found to relate to significant differences in positive reinforcement strategy use (i.e., TSQ Praise and

Incentives Frequency) was significant overall, with the only significant predictor in the model being receiving regular trainings in autism (see Table 10). A second multiple linear regression with the addition of TSQ Praise and Incentives Usefulness revealed a significant change in R^2 ($\Delta R^2 = .55$, $p < .001$), with both TSQ Praise and Incentives Usefulness and regular autism trainings remaining significant predictors in the model (see Table 10).

Table 10

Multiple Linear Regression with Significant Teacher Factors Related to TSQ Praise and Incentives Frequency

	R^2	F	β	t	Sig.
Model 1	.10	3.70			.01
Preparedness to Teach Autistic Students			.03	.27	.79
Regular Trainings in Autism			27*	2.66	.01
General Education Setting			-.06	-.52	.60
Model 2	.65	47.82			.00
Preparedness to Teach Autistic Students			.04	.59	.56
Regular Trainings in Autism			.14*	2.10	.04
General Education Setting			.01	.09	.93
TSQ Praise and Incentives Usefulness			.76**	12.77	.00

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

Discussion

This research aimed to examine the role of positive teacher practices that could jointly serve as protective buffers against some of the risk to poor early school functioning faced by autistic students. Specifically, these analyses provided insight into how teachers' reported use of positive reinforcement strategies (e.g., praising positive behavior, rewarding positive behavior with incentives) promotes closer STRs for young autistic students and how these closer STRs, in turn, contribute to students' social and behavioral functioning at school over time, including their academic engagement, social integration, and social skills. Additionally, this work examined factors that may influence teachers' use of positive reinforcement strategies, including teacher background variables and their perceived usefulness of strategies.

Positive Reinforcement and STR Closeness

First, the present study explored the relationship between teachers' use of positive reinforcement and the development of close STRs for young students on the autism spectrum. As hypothesized, teachers who reported using positive reinforcement strategies more frequently had significantly closer STRs, even after accounting for other student risk factors associated with STR closeness (i.e., cognitive functioning, spoken language skills, externalizing behaviors). Although the correlation between teachers' positive reinforcement use and STR closeness was just under statistical significance ($p = .05$), perhaps due to the relatively small sample size, multiple regression results examining its contribution to STR closeness concurrently with other correlated factors highlighted the significant, standout role of teacher positive reinforcement use. These results are aligned

with both theoretical conceptualizations of positive relationship building and previous research on STR development.

From a behavioral perspective, the development of a positive STR in early elementary can be conceptualized as the process of pairing the classroom teacher, a stimulus that is initially somewhat neutral, with positive stimuli (e.g., praise, positive physical or verbal attention, access to preferred items and activities). If a teacher *consistently* and *predictably* associates themselves with positive stimuli and avoids becoming associated with punishing stimuli, it follows that their STR would be marked by a greater sense of trust, support, and closeness. Further, children who associate their teacher with a consistent source of positive interactions may be more likely to seek out those interactions, including instruction and academic tasks. Shillingsburg and colleagues (2019) examined the impact of a structured pairing protocol in which behavioral therapists paired interactions with access to preferred toys and activities for four young children (ages 3-4) on the autism spectrum prior to placing instructional demands. Following the pairing procedure, all participants demonstrated increased proximity to the therapist, decreased avoidance behaviors (e.g., elopement), and decreased negative affect (e.g., crying). Although this study was conducted in an intensive 1:1 setting with younger children, it lends support to the conceptualization of developing close relationships between students and teachers as the pairing of teachers with positive stimuli (i.e., positive reinforcement). A similar approach is utilized in Parent-Child Interaction Therapy, in which the first stage (i.e., Child-Directed Interaction) focuses on pairing the caregiver with positive stimuli (e.g., praise, commenting on good behavior) and avoiding

pairing the caregiver with negative stimuli (e.g., criticism, demands) in order to establish a positive parent-child relationship before presenting demands in the second stage (i.e., Parent-Directed Interaction). Shillingsburg and colleagues (2018, p. 485) say, "…PCIT makes interaction with the parent valuable through pairing it with reinforcement." Applying this behavioral lens here to teacher-student interactions in the classroom, teachers who successfully pair themselves with positive reinforcement create more valuable, positive relationships with their autistic students.

Previous empirical research has further supported the role of teachers' use of positive reinforcement in the development of positive STRs from both teachers' perspectives (e.g., Van Tartwijk et al., 2009) and students' perspectives (e.g., Mitchell and Bradshaw, 2013). For example, Kincade and colleagues (2020) conducted a meta-analysis of classroom interventions for improving STRs, identifying common practice elements among effective interventions. Effective programs were those that demonstrated statistically significant, positive effects on STRs (N = 12 programs), including Banking Time (Driscoll & Pianta, 2010), Establish-Maintain-Restore (Cook et al., 2018), and the IY TCM program (Webster-Stratton et al., 2001). The most frequently utilized practice element across effective interventions was praise (n = 8). The authors note that praise is relatively easy and free to implement, perhaps making it more feasible and acceptable for teachers than other practice elements (e.g., home visits). Other common practices were feedback (n = 6; including providing "…positive, immediate feedback following a correct response or appropriate behavior…"; Kincade et al., 2020, p. 725), incentives/rewards (n = 5), and positive home notes (n = 2). These practices are captured under the definition of

positive reinforcement and are aligned with items on the TSQ Praise and Incentives subscale employed in the present study (e.g., "comment on good behavior," "praise good behavior," "reward good behavior with incentives," "send notes home about positive behavior"). Thus, it is unsurprising that teachers who reported using these strategies more frequently also had closer STRs. Notably, the most frequently endorsed positive reinforcement practices in the current study were also "comment on good behavior" and "praise good behavior," suggesting that teachers may indeed face the fewest barriers to implementing these specific strategies in the classroom.

Although teachers' use of positive reinforcement was associated with STR closeness as hypothesized, the prediction that this relationship would be stronger for students with greater levels of challenging behavior was not supported. In other words, student externalizing behavior problems did not moderate the relationship between teachers' use of positive reinforcement and STR closeness. There is limited empirical research examining the potential buffering effect of positive reinforcement on STR development for students at risk of developing poorer-quality STRs, specifically. Aasheim and colleagues (2018) found a significantly higher impact of the IY TCM intervention on STR quality for students with more behavior problems. However, their analyses looked at the impact of the IY TCM intervention package as whole in a quasi-experimental design, whereas we isolated analyses to the contribution of positive reinforcement within our longitudinal descriptive study. Our sample was also autistic students, primarily male (84.1%), whereas theirs was primarily non-IEP students (the authors reported 90.0% of their sample was not special education) with 46.7% females. In

our moderation analysis, we controlled for several extraneous variables that could have impacted the association (e.g., spoken language skills, IQ) for our autistic sample, which represents a wide range of language and cognitive skills. There are additional variables that we were not able to reliably examine due to confines of our sample. For example, the contribution of gender on STR closeness was not able to be closely explored due to the limited proportion of female participants in our sample (15.9%). Previous research has indicated differences in STR quality between boys and girls (Jerome et al., 2009; Koepke & Harkins, 2008; McFarland et al., 2016), with studies often reporting boys experiencing more conflict in their STRs and girls experiencing more closeness. Perhaps positive reinforcement as a form of evaluative feedback influences males and females differently (Johnson & Helgeson, 2002), and thus student gender may impact the relationship between teachers' use of positive reinforcement and STR closeness. A larger, more gender-balanced sample could enable analyses that more closely examine the processes by which positive reinforcement is influencing STR closeness and whether gender is an important contributing factor.

Despite lack of evidence that teachers' use of positive reinforcement is more impactful on developing close STRs for students with more externalizing behavior challenges, the current findings are promising. Results suggest that teachers' use of positive reinforcement strategies is a significant predictor of close STRs above and beyond child risk factors, including externalizing behavior problems. Although previous research suggests that children with more externalizing behavior challenges are at risk for developing poorer-quality STRs (Baker et al., 2008; Caplan et al., 2016; Eisenhower et

al, 2015a; Fowler et al., 2008), when we accounted for teachers' use of positive reinforcement in the present sample, child externalizing problems was no longer a significant predictor of STR closeness. Further, all students in this sample were on the autism spectrum, representing a group of students who are at risk for poorer-quality STRs (Blacher et al., 2014; Longobardi et al., 2012; Zee et al., 2020). Results indicate that teachers' use of positive reinforcement strategies may buffer risk for poorer-quality STRs among autistic children, including those students who are at compounded risk due to higher levels of externalizing behavior challenges, lower cognitive functioning, and lower verbal language skills (Caplan et al., 2016).

STR Closeness and Student Social-Emotional and Behavioral Outcomes

The contribution of STR closeness, influenced by teachers' use of positive reinforcement strategies, to student social-emotional and behavioral functioning was then assessed using SEM. The developed model in which teachers' positive reinforcement use contributed to STR closeness, which in turn influenced children's social skills, social integration, and academic engagement at the end of the school year, was a close fit to the data and all key paths with the exception of the stability path for social skills from Time 2 to Time 3 were significant, even after controlling for IQ and spoken language skills, as applicable. Thus, these results support the hypothesis that positive, supportive classrooms in which teachers utilize positive reinforcement strategies and develop close STRs, indeed contribute to positive student outcomes. Findings are consistent with both theoretical and empirical foundations.

From an attachment perspective, teachers who are predictable, consistent, and warm serve as a "secure base" for students, enabling students to explore, learn, and grow knowing that they have a reliable source of comfort and support if needed (Bergin & Bergin, 2009; Riley, 2009; Roorda et al., 2011). Thus, it would be expected that students who have a closer relationship with their teachers (i.e., relationship marked by more openness, warmth, and liking) would be more willing to explore and engage in new social and academic learning opportunities, thereby learning more social and classroom functioning skills. From the behavioral perspective, if teachers have successfully paired themselves and the classroom environment with positive stimuli (i.e., positive reinforcement), and created a safe space by minimizing challenging behaviors and promoting prosocial behavior, students are likely more motivated to seek out and actively participate in social and academic learning activities in the classroom. Participating more in academic and social contexts allows students more opportunities to benefit from instruction, attend to models, practice new skills, and receive feedback (from both teachers and peers in the classroom), consequently developing critical classroom functioning and social skills. Further, from a sociocultural perspective, teachers who develop close STRs serve as models of prosocial, relationship-focused, contextually appropriate behaviors in the classroom from which students are able to learn. From these theoretical perspectives, it follows that students who have developed closer relationships with their teachers would be expected to demonstrate better social skills, experience less social isolation, and be more academically engaged than students who experience less STR closeness. Indeed, our findings indicated that students whose teachers used more

positive reinforcement strategies developed closer STRs, and those closer STRs contributed to better social skills, academic engagement, and less social isolation.

Empirical research corroborates these theoretical models of the important role of STR quality on student social-emotional and behavioral functioning at school, although most of the work has been conducted with non-autistic samples. In a sample of 470 non-autistic preschoolers, Alamos and Williford (2020) coded observed student-teacher interactions for quality of child-teacher interactions (e.g., sensitivity, responsiveness, positive affect) and children's emotional security with the teacher (i.e., teachers' availability and emotional alignment with student, as coded from a standardized interaction task), and had teachers complete a rating scale of student engagement in classroom tasks. They found that the quality of student-teacher interactions led to more secure STRs, which in turn promoted children's positive engagement in classroom tasks. In the present sample, we found that close STRs resulting from teachers' use of positive reinforcement led to better academic engagement. Hughes and Kwok (2006) found that STR quality predicted children's peer acceptance the following school year, controlling for initial level of peer acceptance and externalizing behavior challenges, among a sample of 360 non-autistic first-grade students. In our sample, we found that greater STR closeness led to reduced social isolation. Berry and O'Connor (2010) explored factors contributing to children's social skills development from kindergarten through sixth grade using data from the NICHD Study of Early Child Care and Youth Development (N = 1168). As in our autistic sample, they found that STR quality (as measured by the STRS) was significantly and positively associated with children's social skill

development (as measured by the *Social Skills Rating Scale*; Gresham & Elliott, 1990). Here, we found STR closeness to contribute to later social skills, as perceived by teachers. Collectively, our findings linking STR closeness with student school functioning across social-emotional and behavioral domains is consistent with previous work with non-autistic young children.

Student social isolation and academic engagement outcomes at the end of Year 1 persisted into the following school year, underscoring the importance of developing close STRs upon school entry. Surprisingly, the stability path for social skills across the school years was just below statistical significance (p = .05). Previous research has provided evidence for the stability of social skills and social competence in early elementary grades (e.g., Hajovsky et al., 2021; Lamont & Lee Van Horn, 2013). For example, Hajovsky and colleagues (2021) utilized longitudinal data from the Early Childhood Longitudinal Study (ECLS) to examine relations between social skills and STR quality from kindergarten to third grade (N = 12,507). They found both STR and social skills standard scores to be stable across these early elementary school years. Lamont and Lee Van Horn (2013) used data from the National Head Start – Public School Early Childhood Transition Demonstration Project (N = 6964) to examine trajectories in social skills from kindergarten to third grade, identifying a majority group (approximately 85% of the sample) for whom standardized social skills scores were quite stable across time. This previous work suggests that the impact of early STR closeness on social skills and social integration would be expected to persist across school years, but only the latter was supported by our findings. Much of the previous longitudinal work was conducted with

large samples (N = 12,507 in Hajovsky et al. (2021) and N = 6964 in Lee Van Horn (2013)), whereas the present sample was relatively small (N = 145), which could have limited the ability to detect a statistically significant stability path. Further, the vast majority of prior studies have been conducted with non-autistic samples, whereas our sample was children on the autism spectrum. Autistic students often receive special education supports or clinical intervention services to address social skills goals (Ruble et al., 2010), which were not accounted for here. Quantity and quality of these social skills supports could be a key source of variance contributing to social skills development over time for our autistic sample.

Findings from previous work examining the stability of students' academic engagement over time have been mixed, with much of the literature focusing on middle and high school students (Zhen et al., 2020). Janosz and colleagues (2008) used growth mixture modeling to define trajectories of engagement for a large sample (N = 13,300) of students ages 12-16 years, finding that the vast majority of the sample had stable trajectories (73%). Notably, of the students in the sample with special education services (N = 262), the majority also demonstrated stable trajectories of engagement (71.4%). On the other hand, You and Sharkey (2009) found that a stability model did not adequately fit their data for academic engagement across 8^{th}, 10^{th}, and 12^{th} grades for N=13,825 students from the National Education Longitudinal Study (NELS). Instead, they found that a model with a fixed growth rate describing increasing academic engagement over time was a better fit. Importantly, the authors did not specify if any students in the sample had a disability or explore the possible impact of a disability on these results. Our results

align with those of Janosz and colleagues (2008) and other researchers finding stability of student academic engagement across school years (e.g., Kindermann, 2007). Perhaps engagement is more likely to remain stable for younger children in early elementary, whereas additional variables such as peer group association exert more influence on children's academic engagement as they get older (Kindermann, 2007; Li et al., 2011). Future longitudinal research with autistic students across additional grade levels would be needed to effectively examine this theory.

Regardless, findings from the first two research questions highlight the lasting impact of teachers' use of positive reinforcement strategies. When teachers reported using positive reinforcement strategies more frequently, they had closer STRs, which resulted in better student social skills, reduced social isolation, and increased academic engagement. Student outcomes in academic engagement and social integration persisted into the following school year, often with a new teacher. Among this sample of young autistic students who are at risk for poor school functioning (Ashburner et al., 2010; Blacher et al., 2014), it is clear that positive, supportive classroom environments defined by teachers who prioritize positive reinforcement and developing close relationships with their students, are promoting positive student social-emotional outcomes.

Factors Contributing to Teachers' Positive Reinforcement Strategy Use

The positive reinforcement strategies that teachers reported using most frequently were also those perceived to be the most useful. Top strategies (mean frequency and usefulness scores > 4.0) were "comment on good behavior," "praise good behavior," and "reward good behavior with incentives." These results mirror those of Carlson and

colleagues (2011), who found that teachers' ratings of frequency and perceived usefulness of classroom strategies within the context of the IY TCM intervention were consistently significantly and positively correlated. In Kincade and colleagues' (2020) meta-analysis of teacher practices that were common among effective intervention programs for improving STR quality, praise, feedback (including commenting on good behavior), and incentives/rewards were among the most frequently utilized practices. Although Kincade et al. (2020) were assessing elements of STR interventions, rather than teacher-reported frequency of positive reinforcement strategy use in a business-as-usual context, these simple, straightforward, cost- and time-effective strategies appear to be feasible, acceptable (i.e., useful), and effective for teachers in promoting better STRs. Indeed, teachers often identify lack of time, lack of resources, perceived lack of effectiveness, and poor contextual fit as barriers to implementing classroom practices (Odom et al., 1993; State et al., 2017), so it is not surprising that strategies like praise and positive feedback that are quick and easy to integrate into the classroom context are reported by teachers most frequently.

In general education settings, which represented more than half of our sample, teachers are often managing more students with fewer resources (e.g., teaching aides) and students on the spectrum are often facing greater barriers to learning (e.g., less individualized support, greater social demands); thus, identifying useful teacher practices for building positive, supportive classrooms in general education settings are particularly critical. Bolourian and colleagues (2021) conducted focus groups with teachers in early elementary general education settings (N = 18), asking them about their perceptions of

classroom practices for promoting the inclusion of autistic students and strategies for relationship-building with students on the spectrum. Participants individually ranked their top five most important strategies for each question and rankings were then used to calculate saliency scores indicating those perceptions and practices that were viewed as the most important by the group overall. Among the most salient practices for inclusion were showcasing special talents and strengths and promoting classroom relationships. The present study demonstrated how positive reinforcement strategy use contributes to STR closeness, thereby serving as one element of promoting classroom relationships. Praising or commenting on students' good behavior, including their strengths and special talents, is another strategy that teachers may view as acceptable in general, but also important for including students on the spectrum in general education settings. Notably, students on the spectrum often have intense focus on their interests, and/or interests that could be viewed as unusual or atypical, or even negative. However, teachers' modeling of acceptance of these interests and talents to all students likely promotes students' social integration in the classroom as well as STR quality.

Among the most salient teacher responses for strategies to promote relationship-building with students on the spectrum in the Bolourian et al. (2021) study were providing safety (e.g., being consistent and predictable) and using positive feedback and comments, both of which overlap with teachers' responses in the present study. Teachers using more positive reinforcement create a sense of consistence and predictability that (1) the teacher is a reliable source of positive interaction and (2) positive, prosocial behaviors are the expectation. These practices can help build safety and security for autistic

children. Importantly, being a consistent and reliable source of positive reinforcement is also critical for building trust and safety with students who have experienced trauma, which is unfortunately an especially common experience for individuals on the spectrum (Rajaraman et al., 2022). Together, these results suggest that simple positive reinforcement strategies like praise and providing positive feedback are viewed as both important and useful, are associated with more positive STRs, and are reported to be used quite frequently by teachers of students on the spectrum.

Teachers' perceived usefulness of positive reinforcement strategies contributed to their reported frequency of strategy use, above and beyond other teacher background factors explored. Although teachers feeling more prepared to teach autistic students and teachers in general education settings reported using positive reinforcement strategies significantly more frequently, these factors were not significant contributors to positive reinforcement strategy use after accounting for teachers' perceptions of usefulness. Marchant and colleagues (2013) argue that social validity provides insight into the perceived value of an intervention or practice for key stakeholders and is an indicator of a program's viability. In the context of classroom teachers, practices that are not viewed as socially valid (e.g., not useful) are not likely to be valued and are not likely to succeed (i.e., be implemented).

Although social validity is multidimensional and we only utilized one indicator in the present study (i.e., usefulness), our results emphasize that teachers' perceptions of usefulness are powerful factors in their likelihood of implementing a positive reinforcement strategy. These results are promising because although many teacher

factors we examined are not malleable (e.g., years of teaching experience, general education v. special education setting), teachers' perceptions of usefulness may be a malleable and resource efficient factor that administrators, trainers, and consultants can tap into to promote positive reinforcement strategy use. For example, teacher consultants can assess what an individual teacher values and finds useful, and connect positive reinforcement strategies to these specific values and perspectives on usefulness. These results provide further support for the importance of assessing and considering social validity in classroom practice research (e.g., Marchant et al., 2013), as it appears to be very closely tied to teachers' actual usage of strategies. Future research should also aim to include children's perspectives on the social validity of positive reinforcement strategies, as the recipients of these practices (Hanley, 2010).

Not surprisingly, teachers who reported receiving regular trainings in autism also reported using positive reinforcement strategies more frequently, above and beyond other teacher factors. Teacher trainings in autism commonly incorporate positive behavior support strategies because students on the spectrum often face behavioral challenges in the classroom, and these approaches are grounded in empirical support (e.g., Leblanc et al., 2009; Marder & Debettencourt, 2012; Probst & Leppert, 2008). Promoting more prosocial behavior and reducing challenging behavior creates the opportunity for more positive interactions and fewer conflictual interactions. Further, autism trainings that increase teachers' knowledge of the challenges faced by neurodiverse students may promote empathy and understanding that enables them to be more positive towards this group of students. For example, if a teacher knows that self-stimulatory behaviors,

commonly associated with autism, are often self-soothing for autistic individuals, they may be more inclined to comment on or praise these behaviors as a coping strategy rather than try to punish or extinguish these behaviors. Similarly, if a teacher views intense, focused interests as a strength or special talent rather than a barrier, they may be more likely to praise or comment on these behaviors positively. In the Bolourian et al. (2021) study, general education teachers reported showcasing special talents and strengths and taking an interest in student interests as important strategies for including autistic students and building positive STRs. These are two examples of strategies that could result in more positive reinforcement for autistic characteristics that teachers may be more likely to identify and view as positive if they receive regular trainings in autism. Indeed, the authors suggest that teacher trainings in autism may aim to help teachers identify and highlight student strengths, as well as address challenging behaviors through evidence-based behavioral management strategies. Although the present study did not examine the content, quality, or duration of autism trainings received by teachers, it suggested that autism-focused trainings, which likely address topics like behavior management and general autism knowledge, promote teachers' use of positive reinforcement strategies.

Limitations

Despite the many strengths of this study, including its well-characterized sample of young autistic children, multi-informant data sources, multi-site design, and multi-year longitudinal design, it is not without limitations that should be considered when interpreting findings. First, the results presented here are purely descriptive rather than experimental, as no experimental manipulation was conducted. These results therefore

present preliminary findings that should be used to inform future experimental studies testing the impact of positive reinforcement strategy use on school functioning for young students on the spectrum. Second, the children in this sample represent a range of cognitive abilities, spoken language abilities, behavioral functioning, and social skills, which reflect the range of these domains of functioning present in autism (e.g., Jensen & Spannagel, 2011). However, students with very low cognitive functioning (e.g., students with concurrent ID) are not represented in this sample, primarily due to the focus on children who spent at least some of their school day in general education settings, and thus these results should not be assumed to extend to those students. Further, our sample was predominantly male, reflecting the greater prevalence of autism in males than females (Maenner et al., 2020). Although expected, the limited number of autistic girls in the sample inhibited closer inspection of child sex as a contributing variable to STR quality and school functioning outcomes. Future research should prioritize recruiting more girls on the spectrum. Third, this work relied solely on teacher report of their positive reinforcement strategy use. Ideally, observational measures would also be utilized to more objectively measure teachers' frequency and quality (e.g., specific, individualized praise and incentives vs. non-specific or universal praise and incentives) of using positive reinforcement strategies. Despite observational methods being much more resource-intensive and not without limitations (Girard & Cohn, 2016), future work should incorporate observational measurement to reduce bias, promote more accurate measurement of teachers' strategy use, and examine quality of strategy use. Fourth, this work presents only one perspective (i.e., teachers') in a two-sided relationship. STRs are

dyadic and reciprocal in nature, with both students and teachers contributing to the relationship and holding unique perspectives on the relationship (Doumen et al., 2009). Indeed, recent work has attempted to incorporate autistic students' perspectives on their STRs (Losh et al., 2022; Roorda et al., 2021; Zee et al., 2020), finding that their perceptions may differ substantially from their teachers' (Losh et al., 2022). For this reason, it is critical that future work studying STRs include students' voices, particularly when studying children beyond the early childhood years.

Implications for Practice

Findings from the present study have several important considerations for classroom practices. First, results highlight the direct role of teachers' positive reinforcement strategy use in developing close STRs with young autistic students, and the downstream impact on student outcomes. Young students on the autism spectrum are at risk for poor school adjustment, functioning, and outcomes (Ashburner et al., 2008; Ashburner et al., 2010; Blacher et al., 2014; Matson & Nebel-Schwalm, 2007; Troyb et al., 2014), and it is imperative that we identify socially valid classroom practices that promote their success. Teachers who reported using positive reinforcement strategies more frequently had closer STRs with their autistic students, and those closer STRs contributed to better student social skills, less social isolation, and greater academic engagement. Teachers' positive reinforcement strategy use contributed to STR closeness above and beyond child risk factors, including externalizing behavior challenges, verbal language skills, and cognitive functioning. In this sense, positive reinforcement strategies, used appropriately and with autistic children's strengths in mind, may serve as a critical

protective classroom factor for young autistic students. Future intervention research should aim to experimentally test the impact of positive reinforcement strategy use on STR quality and student outcomes by training teachers on how to use these strategies effectively, reliably, and feasibly.

Second, when positive reinforcement strategies were perceived to be more useful by teachers, they were used more frequently. Perceived usefulness of strategies was the most significant indicator of reported frequency of use, even after accounting for other teacher factors (e.g., regular trainings in autism, general education v. special education setting). School professionals providing consultation and training to teachers (e.g., school psychologists, behavior specialists) should prioritize assessing perceived usefulness and addressing barriers to perceived usefulness when supporting teachers in using positive reinforcement strategies. Specific strategies that were used most frequently and deemed most useful by teachers were commenting on good behavior, praising good behavior, and rewarding good behavior with incentives. These relatively simple, straightforward, and resource efficient (i.e., do not require a lot of time or materials/money) practices are likely easiest to integrate into teachers' existing classroom structures and routines. Therefore, future intervention work aiming to increase teachers' use of positive reinforcement strategies may consider beginning by helping teachers implement these three simple strategies effectively and reliably, particularly with their students on the autism spectrum for whom positive social interactions can be challenging and limited. Special considerations for autistic students, who may not have the social communication skills to express what incentives and rewards they prefer and who may have interests

deemed odd or unconventional, may include utilizing preference assessments or inventories to identify highly motivating reinforcers (Da Fonte et al., 2016), incorporating choice (Da Fonte et al., 2016; Newman et al., 2002; Reinhartsen et al., 2002), or supporting the reinforcement system with visual aids (Steinbrenner et al., 2020).

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