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Student–teacher relationships of children with autism spectrum disorder: Distinct contributions of language domains

Melanie Feldman[a,*], Melissa Maye[a,1], Sarah Levinson[a], Alice Carter[a], Jan Blacher[b], Abbey Eisenhower[a]

[a] Department of Psychology, 100 Morrissey Boulevard, University of Massachusetts Boston, Boston, MA 02125, USA
[b] Department of Education, 1207 Sproul Hall, University of California Riverside, Riverside, CA 92521, USA

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ABSTRACT

Background and aims: High quality student–teacher relationships (STR) are important for children's academic and social development. We explore how individual child language domains (semantics, syntax, pragmatics), teacher years of experience, and classroom placement (general or special education) relate to STR quality for children with autism spectrum disorder (ASD) across the school year.

Methods and procedures: 191 children with ASD (M_{age} = 5.6 years) completed a standardized language assessment and their teachers reported on STR quality twice during the school year.

Outcome and results: Pragmatics, but not semantics or syntax, had a direct effect on student–teacher closeness. The association between semantics and closeness was moderated by classroom type; for students with low semantics, teacher-reported closeness was lower in general versus special education. Teachers in special versus general education classrooms reported closer relationships. More experienced teachers reported closer and less conflictual relationships. None of the three language domains were associated with student–teacher conflict.

Conclusions and implications: Pragmatic and semantic language skills were associated with closer relationships. Language-focused therapies may be effective in carrying over to impact STR quality. Given the stability in relationship quality, targeted interventions should be delivered to teachers at the beginning of the school year to support positive relationship development.

What this paper adds

This paper adds to the limited existing research on factors that are associated with student–teacher relationship (STR) quality for young children with autism spectrum disorder (ASD). While previous studies have illustrated that children with ASD have lower quality relationships with their teachers than typically developing (TD) children, few studies have explored the specific factors that are associated with STR quality for children with ASD, providing little guidance for intervention development. The current study examines how specific components of child language abilities (semantics, syntax, and pragmatics) relate to STR quality in the fall and spring of a school year. We found that certain language domains are more closely associated with STR quality than others. In particular, pragmatic language is associated with student–teacher closeness for all children with ASD and, for those children in a general education setting, semantic language (i.e., vocabulary skills) is associated with student–teacher closeness. Meanwhile,

* Corresponding author.
E-mail address: Melanie.Feldman001@umb.edu (M. Feldman).
[1] Present address: Department of Psychiatry, University of Pennsylvania School of Medicine, 3535 Market Street, Philadelphia, PA 19104, USA.

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syntactic language skills (i.e., grammar) did not relate to STR quality. Results provide a nuanced examination of how child, teacher, and classroom factors independently and jointly influence STR quality for children with ASD. A noteworthy finding includes the role of classroom placement as a moderator of the relationship between child language and STR quality, suggesting that children in general education may need particular support in developing close relationships with their teachers. Findings suggest potential avenues and optimal timing for the delivery of teacher-focused interventions to improve STR quality for children with ASD.

1. Introduction

Autism spectrum disorder (ASD) is characterized by marked and persistent social communication deficits (American Psychiatric Association, 2013). Considerable research has been devoted to identifying and characterizing the social communication deficits associated with ASD, with attention to children's development and skills across broad linguistic domains (e.g., phonology, semantics, syntax, and pragmatics). Research has begun to explore relations between language-related deficits and social relationships among children with ASD (Anderson et al., 2007; Liss et al., 2001). Indeed, children with ASD generally have lower quality relationships with teachers than children with other developmental disabilities or typically developing (TD) peers (Blacher, Howell, Lauderdale-Littin, Reed, & Laugeson, 2014; Prino, Pasta, Giovanna, Gastaldi, & Longobardi, 2016), an important finding given that the quality of children's early relationships with teachers is an important predictor of behavioral, social, and academic functioning as well as school adjustment (Breeman et al., 2015; Mason, Hajovksy, McCune, & Turek, 2017).

Historically, investigations on the association between language skills and social relationships in ASD have examined language through global, expressive, and/or receptive language composites (Eigsti, de Marchena, Schuh, & Kelley, 2011). Prior research on children with ASD suggests that general language abilities are associated with the quality of their relationships with teachers, peers, and family (Bennett et al., 2015; Caplan, Feldman, Eisenhower, & Blacher, 2016; Magiati, Tay, & Howlin, 2014). However, given the variability in skills across language domains that comprise composite language scores, the composite approach to the influence of language on social skills likely obscures the influence of language ability. For example, Bakopoulou and Dockrell (2016) examined the association between general language abilities (e.g., global, expressive, receptive language composites) and social functioning among TD children and children with specific language impairment (SLI). They found that while children with SLI evidenced poorer social functioning than TD, non-verbal IQ matched peers, there was not a significant association between general language abilities and social functioning in either condition group. These findings suggest that although language skills likely influence social functioning, composite-level examinations of language abilities might camouflage the specific impact of structural or pragmatic aspects of language. Thus, there is a need for domain-level examinations of language ability.

The current study was designed to contribute to the existing literature by examining the differential contributions of specific domains of language to the quality of children's relationships with teachers. Given the importance of STR quality for children's adjustment, it is critical to identify factors that promote or challenge the development of high quality STRs for individuals with ASD. The present study explores the associations between specific language skills and STR quality in the fall and spring of the school year among early elementary-age children (i.e., ages 4–7) with ASD. Specifically, we examine the concurrent associations between children's skills in the following three distinct language domains: (1) syntax, (2) semantics, and (3) pragmatics and STR quality, as well as whether specific language domains predict changes in STR quality from the fall to the spring of the school year. Examination of STRs at two time points allows for examination of how the impact of language factors on STR quality may look different at the beginning versus the end of the school year, providing critical information on the stability and directionality of these relations in and ASD population. We also assess whether teacher and classroom characteristics, including teachers' years of experience and classroom type (general education versus special education) moderate the association between children's language skills and STR quality.

1.1. Language skills

Traditionally, linguists have identified five broad language domains, which include phonology, morphology, syntax, semantics, and pragmatics (Eigsti et al., 2011). Although each linguistic domain serves critical and unique communicative functions, for the purposes of the present study, we focus exclusively on semantics, syntax, and pragmatics; these three constructs represent higher-order language skills that are the most practical to conceptualize within a school context as compared to the more microscopic aspects of language including phonology and morphology. Semantics serves as the basic foundation for language and involves an understanding of word meaning. Generally, semantics can be understood as synonymous with vocabulary skills (Eigsti et al., 2011). While many skills fall within this domain, we examined word meaning and word recall as a proxy for overall semantics. *Syntax* can be considered synonymous with grammatical skills and involves the ability to apply grammar rules in speech, which entails utilizing a set of rules to arrange words into well-formed phrases and sentences. *Pragmatics* is the ability to understand and apply socially accepted behaviors during communication exchanges and includes the capacity to understand and use conversational implications and inferences (Whyte & Nelson, 2015). Unlike semantics and syntax, which involve a solely linguistic component, pragmatics includes both linguistic (e.g., referential utterances, register) and non-linguistic, components (e.g., eye contact, facial expressions, body language, gestures).

Most researchers treat pragmatic deficits as the most critical area of linguistic impairment among individuals with ASD (Eigsti et al., 2011), given its direct link to social skills and the social application of language; this perspective has likely contributed to significantly less research being devoted towards examining semantic and syntactic language skills in ASD. Nonetheless, limited research suggests that a considerable proportion of children with ASD evidence semantic and syntactic deficits and that these deficits remain even following intervention (Eigsti & Bennetto, 2009; Kelley, Paul, Fein, & Naigles, 2006). However, other research suggests

that some children with ASD evidence semantic and syntactic language skills equivalent to those of their TD peers (Eigsti et al., 2011; Kjelgaard & Tager-Flusberg, 2001). Consequently, unlike the reliable evidence for the association between ASD and pragmatic language deficits (Tager-Flusberg, 2006), the findings on semantics and syntax are less consistent.

Some postulate that the inconsistency in findings across studies – with some showing semantic and syntactic deficits for children with ASD and some not showing deficits – reflects the actual variability, or scatter, in semantic and syntactic abilities observed across individuals with ASD. To a greater extent than would be expected by their IQs or among those without ASD, people with ASD show great variability in these abilities (Anderson et al., 2007). Given this variability in linguistic skills associated with ASD, examining language domains separately rather than globally may illuminate important patterns.

1.2. Language skills and social relationships

In the limited research focused on language skills and STRs conducted already among children with ASD, language skills have been considered globally. In the only study we identified that examined language in relation to STR quality in an ASD sample, we found that among the current sample of early elementary-aged children with ASD, overall language ability was positively associated with STR closeness and negatively associated with STR conflict (Caplan et al., 2016). No studies have, to our knowledge, examined associations between specific language domains and STR quality for children with ASD, although language skills have been shown to predict the quality of other social relationships for those with ASD (Volden, Coolican, White, & Bryson, 2009; Whyte, Nelson, & Scherf, 2014). For example, pragmatic language skills have been shown to predict the quality of peer relationships and friendships across the lifespan for individuals with ASD (Bauminger-Zviely, Karin, Kimhi, & Agam-Ben-Artzi, 2014; Gillespie-Lynch et al., 2012; Koning & Magill-Evans, 2001). While it is likely that such findings extend to STRs, this study will uniquely examine how children's distinct language skills are associated with the quality of their STRs among children with ASD.

Individuals with ASD often evidence a number of significant and persistent pragmatic language deficits, such as difficulties with understanding and using gestures and sarcasm as well as following culturally normative standards regarding turn-taking during conversations (Chiang, Soong, Lin, & Rogers, 2008; Golubchik, Sever, Katz, Shoval, & Weizman, 2012). Arguably, pragmatics comprise the most socially motivated language domain, as the effective engagement of pragmatic language skills requires the application of numerous social cognitive reasoning abilities (e.g., ability to identify other's mental states; Fernandez, 2013). Indeed, these pragmatic difficulties have been postulated to lead to miscommunication and conflict during social interactions (Loukusa, Makinen, Kuusikko-Gauffin, Ebeling, & Leinonen, 2018). Although not yet empirically tested, pragmatic deficits may contribute to miscommunication and interpersonal conflict between children with ASD and their teachers, and over time, lower quality STRs.

Although limited, emerging research suggests that semantic and syntactic language skills also play a role in shaping the quality of social relationships for those with ASD. Volden et al. (2009) found that, among children with ASD, semantic and syntactic language abilities predicted their pragmatic language skills, which in turn, uniquely predicted their social skills. Because semantic and syntactic language deficits often make it difficult for others to understand individuals with ASD during communicative exchanges, these linguistic deficits likely interfere with the development and maintenance of social relationships. Language difficulties and speech patterns common in ASD – including problems with syntax or semantics, as well as stereotyped speech, unusual intonation, or echolalia – may interfere with teachers' ability to readily form connections with students with ASD. For example, in a sample of teachers working with students with ASD who were between 3 and 7 years of age, teachers were observed to respond inconsistently to communicative bids from students. Indeed, even though teachers reported recognizing their students' pre-linguistic gestures, body movements, and facial expressions as communicative attempts, teachers acknowledged or responded to less than a quarter of students' nonverbal communicative bids (Keen, Sigafoos, & Woodyatt, 2005). This inconsistency in perceiving and responding to children's bids may lead not only to reduced closeness but also to greater conflict and misunderstanding. As the Keen et al. (2005) study lacked a control group, these findings may reflect teachers' responses to students' communicative bids more generally, regardless of their ASD status. However, given the considerable research documenting the reported challenges and communication differences that teachers often encounter when working with their students with ASD (Lindsay, Proulx, Thomson, & Scott, 2013; Soto-Chodiman, Pooley, Cohen, & Taylor, 2012), these findings likely support the contention that, as a result of students' communication difficulties, children with ASD may encounter less responsive or more detached relationships with teachers and, in turn, may experience the concurrent and long-term liabilities engendered by such relationship problems. In addition, research documents a negative association between children's language skills and interpersonal conflicts (Rudasill, Rimm-Kaufman, Justice, & Pence, 2010). For example, in a sample of preschool children, children with expressive language deficits evidenced greater conflict with their teachers than their TD peers (Justice, Cottone, Mashburn, & Rimm-Kaufman, 2008). One potential explanation for the aforementioned findings is that lower language abilities may increase the likelihood of miscommunication and subsequent interpersonal conflicts. Thus, it was hypothesized in the current study that lower levels of semantic, syntactic, and pragmatic language would result in less close and more conflictual STRs for children with ASD.

1.3. Student–teacher relationships and ASD

Children with ASD often evidence lower quality STRs, which are characterized by higher levels of conflict and less closeness, when compared to either TD peers or children with intellectual disabilities (Blacher et al., 2014; Longobardi, Prino, Pasta, Gastaldi, & Quaglia, 2012). A combination of student, teacher, and classroom factors predict STR quality for students with ASD, including children's ASD symptom severity and IQ (Caplan et al., 2016), level of behavior problems (Eisenhower, Blacher, & Bush, 2015), social skills (Blacher et al., 2014), years of teaching experience (Caplan et al., 2016), and curriculum type (e.g., standard versus modified

curriculum; Brown & McIntosh, 2012.)

Teachers' level of experience. Research suggests that more experienced teachers report greater closeness and lower conflict with their early elementary-aged students with and without ASD (Caplan et al., 2016; Mashburn, Hamre, Downer, & Pianta, 2006). It is possible that, in comparison to newer educators, more experienced teachers have greater experience in working with students with ASD and have developed the necessary skills to meet students' needs and foster higher-quality STRs (Corona, Christodulu, & Rinaldi, 2017). Thus, in the current study, we expected that more experienced teachers may be better positioned than less experienced teachers to form close, low-conflict relationships with students even in the context of children's syntactic, semantic, or pragmatic language difficulties. As such, we examine whether years of teacher experience moderates the link between child language skills and STR quality.

Classroom placement. With regard to type of educational setting (e.g., special education versus general education), Brown and McIntosh (2012) found that in their study of early elementary-aged boys with ASD, children who received the general education curriculum for a greater proportion of the school day had higher STR quality. These findings may reflect, in part, the greater symptom severity of the children who require greater educational supports. In addition, teachers in special education classrooms may be better equipped (through greater special education training, a smaller student–teacher ratio, or greater attention to ASD-related communicative challenges) to form close, low-conflict relationships with children with ASD regardless of language skills. Thus, we consider whether classroom placement moderates the association between child language skills and STR quality.

1.4. Aims of the current study

Presently, there is an absence of research examining the contributions of distinct language skill domains to STR quality for young children with ASD. Thus, this paper addresses the following two questions: (1) How do skills across language domains, including semantics, syntax, and pragmatics, relate to STR quality and predict change in STR quality over the course of the school year? (2) Do teacher and classroom factors, including teachers' years of experience and classroom placement (general education vs. special education), moderate the association between language and STR quality, either concurrently or over time?

2. Material and methods

2.1. Procedure

As part of a larger study examining the adaptation to early schooling among young children with ASD, we recruited participants through online and print advertisements, autism-related conferences, school districts, clinicians, and autism resource centers. Interested families attended initial eligibility sessions during the summer or fall. After parents provided informed consent, clinicians administered the Autism Diagnostic Observation Schedule (ADOS: Lord et al., 2000) using revised research algorithms developed for the ADOS-2 (Gotham, Risi, Pickles, & Lord, 2007; Gotham et al., 2008), and an abbreviated version of the Wechsler Preschool Primary Intelligence Scales (WPPSI-III: Wechsler, 2002) to children. At the time of data collection, the later released versions of these assessments (ADOS-2 [Lord et al., 2012]; WPPSI-IV [Wechsler, 2012]) were not available.

Children who had previously received a formal diagnosis of ASD were eligible for the study if they scored in the autism or autism spectrum range on the ADOS, using the revised algorithms, met clinical criteria based on the judgment of graduate-level clinicians, and earned an estimated IQ score of 50 or higher on the WPPSI-III. If children had not already received a formal diagnosis of ASD, the Autism Diagnostic Interview – Revised (ADI-R: Le Couteur, Lord, & Rutter, 2003) was also administered to the parent.

Eligible families subsequently attended two visits that school year, once in the fall (Time 1) one to two months after the initial eligibility visit, and once in the spring (Time 2), which was six to nine months after Time 1. During these visits, parents completed questionnaires and interviews while children participated in performance-based assessments of language and academic skills. At each visit, parents provided their consent to have the child's teacher complete study measures and were provided with a packet of questionnaires which they were instructed to bring to the child's primary teacher. Teacher participation was voluntary, and all participating teachers also provided informed consent. At each time point, both parents and teachers received a modest honorarium for their participation. A university institutional review board approved all study procedures.

2.2. Participants

Participants included 191 children with ASD, their parents, and teachers in Massachusetts ($n = 69$) and inland Southern California ($n = 122$). One parent from each family (89% female) completed all surveys; most parents were married or cohabiting (85%), and 63% had at least a 4-year college degree. We assessed race with an open-ended, parent-report item later aggregated into categories; children were 5% Asian, 18% bi- or multi-racial, 3% Black or African-American, 8% Latino/a, 48% White, 4% other, and 14% did not provide race. Forty-five percent of families had an annual income above $80,000. Children (82% male) were ages 4–7 years (Mean = 5 years, 7 months) at the Time 1 visit during the fall of the school year. Participating children had a mean severity score of 7.54 ($SD = 1.80$; range: 3–10) on the ADOS, indicating the average level of autism spectrum-related symptoms in this sample was moderate to high. Children earned a mean Estimated Full-Scale IQ score of 87.6 on the abbreviated WPPSI-III, with 17.8% of children earning FSIQ scores that fell in the range of intellectual disability (< 70). At Times 1 and 2, children were in preschool (35%), kindergarten (33%), 1st grade (25%), and 2nd grade (7%); 93% attended public schools (vs. private or parochial schools, including private preschools). Slightly more than half (55%) of children spent at least 50% of their day in general education

classrooms [minimal to no specialized instruction provided] versus special education [specialized instruction provided based on child's needs]), Teachers were 88% female, 68% had a Master's degree, and 55% were teaching in a general education class; teachers had, on average, 14 years of teaching experiences (range: < 1 to 44 years). Teachers in special education classrooms (M = 12.14, SD = 0.95) had fewer years of teaching experience than general education teachers (M = 15.82, SD = 1.05) (Wald (1) = 6.75, p < .01). Most teachers (83%) had not previously had the student in their classroom prior to the current school year; both general education (22%) and special education (13%) teachers reported having had students in their classroom for one or two previous years.

2.3. Measures

2.3.1. Child ASD symptomatology

During initial eligibility sessions, we evaluated children's autism symptomatology and cognitive ability for the purposes of determining eligibility for the study. We assessed autism symptomatology via the *Autism Diagnostic Observation Schedule* (ADOS; Lord et al., 2000) a semi-structured, interactive, clinician-administered assessment of autism symptomology, which is considered the gold standard diagnostic instrument for autism spectrum disorders in both research and clinical settings (Hurwitz & Yirmiya, 2014). The goal of the ADOS is to elicit spontaneous examples of social interaction and restricted or repetitive behaviors in a semi-structured environment. Ratings were determined using the revised ADOS algorithms (Gotham et al., 2007; Gotham et al., 2008), which are reflective of the current DSM-5 criteria for ASD (APA, 2013), as well as an overall severity rating which can be compared across modules. These revised algorithms outperform the original ADOS algorithms, providing improved predictive validity and comparability across modules (Gotham et al., 2008). To qualify for our study, children's scores must have fallen in the autism or autism spectrum range.

2.3.2. Cognitive functioning

We assessed children's cognitive functioning with the *Wechsler Preschool and Primary Scale of Intelligence* (WPPSI-III), a widely-used assessment of cognitive ability for children ages 2 years, 6 months to 7 years, 3 months. The instrument yields IQ scores with a normative mean of 100 and a standard deviation of 15. The WPPSI-III demonstrates strong psychometric properties, including excellent internal consistency (.86–.97) and test–retest reliability (.84–.92; Wechsler, 2002). Three subtests were administered (Vocabulary, Matrix Reasoning, Picture Completion), from which a full-scale IQ score was estimated using Sattler's conversion tables (Sattler, 2008). Abbreviated versions of the WPPSI have demonstrated high reliability and convergent validity (e.g., LoBello, 1991), and the composite score from this 3-subtest version of the WPPSI has been shown to correlate strongly (r = .90) with the full-scale IQ in the normative sample (Sattler, 2008).

2.3.3. Child language ability

Language skills were assessed using the *Comprehensive Assessment of Spoken Language* (CASL: Carrow-Woolfolk, 1999), a standardized assessment of spoken language in youth between the ages of 3 and 21 years. For the purposes of the current study, three subtests were selected as a representative selection of semantic (Basic Concepts), syntactic (Syntax Construction) and pragmatic (Pragmatic Judgment) language skills. The Basic Concepts subtest assessed children's comprehension of semantics as determined by the child pointing to or vocally indicating the appropriate response out of four options; Syntax Construction and Pragmatic Judgement were both assessed based on children's production of language in response to item prompts. The Basic Concepts subtest is only

Table 1
Descriptive statistics of child language, teacher/classroom factors, and STR quality scores at Time 1 and Time 2.

Scores	M (SD)[a]	Percentile[b]
Language skills		
Semantics (CASL Comprehension of Basic Concepts subtest; n = 168)[c]	84.6 (19.5)	16th
Syntax (CASL Syntax Construction subtest; n = 190)	82.2 (18.6)	12th
Pragmatics (CASL Pragmatic Judgment; n = 190)	80.3 (17.6)	9th
Teacher/classroom factors		
Years of experience	14.9 (9.0)	–
Classroom placement	55% General Education; 45% Special Education	–
Student–Teacher Relationship Quality (STRS)		
STRS Time 1 (n = 148)		
Conflict	22.9 (8.0)	62nd
Closeness	40.4 (7.5)	25th
Total	109.5 (12.8)	34th
STRS Time 2 (n = 138)		
Conflict	22.7 (8.3)	62nd
Closeness	40.3 (8.1)	25th
Total	(14.4)	32nd

[a] Values reflect unadjusted means.
[b] Percentiles are based on normative data from scoring manuals.
[c] The CASL Comprehension of Basic Concepts subtests was developed for children under 7 and thus this subtest was not administered to participants 7 and older.

appropriate for children under the age of seven and so fewer children completed this subtest than the other two which were completed by all children (see Table 1). For all subtests, an age-based standard score is derived with a mean of 100 and a standard deviation of 15. In the normative sample, internal consistency coefficients ranged from .85 to .96 and test–retest reliability correlations coefficients ranged from .65 to .96 (Carrow-Woolfolk, 1999). The correlation among the subscales was .78 to .79, suggesting strong interdependence. The CASL has shown good construct validity and strong test–retest reliabilities of .92 to .96 across indices (Carrow-Woolfolk, 1999) and has been widely used among children with ASD, language delays, aphasia, and intellectual disabilities (e.g. Reichow, Salamack, Paul, Volkmar, & Klin, 2008).

2.3.4. Student–teacher relationship quality

The *Student–Teacher Relationship Scale* (STRS; Pianta, 2001) is a widely used, 28-item instrument that assesses a teacher's perceptions of his or her relationship with a target student (grades Pre-K to 3rd). The measure is composed of three subscales: Conflict (12 items), which measures the teacher's feelings of negativity or conflict with the student (e.g., "The child and I always seem to be struggling with one another"); Closeness (11 items), which measures the teacher's feelings of affection and open communication with the student (e.g., "I share an affectionate, warm relationship with this child"); and Dependency (5 items), which measures the extent to which the teacher views the student as overly dependent (e.g., "This child is overly dependent on me"). Closeness and Conflict were marginally related to one another at only Time 2 ($r = –.17$, $p = .05$), a correlation which is markedly lower than the correlation of $-.45$ reported in the STRS standardization sample (Pianta, 2001); therefore, we examined these subscales separately rather than assessing the STRS Total score. The dependency subscale was not used in the current analyses. Reliability alphas for Closeness were .80 and .85 and Conflict were .83 and .85 for time 1 and 2, respectively.

2.3.5. Teacher and classroom characteristics

In a survey questionnaire, teachers were asked to indicate the number of years of full-time-equivalent teaching experience they had completed and to "Please check the educational setting in which you teach this student *(Check all that apply)*" Options were general education, resource, or special education; no teachers checked "resource." Thus, the current study looks at one teacher characteristic (i.e., years of teaching experience) and one classroom characteristic (i.e., the classroom setting in which the teacher provides instruction to the child defined as special education or general education).

2.4. Statistical analysis

Missing data analysis indicated that data were missing completely at random (Little's MCAR test: $X^2(70, N = 191) = 90.16$, $p > .05$). Analyses were conducted in Mplus 8.0 (Muthén & Muthén, 2010) using full information likelihood (FIML) to estimate missing data. Included participants were those who had CASL data at Time 1 or teacher-reported STRS data at one or two time points ($N = 191$). Twenty-five percent of children were missing teacher-reported data at one time point; FIML has shown to be robust to bias at this level of missingness (Enders, 2001).

To evaluate the hypothesized concurrent association between language and STR quality, and the hypothesized moderation of teacher/classroom factors, we conducted multiple two-step linear regressions. In the first step, all three language variables (syntax, semantics, and pragmatics) were entered as explanatory variables with STR closeness or conflict as the dependent variable. In the second step, teacher years of experience and classroom placement were entered, as well as the interaction terms of language and the teacher and classroom variables. Each of the six potential moderators was examined in a separate analysis along with the language and teacher/classroom variables to ensure sufficient statistical power. After separately examining all potential moderators, a final iteration of the second step multiple regression was then conducted using all language and teacher/classroom factors as well as any significant moderators.

For examinations of change in STR quality, the corresponding STRS subscale (Conflict or Closeness) at Time 1 was also entered in the model along with the same explanatory variables to control for prior levels of STR quality in predicting Time 2 student–teacher conflict or closeness scores; this approach has been found to be more statistically powerful in estimating change than using change scores as the dependent variable (Rausch, Maxwell, & Kelley, 2003).

3. Results

3.1. Preliminary analyses

Table 1 shows mean scores for child language, teacher/classroom, and STR quality variables. Scores on the three language domains (semantics, syntax, pragmatics) were strongly and positively correlated ($rs = .78–.79$, $ps < .001$). To rule out potential issues of multicollinearity, the variance inflation factor (VIF) score for each of the explanatory variables was tested. The VIF for the semantic, syntax, and pragmatic variables fell below the conservative value of 4, indicating that all variables could be included simultaneously in the model (O'Brien, 2007). The STR quality Conflict and Closeness domains, examined separately in the following analyses, were not significantly related to each other at Time 1 ($r = -.13$) but were marginally significantly related at Time 2 ($r = -.17$, $p = .05$). Between Time 1 and Time 2, both closeness ($r = .52$, $p < .001$) and conflict ($r = .69$, $p < .001$) were moderately stable. As reported in Table 1, STR closeness fell in the 25th percentile and conflict was in the 62nd percentile, with the total score falling in the 34th percentile at Time 1, indicating that for the children in our sample, their relationships were less close and more conflictual, on average, than those of their peers.

Table 2
Associations with concurrent STR quality by child and teacher factors.

	STRS closeness at Time 1						STRS conflict at Time 1					
	Step 1			Step 2			Step 1			Step 2		
Explanatory variables	*B*	SE (*B*)	*β*	*B*	SE (*B*)	*β*	*B*	SE (*B*)	*β*	*B*	SE (*B*)	*β*
Semantics	−0.04	0.06	−.09	0.06	1.11	.01	−0.01	0.07	−.03	−0.02	0.06	−.06
Syntax	0.01	0.06	.02	−0.06	1.02	−.01	0.01	0.06	.01	0.01	0.07	.01
Pragmatics	0.16	0.06	.37**	2.84	1.03	.38**	−0.08	0.07	−.18	−0.07	0.07	−.16
Teacher experience (years)	–	–	–	1.55	0.56	.21**	–	–	–	−0.24	0.07	−.27***
Classroom Placement	–	–	–	−1.84	0.62	−.24**	–	–	–	1.59	1.37	.10
Semantics*Setting	–	–	–	1.69	0.66	.21**	–	–	–	–	–	–

Note: Step 2 represents the final trimmed model.
*$p < .05$, **$p < .01$, ***$p < .001$.

3.2. Concurrent and predictive associations between language skills, teacher/classroom factors, and STR quality

3.2.1. Concurrent associations with student–teacher closeness

To address our first question, linear regression models were used to determine which language factors were associated with student–teacher closeness at Time 1 (see Table 2). All three language domains (semantics, syntax, pragmatics) were entered into step 1 of the model. Only pragmatic language skills, not semantic or syntactic language skills, were associated with concurrent student–teacher closeness ($\beta = .37$, $p < .01$).

In the second step of the regressions, teacher experience, classroom placement, and moderating variables were entered in addition to the language variables; all non-significant moderators were trimmed from the final model (see Table 2). Pragmatic language remained the only significant explanatory variable; there were also significant main effects of teacher experience and classroom placement. Teachers with more years of teaching experience reported closer relationships with their students than less experienced teachers. Further, teachers in special education classrooms reported closer relationships with their students than did teachers in general education classes. Additionally, there was one significant moderating effect of classroom placement and semantic language on student–teacher closeness, but no moderating effects of teacher experience (see Fig. 1). The moderating effect indicated that, in general education classes, teachers rated themselves as closer to children with greater semantic language skills than those with lower semantic skills, whereas in special education classes, student–teacher closeness was similar regardless of the child's semantic language level. Group means were compared for children in general versus special education classrooms across levels of semantic language to test for significant differences using Wald's Test; to allow adequate sample size, the low and average groups were combined in these analyses. For children in the low to average semantic language group, children in general education classes were significantly less close to their teachers than children in special education classes [Wald (1) = 20.06, $p < .001$]. For children with high semantic language abilities, student–teacher closeness did not differ across classroom type ($p > .99$).

3.2.2. Predicting change in student–teacher closeness

Hierarchical regression models were conducted to examine predictors of change over time in student–teacher closeness. In step 1, after controlling for earlier student–teacher closeness, only semantic language ($\beta = .27$, $p = .06$) was marginally associated with change in student–teacher closeness, with better semantic skills predicting marginally greater gains in student–teacher closeness over time. Pragmatic and syntactic language did not predict change in student–teacher closeness. In step 2, there were no main or

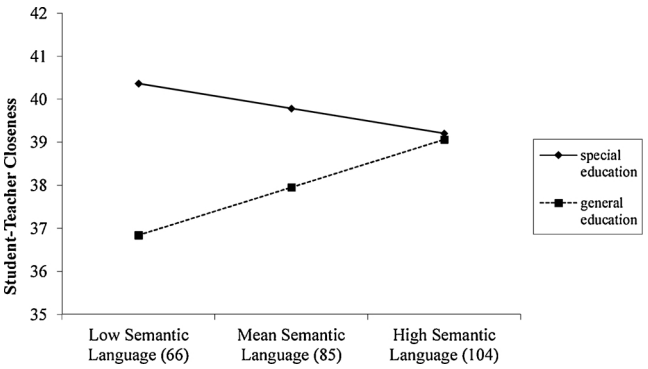

Fig. 1. Student–Teacher Closeness – Associations with Semantic Language by Classroom Type.
Note: Semantic Language groupings were formed based on child scores more than one SD below the mean, within one SD of the mean, and more than one SD above the mean. Standard score estimates for these groups are provided in the figure

Table 3
Predictors of change in STR quality over time by child and teacher factors.

	STRS closeness at Time 2						STRS conflict at Time 2					
	Step 1			Step 2			Step 1			Step 2		
Predictors	*B*	SE (*B*)	*β*	*B*	SE (*B*)	*β*	*B*	SE (*B*)	*β*	*B*	SE (*B*)	*β*
STRS Closeness/Conflict Time 1[a]	0.52	0.08	.49***	0.54	0.09	.50***	0.70	0.07	.67***	0.71	0.07	.68***
Semantics	0.12	0.06	.29	0.11	0.06	.27	−0.04	0.05	−.09	−0.03	0.05	−.07
Syntax	−0.07	0.06	−.16	−0.07	0.06	−.15	−0.01	0.05	−.03	−0.02	0.05	−.03
Pragmatics	0.02	0.07	.05	0.02	0.07	.04	0.01	0.06	.01	0.01	0.06	.01
Teacher experience (years)	–	–	–	−0.04	0.07	−.04	–	–	–	0.02	0.07	.02
Classroom Placement	–	–	–	0.82	1.35	.05	–	–	–	−1.02	1.18	−.06

Note: Step 2 represents the final trimmed model.
[a] The STRS domain entered into the regression was matched to the dependent variable STRS domain.

moderating effects of language, teacher, or classroom variables on the change in student–teacher closeness; all non-significant moderators were trimmed from the final model (see Table 3).

3.2.3. Concurrent associations with student–teacher conflict

In the first step, linear regression models were used to determine which language factors were most strongly associated with student–teacher conflict (see Table 2). None of the three language skill domains were associated with initial levels of student–teacher conflict. In Step 2 of the regression, with the addition of teacher and classroom variables, there was a main effect of teacher experience such that teachers with more years of experience had less conflictual relationships with their students; language and classroom placement did not relate to student–teacher conflict. The interaction effects of teacher experience and classroom type with language skills were non-significant and trimmed from the final model.

3.2.4. Predicting change in student–teacher conflict

Multiple regression models were used to determine how the three language skill domains predicted change in student–teacher conflict over time (see Table 3). In the first step, none of the three language factors predicted change in conflict over time after controlling for earlier student–teacher conflict. In the second step, teacher and classroom variables were entered; no individual predictor was significant over and above the effect of baseline ratings of student–teacher conflict. The interaction effects of teacher experience and classroom type with language skills were also non-significant; all non-significant moderators were trimmed from the final model.

4. Discussion

Young children with ASD have lower quality STRs than their non-ASD peers (Blacher et al., 2014; Prino et al., 2016). This finding was supported in the current study, with student–teacher closeness and conflict falling markedly below and above normative means, respectively. This is a concerning pattern given the importance of STR quality during the early school years in predicting long-term school adjustment. In keeping with our expectation that children's language skills may shape their ability to form positive connections with their teachers, we examined associations between children's language skills across multiple domains (semantics, syntax, pragmatics) and STR quality. We also considered how language skills might interact with aspects of the teacher and classroom context (teachers' years of experience, classroom type) to relate to STR quality at the start of the school year as well as predict change in STR quality over the course of a school year for early elementary-aged children with ASD.

4.1. Major findings

4.1.1. Student–teacher closeness

Consistent with our hypothesis, a child's lower pragmatic speech score uniquely contributed to lower ratings of teacher closeness at the beginning of the school year. Although this is one of the first studies to specifically examine the relationship between pragmatic language skills and student–teacher closeness among children with ASD, this finding is in alignment with previous research suggesting that pragmatic language skills are associated with the quality of relationships with friends and families for children with ASD (Bennett et al., 2015; Magiati et al., 2014). Interestingly, and in opposition to our hypotheses, children's semantic language skills and syntactic language skills did not uniquely contribute to overall teacher ratings of closeness. In this sample, teachers with more years of experience reported higher levels of closeness with students with ASD. However, in contrast to previous findings (Brown & McIntosh, 2012), teachers in our sample who were working with students in special education settings reported higher ratings of closeness than teachers working in general education settings.

Although semantics did not uniquely contribute to teacher ratings of closeness of students with ASD, an interesting interaction was observed between semantic score and classroom placement. Children with lower levels of semantic scores were rated as having significantly lower ratings of student–teacher closeness if they were rated by teachers in general education classrooms. It is possible

that general education teachers may not be actively thinking about the specific language difficulties of children with ASD – or that they are focusing their attention and understanding on other, more commonly discussed, language deficits of children with ASD such as pragmatic speech. This lack of awareness may result in a teacher becoming consciously or unconsciously frustrated in a child's deficits in semantic understanding of language. This relationship between semantic language abilities and closeness rating was not observed in the special education setting. This interaction suggests that teachers working in special education settings may be better informed about the language difficulties that children with ASD have than teachers in general education settings. Thus, they are more able to form closer relationships with students who have semantic language difficulties.

Child language and teacher factors did not significantly impact changes in closeness between the Fall and Spring observations. Controlling for Time 1 ratings of closeness, no significant effects were observed for any student language or teacher/classroom factors at Time 2. This might indicate that difficulties with pragmatic language may uniquely contribute to teacher's initial ratings of closeness, but that pragmatic language difficulties do not negatively compound the student–teacher closeness level over time. This finding of stability in STR quality across the school year is consistent with prior research indicating that student–teacher closeness is moderately stable for TD children and children with intellectual disability (Blacher, Baker, & Eisenhower, 2009). The current findings suggest that continuity in student–teacher closeness for students with ASD is maintained regardless of child language ability.

4.1.2. Student–teacher conflict

Contrary to our hypotheses, child language factors did not contribute to teacher ratings of student–teacher conflict. However, there was a relationship between years of teaching experience and reported conflict. Teachers with more years of teaching experience reported lower levels of conflict with children at Time 1. This finding differs from previous research that indicates no difference in STR quality in relation to teacher experience for children with ASD (Longobardi et al., 2012).

Child language and teacher/classroom factors did not significantly impact changes in student–teacher conflict over time. Controlling for teacher's initial ratings of student–teacher conflict, there were no significant child or teacher/classroom factors at Time 2. This suggests that initial teacher ratings did not change above baseline by the end of the school-year. It appears that once STR patterns are established in the beginning of the school year, they are maintained. While little research has examined the stability in student–teacher conflict for students with ASD, the present findings indicate moderate stability, which is consistent with prior research demonstrating moderate stability in student–teacher conflict for TD children over the first few years of schooling (Pianta & Stuhlman, 2004). The present findings further underscore the need for earlier intervention, particularly for less experienced teachers, to develop less conflictual relationships with their students.

4.2. Limitations of the current study

This study offers initial insight into the role distinct aspects of language play in the relationship between school-age children with ASD and their teachers. Although the findings from this study indicate how child language ability impacts the STR – methodological considerations should be noted when interpreting our results. First, the study excluded children with moderate-to-severe comorbid intellectual disability and focused on children with at least some functional language. So, although children with lower language abilities are likely to have lower scores on language assessments, the relationships between these scores and the quality of the STR may not be the same as the results presented in this study. Further, this study only incorporated child language abilities at one time point. It is possible that some demonstrated growth or stagnation in their language development between the two surveys of teacher ratings of the STR. Given this limitation, we were unable to assess whether or not change in child language ability over time was also related to a change in the quality of the STR. Additionally, this study did not examine how the role of language may interact with other factors known to be associated with STRs, including children's ASD symptom severity and cognitive functioning (Caplan et al., 2016), behavior problems (Eisenhower et al., 2015), social skills (Blacher et al., 2014), or teacher factors, such as teacher sex and ethnicity match to students (Pianta, Stuhlman, & Hamre, 2002).

5. Conclusions

Child pragmatic language skills were associated with initial teacher ratings of closeness for young children with ASD in both general education and special education settings. However, these effects did not predict beyond baseline ratings over the course of the school year when controlling for teacher's initial ratings of closeness. This suggests that while pragmatic language contributes to initial teacher ratings, the effects of limited pragmatic language skills do not compound difficulties in STR over time. Further, while semantic language skills did not independently contribute to student–teacher closeness, we noted a significant interaction between semantics and classroom placement that indicated special education teachers may be better prepared to work with students with semantic language difficulties than teachers in the general education setting.

Thus, given the association between various aspects of language and initial ratings of closeness, there are multiple potential avenues for intervention. First, language-based interventions for young children may be viewed not only as producing language skill gains but as supporting them to connect more readily with their teachers. Ideally, these language-based interventions could be integrated into the schools so that teachers utilize similar strategies to support language development and use in the classroom. For instance, general education teachers could incorporate visual communication systems to support children who have difficulty with semantics by presenting information in multiple formats to aid in their comprehension. In addition, language interventions aimed at boosting vocabulary might also be important given the importance of semantic language skills. Second, teacher-focused interventions may be delivered prior to, or at the beginning of, the school year, before initial impressions of students are formed. Teacher-focused

interventions should include both education about children with ASD and their known difficulties with pragmatic and semantic language skills as well as emerging findings as to how these deficits impact the student–teacher closeness.

Moreover, given the stability of early established high conflict relationships, targeted interventions to improve STR could be implemented before these patterns emerge. Strategies that have demonstrated effectiveness in fostering closer relationships for TD students such as Banking Time (Driscoll & Pianta, 2010) – in which teachers set aside one-on-one time to engage in child-directed interaction with a student – might work similarly for students with ASD. If implemented early at the beginning of the school year, such interventions may help to foster positive relationship development before negative relationship patterns become stable.

Declarations of interest

None.

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