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Reliability and validity of teacher ratings on the Adapted Skillstreaming Checklist for children with autism spectrum disorder

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Abstract

This study assessed the reliability and criterion-related validity of teacher ratings on the Adapted Skillstreaming Checklist for a sample of 133 children, aged 6–11 years, with autism spectrum disorder (without intellectual disability). Internal consistency for the total sample was 0.93. For a subsample, test–retest reliability was very good ($r = 0.74$; intraclass correlation coefficient = 0.85) at a 9-month interval. Child age, intelligence quotient, language abilities, and sex were not associated with the Adapted Skillstreaming Checklist total score. The Adapted Skillstreaming Checklist total score was inversely and strongly related to teacher ratings of autism spectrum disorder symptom severity. Significant positive correlations (moderate-to-high) were found between the Adapted Skillstreaming Checklist and prosocial skills scales and significant negative correlations (low-to-moderate) with problem behavior scales on a broad measure of child functioning. Implications and suggestions for future study are discussed.

Keywords

Adapted Skillstreaming Checklist, children with autism spectrum disorder (without intellectual disability), psychometric properties, teacher ratings

Introduction

Estimates have indicated a significant increase in the prevalence of children with autism spectrum disorder (ASD) including among children with ASD without intellectual disability (ID) who currently comprise approximately 68% of those diagnosed (Christensen et al., 2016). Although these children are characterized by relative strengths in cognitive and language abilities, they exhibit the characteristic symptoms of social/social-communication impairments and repetitive and circumscribed interests, and behaviors that interfere with daily functioning (American Psychiatric Association (APA), 2013). The multi-symptom nature of ASD and significant heterogeneity in functional levels pose a major assessment challenge and can affect the properties of a measure. Factors including intellectual, language, and developmental level influence the way skills and symptoms are demonstrated, as well as the properties of assessment instruments (Koenig et al., 2009; Lord & Corsello, 2005; Lord et al., 2014) supporting the need for development and testing of measures for more functionally homogeneous (narrower) subgroups with ASD (Lord et al., 2014) including ASD without ID (Lopata et al., 2017; Nelson et al., 2016).

Rating scales are commonly used to gather information on the skills and symptoms of children with ASD (Lord & Corsello, 2005; Stratis & Lecavalier, 2015), and they offer a number of advantages. In contrast to diagnostic measures that require extensive training, expertise, and time to administer, rating scales are economical, brief, and can be completed by informants from authentic settings (Constantino & Gruber, 2012; Norris & Lecavalier, 2010). Another advantage is that many rating scales utilize continuous scaling which provides important information on the extent to which a skill/symptom is present and/or degree of impairment, which differs from many diagnostic measures which measure these features dichotomously

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(i.e. absent or present; Achenbach, 2011). To illustrate, there are few social/social-communication behaviors that are completely absent for children with ASD without ID, which warrants a different type of scale item/assessment approach (Lord et al., 2014). Continuous scaling also more closely reflects the diagnostic framework which conceptualizes ASD along a continuum with varying symptom expression and degrees of impairment (APA, 2013). An additional potential benefit is that rating scales can assess skills/symptoms over time and in response to treatment (Achenbach, 2011; Reynolds & Kamphaus, 2015). Despite this potential benefit, there is widespread recognition of the need for treatment sensitive measures to assess changes in skills/behaviors/symptoms of children with ASD including ASD without ID (Bellini et al., 2014; Reichow & Volkmar, 2010; White et al., 2007). One reason for poor treatment sensitivity may be poor alignment of scale items with intervention targets (Bellini et al., 2014; Koenig et al., 2009); keying (aligning) scale items and intervention targets to the core skills/features of ASD may enhance a scale's treatment sensitivity (White et al., 2007).

Teachers are increasingly recognized as a critical source of information on the skills/symptoms of children with ASD (Norris & Lecavalier, 2010; Schanding et al., 2012) as they possess advanced professional training and knowledge of child development (typical and atypical) and have the opportunity to observe the children in authentic school environments (Constantino & Gruber, 2012; Mayes & Lockridge, 2018). In addition, schools are a primary setting in which psychosocial interventions are delivered for these children (Kasari & Smith, 2013) and teachers are often used to monitor response to intervention. Because children with ASD including ASD without ID spend a considerable portion of their development in schools and interventions are often conducted in these settings, information from teachers plays a central role in understanding baseline functioning, changes over time, and/or response to intervention (Nelson et al., 2016; Schanding et al., 2012).

There is a need for measures that efficiently yield accurate information on the skills of children with ASD without ID (Lopata et al., 2017; McMahon et al., 2013) including measures that can be used in authentic school environments (Kasari & Smith, 2013). A measure that has been used to assess the skills and functioning of children with ASD without ID is the Adapted Skillstreaming Checklist (ASC; Lopata et al., 2008). It was originally developed as a study-specific measure to assess outcomes of a clinic-based psychosocial treatment for children with ASD without ID. The measure and intervention were keyed to the two core diagnostic features; however, the ASC assesses these features from an adaptive/prosocial perspective. Specifically, the ASC measures the frequency with which children with ASD without ID exhibit adaptive social/social-communication skills and behavioral flexibility/regulation (Lopata et al., 2017); this approach differs from other diagnostically keyed instruments that measure the absence of social-communication skills/behaviors and presence of unusual interests/behaviors (Lord et al., 2014). In addition, the ASC differs from other measures of prosocial/adaptive functioning in that it was developed to assess prosocial/adaptive skills and behaviors specifically linked to core ASD features, whereas other adaptive measures assess a broad array of adaptive skills/behaviors that extend far beyond features associated with ASD (e.g. study skills). As such, broad measures of adaptive functioning may assess some ASD-related features; however, they also assess many aspects of adaptive functioning that are unrelated. The ASC is the only identified scale that assesses adaptive social/social-communication skills and behavioral flexibility/regulation specifically linked to the two core diagnostic features of children with ASD without ID.

Several psychosocial intervention studies for children with ASD without ID have shown the ASC to have good treatment sensitivity for parent ratings, and good internal consistency and concurrent validity with other prosocial/adaptive skills scales; however, the initial indications of reliability and criterion-related validity were based on small study-specific samples (i.e. $N=54$ parent ratings for Lopata et al., 2008 and $N=36$ parent ratings for Lopata et al., 2010). A recent psychometric study examined the reliability and validity of parent ASC ratings for a larger group of children with ASD without ID ($N=275$; Lopata et al., 2017). Internal consistency was 0.92, and test–retest reliability (for two subsamples) was very good at 6 weeks (Pearson $r=0.81$ and intraclass correlation coefficient (ICC)$=0.78$) and good at 9 months (Pearson $r=0.63$ and ICC$=0.64$). Child characteristics including age, intelligence quotient (IQ), and language level were unrelated to the ASC total score. The ASC score was strongly and negatively correlated with ASD-symptom severity ratings ($r=-0.69$, Social Responsiveness Scale, Second Edition (SRS-2); Constantino & Gruber, 2012; $r=-0.67$, Developmental Social Disorders (DSD) Scale of the Behavior Assessment System for Children, Second Edition/Third Edition (BASC-2/3); Reynolds & Kamphaus, 2004, 2015). Criterion-related validity was also supported in significant positive associations between the ASC and BASC-2/3 Adaptive Skills Composite ($r=0.75$) and all its constituent scales (the correlation was highest for the Social Skills scale at $r=0.64$) and significant negative associations between the ASC and BASC-2/3 Externalizing Problems Composite ($r=-0.45$) and its constituent scales (rs from -0.46 to -0.29).

Lopata, Donnelly, et al. (2019) also recently completed an exploratory factor analysis of ASC parent ratings for a sample of children with ASD without ID ($N=331$). Results yielded a correlated three-factor solution consisting of a *Social Communication Skills* scale (SCS; assessing prosocial interpersonal skills related to social interactions and social cognition), *Behavior Regulation Skills* scale (BRS; assessing behavioral flexibility and self-control), and

Interest Regulation during Discussions scale (IRD; regulation of self-interests during discussions and engaging with topics of interest to others). The authors concluded that the ASC measures the two broad diagnostic dimensions; however, the area of behavioral and interest flexibility/regulation identified by Lopata et al. (2008, 2017) appeared to consist of two subscales (BRS and IRD). Overall, the authors indicated that the results supported derivation of three subscale scores and a total composite score.

The ASC has also shown good treatment sensitivity in school psychosocial intervention studies for children with ASD without ID, with baseline-posttest effect sizes ranging from medium ($d = 0.59$ Lopata et al., 2012) to large ($d = 0.92$ Lopata et al., 2013) for teacher ratings. Despite good treatment sensitivity, no sample-specific psychometric data were described for the ASC teacher ratings for either school intervention study, and the sample sizes were small ($N = 12$ per trial). The ASC also exhibited good treatment sensitivity in a randomized controlled trial of a psychosocial school intervention for elementary school-age students with ASD without ID (between-condition $d = 1.29$); however, that study utilized a combined parent–teacher composite for the analyses and no psychometric data were presented for the teacher ratings or combined parent/teacher ratings (Lopata, Thomeer, et al., 2019). Although these initial studies suggest that ASC teacher ratings are sensitive to changes in the social/social-communication skills and behavioral flexibility/regulation of children with ASD without ID, no studies have examined the psychometric properties of ASC teacher ratings. This led Lopata et al. (2017) to recommend psychometric testing of the ASC for teacher ratings.

This study assessed the psychometric properties of ASC teacher ratings for a sample of children with ASD without ID. Given the effect of functional level on a measure's properties, this study addressed the need for psychometric studies of ASD-related scales using well-characterized samples and more narrowly defined subgroups (i.e. ASD without ID; Lord & Corsello, 2005; Lord et al., 2014; Norris & Lecavalier, 2010). Such studies are especially needed for researcher-created measures developed for a specific study, and for measures that exhibit good treatment sensitivity. White et al. (2007) noted that "new or adapted outcome measures should be evaluated for reliability and validity" (p. 1867). There is also a significant need for measures that can be completed quickly and yield valid information in school settings because teachers are critical sources of information on the skills/symptoms of these children and schools are a primary setting in which they receive psychosocial interventions (Kasari & Smith, 2013). This study tested the psychometric properties of ASC teacher ratings using the same methodology and analyses as Lopata et al. (2017) for ASC parent ratings. Specifically, this study examined (1) internal consistency and stability, and (2) criterion-related validity against other established ASD-impairment and prosocial scales for ASC teacher ratings of children with ASD without ID.

Method

Participants

Teacher ratings of 133 children, aged 6–11 years, with ASD without ID were included in the analyses. All of the children were participants in prior school intervention studies for this population and were recruited for those studies using school-disseminated announcements. Each child had a prior clinical diagnosis of ASD (or autism, Asperger's, or Pervasive Developmental Disorder-Not Otherwise Specified), Wechsler Intelligence Scale for Children-Fourth Edition (WISC-IV; Wechsler, 2003) short-form IQ > 70, and Comprehensive Assessment of Spoken Language (CASL; Carrow-Woolfolk, 1999) short-form expressive or receptive language score > 70. Each child also met criteria on the Autism Diagnostic Interview-Revised (Rutter et al., 2003) or Social Communication Questionnaire (Rutter et al., 2003) which was completed to confirm her or his diagnosis. The child sample was predominantly male (91%) and Caucasian (94%), and had a mean IQ and language level in the average range, and parents reported an average parent education level of 15.5 years (Table 1). Demographic data were compiled from the various school study databases. Each child was rated by her or his primary classroom teacher (teacher with whom the child spent the majority of the school day). All teacher raters possessed state teacher certification (and requisite bachelor's or master's degree).

Measures

ASC. The ASC (Lopata et al., 2008) is a 38-item rating scale that measures the social/social-communication skills and behaviors of children with ASD without ID. Individual items measure a specific skill/behavior that is keyed to a clinical feature of this population. Although many measures assess ASD-related features via the absence of social skills or presence of odd or unusual behaviors, items on the ASC assess these features from a prosocial/adaptive perspective (i.e. frequency with which the skill/adaptive behavior is exhibited). Thirty-two items reportedly measure social/social-communication skills, and six assess behavioral/interest flexibility and regulation. The ASC includes 30 items (including adapted items) from the Skillstreaming curriculum (Goldstein et al., 1997; McGinnis & Goldstein, 1997) and 8 researcher-created items. Teachers rate individual items on a scale of 1 (almost never) to 5 (almost always). Individual item scores are summed to yield a total composite score, with higher scores indicating greater use of the prosocial/adaptive skill/behavior. The complete 38-item scale is also presented in Lopata et al.

Table 1. Demographic characteristics of child sample and parents.

Characteristic	Child participants ($N = 133$)
	M (*SD*)
Age (years)	8.74 (1.35)
Parent Education (years)	15.51 (2.07)
WISC-IV Short-Form IQ	102.34 (14.52)
CASL	
Short-Form Expressive Language	96.32 (16.54)
Short-Form Receptive Language	101.50 (16.64)
ADI-R	
Impairment in Social Interaction	18.64 (5.91)[a]
Impairment in Communication	15.06 (4.77)[a]
Restricted Repetitive Behavior	6.06 (2.23)[a]
SCQ Total Score	22.78 (2.33)[b]
	n (% of total)
Sex	
Male	121 (91.0)
Female	12 (9.0)
Ethnicity	
Caucasian	125 (94.0)
African–American	1 (0.8)
Latino	2 (1.5)
Asian–American	1 (0.8)
Mixed race/ethnicity	4 (3.0)

WISC-IV: Wechsler Intelligence Scale for Children-Fourth Edition; CASL: Comprehensive Assessment of Spoken Language; ADI-R: Autism Diagnostic Interview-Revised; SCQ: Social Communication Questionnaire; SD: standard deviation.
The WISC-IV 4-subtest short form consisted of the Block Design, Similarities, Vocabulary, and Matrix Reasoning subtests, and the CASL 4-subtest short form consisted of the Antonyms, Synonyms, Syntax Construction, and Paragraph Comprehension subtests.
[a]ADI-R score's *M* and *SD* based on a sample size of $n = 124$.
[b]SCQ Total Score's *M* and *SD* based on a sample size of $n = 9$.

(2017); the items are the same in both versions (parent and teacher), the only exception is that the teacher version items use the term "the" child and parent items use the term "your" child. (Psychometric data of ASC parent ratings were described in the "Introduction" section; no data are available for ASC teacher ratings.)

SRS-2. The SRS-2 School-Age Form (aged 4–18 years; Constantino & Gruber, 2012) is an objective measure of ASD-associated symptoms. It comprises 65 items that assess ASD features involving interpersonal behavior, communication, and stereotypic and circumscribed behaviors and interests on a continuous scale. Teachers/informants rate the frequency of behaviors on a scale ranging from 1 (not true) to 4 (almost always true). Items are summed and converted to a total standard score ($M = 50$, $SD = 10$), and higher scores indicate greater ASD-associated symptom severity/impairments. The total score has internal consistency estimates of 0.92–0.97 for teacher reports (aged 6–11 years). The test manual indicates moderate-to-high correlations with other ASD measures, and that the SRS-2 accurately differentiates individuals with ASD from typically developing individuals and individuals with other clinical disorders. Factor analyses have repeatedly yielded a single factor structure representing a unitary construct underlying ASD-symptom severity (Constantino & Gruber, 2012).

Behavior Assessment System for Children, Second Edition/Third Edition, Teacher Rating Scales. The Behavior Assessment System for Children, Second Edition/Third Edition, Teacher Rating Scales (BASC-2/3 TRS) (Reynolds & Kamphaus, 2004, 2015) assess a range of adaptive (prosocial) skills and clinical symptoms to assist with differential diagnosis, intervention planning, and outcome monitoring. Teachers rate items on a 4-point frequency scale from 0 (Never) to 3 (Almost always), and item scores are summed and converted to standard scores ($M = 50$, $SD = 10$). Higher scores on the adaptive skills composite/scales indicate more adaptive and prosocial skills, and higher scores on the clinical composites/scales indicate more problematic symptoms/behaviors. This study included the Adaptive Skills Composite (and its constituent scales including Adaptability, Social Skills, Leadership, Study Skills, and Functional Communication) and the Externalizing Problems Composite (and its scales including Hyperactivity, Aggression, and Conduct Problems). Internal consistency reliability was 0.97 for the Adaptive Skills Composite (and ranged from 0.86 to 0.94 for the individual adaptive scales) and ranged from 0.96 to 0.97 for the Externalizing Problems Composite (and from 0.89 to 0.94 for the individual externalizing scales). The DSD Content Scale was included as it assesses impairments in social and communication skills, and interests and activities associated with ASD. DSD scale's internal consistency ranged from 0.87 to 0.90. Validity is supported in factor analytic data for the derivation of scales, as well as high intercorrelations among scales within the individual composites. Concurrent validity is supported in moderate-to-high correlations between the BASC-2/3 composites and scales and comparable composites and scales on other established measures (Reynolds & Kamphaus, 2004, 2015). These composites and scales assess prosocial and adaptive skills/behaviors, problems associated with behavioral regulation/rigidity, and ASD features related to the skills assessed by the ASC.

Procedures

Institutional Review Board (IRB) approval was obtained for each of the treatment trials from which the cases were obtained, along with written parent informed consent and child assent (Canisius College IRB). For each treatment trial, teachers completed a battery of pretreatment

(baseline) measures 6 weeks into the school year that included the ASC, SRS-2, and BASC-2/3. Upon return, each rating scale was immediately reviewed for completeness. Incomplete protocols or protocols containing errors (multiple responses to an item, omitted items, etc.) were immediately reviewed with the teacher to correct the error(s). A structured scoring and data entry protocol was also used in each trial to ensure accuracy. Each ASC protocol was scored independently by two research assistants, with any discrepancies in scoring resolved by a third scorer. The SRS-2 and BASC-2/3 protocols were scored using their respective computer scoring programs by research assistants. Following a similar procedure, all protocol and demographic data were initially entered into the study database by a research assistant and independently checked by a second research assistant, with any discrepancy resolved by a third member of the team.

Data analysis plan

Prior to calculating reliability and validity coefficients, data quality and completeness were assessed, followed by study of deviations from normality for individual ASC items. All 133 cases had complete data, and there were no instances of out-of-range values. Following the initial data review, individual ASC item characteristics were evaluated. Full-scale analyses included two forms of reliability that are important to ASD-related measures including internal consistency and temporal stability (test–retest; Lord et al., 2014). Criterion-related validity was tested via correlations between the ASC and measures of ASD-related symptoms/impairments (SRS-2 and BASC-2/3 DSD) and several prosocial and problem behavior scales from an established and respected multi-dimensional rating scale (BASC-2/3).

Results

Item analysis

Table 2 presents central tendency, variability, and distribution statistics for all items and the total score. The overall central tendency evident in the medians and means is close to the center of the scale (3.0). Of the 38 items, 26 have medians at the center point of the scale (3.0), with 11 items having a median of 2.0 and 1 item a median of 4.0. Item distribution indicators, including standard deviations, skewness, and kurtosis, are generally acceptable (American Educational Research Association, 2014; DeVellis, 2017). Standard deviations are generally close to 1.0, with none being extremely high or low. Average skewness value for the 38 items was 0.05, and the average kurtosis value was –0.25. A total of five items had skewness values beyond the level of 2 standard errors ($SE = 0.420$, that is, items 6, 12, 15, 24, and 30), and two items had kurtosis values beyond the level of 2 *SE*s ($SE = 0.834$, that is, items 11 and 23); these items had otherwise acceptable psychometric characteristics (see Table 2) and were retained for full-scale inclusion and analyses. Corrected item-total correlations for all items (correlation of item to total scale excluding itself) ranged from 0.23 to 0.70 with a mean of 0.51.

Internal consistency and test–retest reliability

Internal consistency for the full scale was 0.93 (assessed via Cronbach's coefficient alpha). Test–retest reliability was estimated for a subsample of untreated children over a 9-month interval ($n = 51$) via Pearson correlation and ICC. These two stability estimates were included because the correlation shows the degree of covariation over time, while the ICC provides an accurate measure of agreement in which the level of endorsement as well as covariation is accounted for. Specifically, Pearson *r* indicates covariation but would not identify a systematic increase from the first to second administration. The correlation for the 9-month test–retest was 0.74, with an ICC of 0.85.

Criterion-related validity

Validity correlations for the ASC total score with selected child characteristics, SRS-2, and BASC-2/3 composites and scales are delineated in Table 3. Correlations between the ASC total score and child age, IQ (WISC-IV), receptive and expressive language (CASL), and sex are all negligible and non-significant, indicating independence of the ASC content from age, intellectual and language abilities, and sex. The significant negative correlation found between the ASC total score and SRS-2 (–0.74) was large and consistent with the predicted direction (the disattenuated correlation between the SRS-2 and ASC ($r = –0.80$), which accounts for the unreliability in the predictor and criterion, was also large). Consistent and predicted patterns are also evident in the correlations with the BASC-2/3 composites and scales. The ASC total score was positively correlated with the Adaptive Skills Composite (0.81), with the individual scale correlations ranging from 0.42 for the Study Skills Scale to 0.72 for the Social Skills Scale, again consistent with expectations. Low-to-moderate (significant) negative correlations were found between the ASC total and the Externalizing Problems Composite (–0.30) and its component scales (−0.24 to −0.28); these were anticipated. Finally, as predicted, a significant negative correlation (–0.79) was found between the ASC and DSD Content Scale (BASC-2/3).

Discussion

The field currently lacks measures that accurately assess the social and behavioral functioning of children with ASD/ASD without ID (Davis & Carter, 2014; Lopata et al., 2017). The need is even greater for measures that are

Table 2. Item characteristics.

Item	Median	*M*	*SD*	Skewness	Kurtosis	Corrected item-total *r*
1. Does the child listen when you or others talk to him/her?[a]	3.0	3.55	0.88	0.151	−0.733	0.57
2. Does the child begin conversations with other people?[a]	3.0	3.05	0.98	0.103	−0.189	0.57
3. Does the child talk to others about things of interest to both of them?[a]	3.0	2.55	0.92	0.243	−0.050	0.61
4. Does the child know how and when to ask questions of another person?[a]	3.0	2.80	0.96	0.087	−0.256	0.60
5. Does the child let others know that he or she is grateful for favors, etc.?[a]	2.0	2.47	1.01	0.184	−0.700	0.62
6. Does the child become acquainted with new people on his or her own?[a]	2.0	2.27	1.07	0.557	−0.369	0.60
7. Does the child tell others that he or she likes something they have done?[b]	2.0	2.43	1.00	0.245	−0.433	0.55
8. Does the child request assistance when he or she is having difficulty?[a]	3.0	3.01	1.10	0.122	−0.680	0.36
9. Does the child carry out instructions from others quickly and correctly?[a]	3.0	2.58	0.91	−0.086	−0.510	0.54
10. Does the child contribute to discussions occurring in the environment?	3.0	2.79	1.02	−0.138	−0.521	0.57
11. Does the child give assistance to adults who might need some assistance?[b]	2.0	2.47	1.08	0.179	−0.840	0.56
12. Does the child ignore distractions and remain focused on the task at hand?	2.0	2.18	0.99	0.577	−0.048	0.29
13. Does the child end conversations before leaving or beginning a new topic?	3.0	2.70	0.99	−0.166	−0.445	0.50
14. Does the child take steps to become part of an ongoing activity or group?[a]	3.0	2.50	0.92	0.138	−0.267	0.58
15. Does the child give assistance to other children who might need or want it?[a]	2.0	2.24	0.97	0.458	−0.280	0.66
16. Does the child acknowledge and accept complements from others?[b]	3.0	3.00	1.05	−0.040	−0.335	0.60
17. Does the child offer to share what he or she has with others?[a]	3.0	2.73	1.09	0.164	−0.521	0.59
18. Does the child make verbal or written apologies for things said or done?[b]	3.0	2.71	1.13	0.149	−0.806	0.55
19. Does the child recognize which emotions he or she has at different times?[a]	3.0	2.75	0.89	−0.206	−0.417	0.50
20. Does the child let others know which emotions he or she is feeling?[a]	3.0	2.58	1.06	0.370	−0.294	0.38
21. Does the child understand what other people are feeling?[a]	3.0	2.55	0.86	−0.301	−0.545	0.63
22. Does the child show understanding of another person's feelings?[b]	2.0	2.47	0.86	0.180	−0.232	0.70
23. Does the child express anger without verbal or physical aggression?[b]	3.0	2.77	1.31	0.298	−0.956	0.23
24. Does the child try to understand someone else's anger without getting angry him/herself?[a]	2.0	2.45	1.17	0.465	−0.493	0.52
25. Does the child let others know that he or she cares about them?[a]	2.0	2.31	0.99	0.286	−0.351	0.46
26. Does the child exercise self-control under difficult circumstances?[b]	3.0	2.74	1.08	0.103	−0.428	0.38
27. Does the child understand when permission is needed and the right person to ask for it?[b]	3.0	3.46	1.00	−0.281	−0.317	0.53
28. Does the child deal in a constructive way with being teased?[a]	3.0	2.55	1.12	0.371	−0.455	0.28
29. Does the child stay out of situations that might get him or her in trouble?[a]	3.0	3.35	1.07	−0.293	−0.298	0.34
30. Does the child accept the consequence of her or his behavior?[b]	4.0	3.49	0.95	−0.424	0.012	0.42
31. Does the child help arrive at a plan that satisfies both him/herself and others who have taken different positions (i.e. negotiates)?[a]	2.0	2.34	1.03	0.381	−0.296	0.55
32. Does the child express an honest complement to others about how they played a game?[b]	2.0	2.42	1.12	0.412	−0.550	0.64
33. Does the child deal positively with being left out of some activity?[a]	3.0	2.89	1.11	−0.013	−0.555	0.30
34. Does the child maintain eye contact when talking with others?	3.0	2.59	1.08	0.247	−0.405	0.55
35. Does the child wait his or her turn to talk (without interrupting)?	3.0	2.70	1.01	−0.027	−0.673	0.42
36. Does the child express her or his thoughts and concerns without complaining or whining?	3.0	2.99	1.10	−0.264	−0.503	0.49
37. Does the child have discussions with others without sharing information that is unrelated to the topic at-hand?	3.0	2.77	0.83	−0.197	0.258	0.48
38. Does the child have discussions without running on about a specific topic?	3.0	2.84	0.94	−0.016	−0.050	0.53
Total score	102.0	103.04	20.77	0.232	−0.121	

Source: Items reproduced with permission from Research Press and Lopata and Thomeer.
SD: standard deviation.
Other items created by Lopata and Thomeer (Lopata et al., 2008).
[a]Indicates exact item from Skillstreaming curriculum (Goldstein et al., 1997; McGinnis & Goldstein, 1997).
[b]Indicates item adapted from the Skillstreaming curriculum (Goldstein et al., 1997; McGinnis & Goldstein, 1997).

Table 3. Validity correlations between ASC total and child characteristics, SRS-2, and BASC-2/3.

Variable/scale	*r* (*p*)
Child characteristics	
Age (years)	0.05 (0.61)
WISC-IV IQ	−0.04 (0.63)
CASL	
Short-Form Expressive Language	0.08 (0.36)
Short-Form Receptive Language	0.11 (0.22)
Sex	−0.02 (0.86)
SRS-2	−0.74 (<0.001)
BASC-2/3 TRS	
Adaptive Skills Composite	0.81 (<0.001)
Adaptability Scale	0.53 (<0.001)
Social Skills Scale	0.72 (<0.001)
Leadership Scale	0.68 (<0.001)
Study Skills	0.42 (<0.001)
Functional Communication Scale	0.59 (<0.001)
Externalizing Problems Composite	−0.30 (<0.001)
Hyperactivity Scale	−0.28 (0.001)
Aggression Scale	−0.24 (0.005)
Conduct Problems Scale	−0.26 (0.002)
Developmental Social Disorders Content Scale	−0.79 (<0.001)

WISC-IV: Wechsler Intelligence Scale for Children-Fourth Edition; CASL: Comprehensive Assessment of Spoken Language; SRS-2: Social Responsiveness Scale, Second Edition, School Age Form; BASC-2/3 TRS: Behavior Assessment System for Children, Second/Third Edition, Teacher Rating Scales.
All calculations based on $N = 133$ teacher ratings.

capable of accurately detecting changes in skills/behaviors/symptoms over time and that are treatment sensitive (Davis & Carter, 2014; Lord et al., 2014). Diagnostic instruments have generally lacked treatment sensitivity as they were not developed to measure more-subtle changes in skills/symptoms (Lord et al., 2014), and they are often not feasible in applied settings including schools (Constantino et al., 2003). According to Mayes and Lockridge (2018), the field is moving toward assessment techniques that can be done quickly and efficiently and are cost effective and valid. Rating scales may constitute an effective means for assessing the skills/behaviors of children with ASD without ID, particularly if the measure utilizes continuous scaling which provides an indication of the degree to which the skill/behavior is demonstrated (Constantino & Gruber, 2012; Reynolds & Kamphaus, 2015). Teachers are regarded as critical sources of information as they have extensive opportunities to observe the skills/behaviors of children with ASD without ID in natural contexts (Constantino & Gruber, 2012; Mayes and Lockridge, 2018). Given the increased use of teachers for information on the functioning of these children, it is essential to assess the psychometric properties of rating scales for this informant group. The potential impact of cognitive, language, and developmental level on skill/symptom expression and the psychometric properties of a scale (Lord et al., 2014) also indicates the need to develop and test measures for more functionally homogeneous subgroups including ASD without ID (Lopata et al., 2017; Nelson et al., 2016). Finally, the utility of a measure may be increased if the skills/symptoms are aligned (keyed) to the primary core features (Gadow et al., 2006). At present, there is a dearth of rating scales that measure prosocial skills/behaviors linked to the core features of ASD. Existing measures of prosocial and adaptive skills were not developed around, and they assess many skills/behaviors that are not central to, the core ASD features. In addition, ASD-specific measures have assessed the absence of social-communication skills/behaviors and presence of unusual interests/behaviors (Lord et al., 2014), even those employing continuous scaling (e.g. SRS-2; Constantino & Gruber, 2012).

The ASC (Lopata et al., 2008) was originally designed as a study-specific measure to assess ASD-related features including social/social-communication skills and behavioral/interest flexibility and regulation of children with ASD without ID from an adaptive perspective. Initial use in psychosocial treatment studies yielded preliminary evidence of reliability, validity, and treatment sensitivity for parent ratings, and a larger psychometric study provided support for reliability (internal consistency and stability) and criterion-related validity of parent ratings for children with ASD without ID (Lopata et al., 2017). The ASC also exhibited treatment sensitivity for parent and teacher ratings in several school intervention trials; however, no psychometric information was reported; no studies have examined the properties of teacher ASC ratings, and studies are needed

(Lopata et al., 2017). This study assessed the reliability and criterion-related validity of ASC teacher ratings.

Results indicated good internal consistency for teacher ASC ratings (0.93) which is consistent with that reported for parent ASC ratings (Lopata et al., 2017). Indices of skewness and kurtosis were generally good for the items and total score, and the item-total correlations were generally moderate for the items (ranging from 0.23 to 0.70). These findings provide support for the internal consistency of the ASC items and total score. The stability of ASC teacher ratings was tested at a 9-month interval (for a subsample of the children), and results indicated very good test–retest reliability (Pearson $r=0.74$ and ICC = 0.85). These estimates are similar to those reported by Lopata et al. (2017) at a 6-week interval for parent ASC ratings, but exceed their estimates at a 9-month interval (Pearson $r=0.63$ and ICC = 0.64). Overall, the current results as well as those of Lopata et al. (2017) provide support for the internal consistency and stability of teacher and parent ASC ratings for children with ASD without ID.

ASC ratings were also tested for their relationship to child characteristics. Results revealed negligible (non-significant) associations between teacher ASC ratings and child age, IQ, expressive and receptive language abilities, and sex. Lopata et al. (2017) also found negligible associations between child age, IQ, and expressive and receptive language abilities, and parent ASC ratings providing additional support for the relative independence of the skills/behaviors assessed by the ASC and those child variables (sex was not tested in that study). Other studies of youth with ASD without ID have also reported an overall lack of association between adaptive skills and child age and IQ (e.g. Kenworthy et al., 2010; McDonald et al., 2017).

Criterion-related validity of the ASC teacher ratings was tested via associations with scales measuring ASD-related symptoms/impairments, adaptive/prosocial skills, and problems with behavior regulation. Results of these analyses were remarkably similar to those reported for parent ASC ratings (Lopata et al., 2017). For the current sample, a strong inverse association was observed between teacher ratings on the ASC and scales measuring ASD-symptom severity (i.e. SRS-2 and BASC-2/3 DSD) such that as the ratings of prosocial/adaptive skills increased, ASD-symptom severity ratings decreased. This pattern suggests some overlap in the underlying feature being assessed; however, it is being measured from different perspectives (i.e. degree of ASD-related prosocial skills/performance vs impairment). The strengths of associations in this study were large and very similar (i.e. −0.74 and −0.79), and paralleled those of parent ASC ratings (i.e. −0.69 and −0.67; Lopata et al., 2017).

The ASC teacher ratings were also compared to adaptive prosocial scales ratings from the BASC-2/3. A strong positive association was found between teacher ratings on the ASC and overall adaptive skills, with moderate-to-strong associations for the individual adaptive scales (i.e. 0.42–0.72). Given that the large majority of ASC items reportedly assess social/social-communication skills, it was not surprising that the strongest individual scale correlation was with the Social Skills Scale. Although this suggests some overlap in the social skills/competencies assessed, the ASC measures social/social-communication skills associated with ASD, whereas the BASC-2/3 Social Skills Scale covers a much broader range of social skills/behaviors. The pattern of lower correlations with the other adaptive skill scales also reflects the broader range of adaptive skills assessed by the BASC-2/3. Lopata et al. (2017) reported the same pattern and similar strengths of associations for parent ASC ratings, including the strongest (albeit slightly lower) individual scale correlation with the Social Skills Scale (0.64). The ASC also includes items assessing behavior regulation and coping. As such, teacher ASC ratings were compared with ratings on several externalizing behavior scales. Significant inverse correlations of low-to-moderate magnitude were found between teacher ASC ratings and ratings of overall behavior problems and specific problem behavior types (individual scales ranged from 0.24 to 0.28). Again, these results and associations were similar to those for parent ASC ratings (Lopata et al., 2017). Results of these analyses provide support for the criterion-related validity of ASC teacher ratings as a measure of prosocial and behavior regulation skills for children with ASD without ID.

Overall, findings of this study and those of Lopata et al. (2017) suggest that the ASC has good reliability and criterion-related validity for both teacher and parent informants when assessing the functioning of children with ASD without ID. These results are considered especially promising as the ASC has shown good treatment sensitivity in school and clinic intervention trials for these children and there is widespread recognition of the need for treatment sensitive measures (e.g. Bellini et al., 2014). In addition, psychometric testing of teacher-completed measures is needed as schools constitute a primary psychosocial intervention setting for these children (Kasari & Smith, 2013) and teachers are a common source of information on their functioning (Norris & Lecavalier, 2010; Schanding et al., 2012). As noted, a unique feature of the ASC is its assessment of ASD-related dimensions from an adaptive/prosocial skills and positive behavior/interest flexibility and control perspective; other measures often assess these in terms of the absence of social/social-communication skills and/or presence of unusual behaviors/interests (Lord et al., 2014). Continuous scaling also provides information on the degree to which the ASD-related adaptive prosocial skill and behavior is exhibited which may help determine baseline functioning, treatment targets, and/or response to intervention.

This study addressed several areas of need and provided important information on the psychometric properties of teacher ASC ratings; however, several limitations

warrant mention. One limitation involved the size and characteristics of the sample. Although this was the first psychometric test of ASC teacher ratings, the sample was nonetheless limited to 133 teacher ratings. The relatively homogeneous sample of children with ASD without ID helped reduce potential confounding of the results as cognitive, language, and developmental level can affect the properties of a scale (Lord et al., 2014), yet this functional-homogeneity limits the generalizability of results to others not meeting the inclusion criteria. Generalizability is also restricted as the child sample was predominantly male and Caucasian. The small number of females in the sample also warrants some caution when interpreting the lack of association between child sex and teacher ASC scores. Future studies should test the psychometric properties of ASC teacher ratings in larger and more diverse (functional levels, racial/ethnic, sex, and/or age) samples. A more comprehensive examination of potential sex differences in ASC teacher ratings would also be beneficial once a sufficient number of females are obtained. This study was also limited in that it utilized the total score for the analyses. Once sufficient sample sizes are available, factor analyses are recommended to determine the possible presence of underlying factors. As noted, the ASC was developed to assess positive/adaptive functioning related to the two ASD diagnostic dimensions. The only prior factor analysis of ASC ratings (parent ratings) for these children found a three-factor correlated solution that encompassed the underlying diagnostic dimensions. As such, it is likely that future factor analyses of ASC teacher ratings will yield a multi-factor correlated solution either consisting of two factors (as described by the ASC developers including social-communication skills and behavioral flexibility/regulation skills) or three factors (as found by Lopata, Donnelly, et al., 2019 including SCS, BRS, and IRD). Future studies should also test the factor structure in different subgroups with ASD (e.g. ASD with ID, ASD without ID; Fernandopulle, 2011). A larger sample of ASC teacher ratings would also allow for a more detailed examination of item characteristics using item-response theory. In addition, this study was limited in that it only examined teacher ASC ratings. Future studies would be strengthened by comparing ASC ratings across informants (source), as well as to different measure types (method, for example, direct observations); such studies will provide a more comprehensive examination of the ASC properties (our team is currently conducting a comprehensive test of cross-informant consistency of parent and teacher ASC ratings). Studies are also needed testing the ability of the ASC to discriminate children with ASD without ID from typically developing children and those with other clinical disorders. Finally, given the large inverse association between the ASC and SRS-2, future studies should examine overlap in these scales to determine whether the ASC adds to the information yielded by the SRS-2 (incremental validity) or might be able to be used instead of the SRS-2 (if subsequent psychometric testing continues to support the properties of the ASC).

This study was an important first test of the psychometric properties of teacher ASC ratings, and additional studies are needed. The field is in need of measures that accurately and comprehensively assess the skills/behaviors of children with ASD (with and without ID; Davis & Carter, 2014; McMahon et al., 2013) including both social/social-communication skills and behavioral/interest flexibility and control as these dimensions significantly affect daily functioning (Bauminger-Zviely, 2014). These measures will also need to be brief and cost effective, as well as valid (Mayes & Lockridge, 2018) in order to be feasible in applied settings (e.g. schools, clinics, etc.; Murray et al., 2011). The ASC appears to possess many of these desirable attributes, and additional testing is warranted.

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