

Research Article

Assessment of Language Abilities in Minority Adolescents and Young Adults With Autism Spectrum Disorder and Extensive Special Education Needs: A Pilot Study

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Purpose: Little is known about the language abilities of adolescents and young adults with autism spectrum disorder (ASD) despite the importance of language in their other life outcomes. Even less is known about the language abilities of racial/ethnic minorities with ASD and extensive special education needs. These gaps limit our understanding of adolescents and young adults with ASD.

Method: A pilot study evaluated the efficacy of individualized age-referenced language assessment for minority adolescents and young adults with ASD in self-contained special education settings. Participants ($n = 10$) completed the Clinical Evaluation of Language Fundamentals–Third Edition, Test for Early Grammatical Impairment (TEGI), Columbia

Mental Maturity Scale, and Wechsler Intelligence Scale for Children–Third Edition Digit Span.

Results: Clinical Evaluation of Language Fundamentals–Third Edition scores showed little variation, with most participants showing a floor effect. TEGI, Columbia Mental Maturity Scale, and Digit Span scores showed greater variation. Some participants had ceiling TEGI scores, and some had variable assessment profiles.

Conclusion: Assessment was sensitive to variability across some measures. The pilot study outcomes support the feasibility and potential informativeness of additional investigation of conventional language assessments and change over time.

Language abilities predict children's successful transition from school to adult employment (Johnson et al., 2010; Law et al., 2009). Such successful outcomes are goals for adolescents and young adults with autism spectrum disorder (ASD; Shattuck et al., 2012; Shogren & Plotner, 2012). Yet, little is known about the language abilities of adolescents and young adults with ASD. Even less is known about the language and grammar abilities of racial/ethnic minorities (hereafter, minorities) with ASD who receive their education in self-contained special education settings with small class sizes and are exempt from

state standardized testing (hereafter, extensive special education needs). Such gaps in our knowledge limit not only our understanding of all individuals with ASD but also the ability to develop suitable services for each individual. The present pilot study reports on the assessment of language abilities in a sample of minority adolescents and young adults with ASD and extensive special education needs.

Considering the Co-Occurrence of Language Impairment With ASD

Although language abilities in childhood play an important role in later outcomes for children with ASD (Howlin et al., 2004), the range of language abilities in adolescents and young adults with ASD is unclear.

Individuals With ASD May Also Have Language Impairment

One major shift in the definition of ASD involves the centrality of language impairment (LI). Under the *Diagnostic and Statistical Manual of Mental Disorders, Fourth*

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Edition, a language delay was a core characteristic of ASD (American Psychiatric Association, 2000). However, under the *Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition*, the core characteristics of ASD only include (a) restricted and repetitive behaviors and interests and (b) a social communication deficit (American Psychiatric Association, 2013). This shift reflects that individuals with ASD may or may not have co-occurring LI (Grzadzinski et al., 2013; Lord & Bishop, 2015). Thus, while individuals with ASD present issues with the use of language in social contexts, they may also present issues with structural language (e.g., syntax; Eigsti et al., 2011; Lord & Bishop, 2015). In terms of diagnoses, an individual may have ASD, LI, both ASD and LI (hereafter, ALI), or neither condition (Rice, 2016).

Tense marking as a clinical marker of LI. Individuals with ALI may or may not show the same deficits as individuals with specific LI (SLI), who are likely to have persistent morphosyntactic deficits (Rice et al., 2009; Rice & Wexler, 1996; Tomblin, 2011). To this end, some studies have found that children with ALI omit tense markers, such as third-person singular, past tense, auxiliary BE, copula BE, and auxiliary DO (Bartolucci et al., 1980; Kjelgaard & Tager-Flusberg, 2001; Riches et al., 2010; Roberts et al., 2004). In contrast, other studies have found that children with ALI may use tense but mark it incorrectly (Modyanova et al., 2017). Interestingly, some children with ASD and below typical nonverbal intelligence (NVIQ) have performed in the typical range on measures of morphosyntax (Roberts et al., 2004). Thus, the reliability of tense marking as a clinical marker of LI in individuals with ASD, not to mention the range of morphosyntactic behavior across all individuals with ASD, is unknown.

In interpreting discrepancies in the morphosyntactic behavior of individuals with ASD, it is important to note that ASD and SLI are heterogeneous disorders with great phenotypic variability (Tomblin, 2011). Under these circumstances, focusing on a clinical marker of LI such as tense marking may be a promising line of inquiry. Specifically, understanding morphosyntactic abilities across a wide range of individuals with ASD can help provide evidence on the ways in which ALI phenotypes may or may not overlap. To the extent to which such morphosyntactic behavior is similar or different across these groups has implications for understanding the causal pathways of each disorder (Tomblin, 2011).

Language in Individuals With ASD May Predict Life Outcomes

While early language abilities are known to play a role in other outcomes (Magiati et al., 2014), it is unclear how later language abilities change over time or how they may impact outcomes in adulthood.

Outcomes in early adulthood. Although young adults with ASD may show improvement of ASD symptoms over time, the rate of improvement may slow upon aging out of the public education system (Howlin et al., 2013; Taylor & Seltzer, 2010). Individuals with ASD face an overall risk

of poor outcomes in adulthood (Billstedt et al., 2005; Eaves & Ho, 2008; Howlin et al., 2004, 2013; Taylor & Seltzer, 2011). However, how and why young adults with ASD converge upon those poor outcomes is unclear.

On one hand, predictors of good outcomes in adulthood may include intelligence and autism symptoms (Billstedt et al., 2005; Eaves & Ho, 2008), communicative speech in childhood (Billstedt et al., 2005), and social interaction in childhood (Howlin et al., 2013). On the other hand, young adults with intellectual disability (ID) may be more likely to have any type of day-programming than their peers with ASD and without an ID (Taylor & Seltzer 2010, 2011). One possibility is that co-occurring disabilities may make the needs of an individual with ASD more salient and increase the likelihood of service delivery. It is unknown how such programming may impact adulthood outcomes. The role of language abilities, and particularly among individuals with ASD who are likely to have extensive needs for support, is also unclear. Systematically documenting the abilities, outcomes, and persistent deficits of minority adolescents and young adults with ASD is critical to filling these gaps.

Altogether, understanding the underlying causes of limitations in communicative competence in all communities is clinically important and should inform treatment. ALI may contribute to such limitations in children with ALI. Yet, without accurate diagnosis and appropriate assessment, it is difficult to determine entry points for treatment.

Assessing Adolescents and Young Adults With ASD Requires Special Consideration

Assessing language abilities in individuals with ASD—and especially those who are minorities receiving their education in self-contained settings with small class sizes—may require special considerations in the way of the (a) use of standardized assessments, (b) selection of standardized assessments, and (c) assessment practices for minority communities.

The Use of Standardized Assessments

One consideration, the use of standardized assessments with minority adolescents and young adults with ASD, brings into question the advantages and disadvantages of standardized and nonstandardized assessments.

Advantages. On one hand, standardized assessments utilize the same procedures across children with the aim of attaining scores that place a child in the distribution of unaffected children of the same age level. Critically, standardized assessments are likely to be available to clinicians in school settings and are often included in school eligibility policy (Selin et al., 2019). Moreover, some standardized language assessments may measure the same language constructs in children with ASD as nonstandardized measures (Condouris et al., 2003). The most obvious advantage of standardized assessments is an outcome score interpretable relative to a child's age peers.

Disadvantages. Potential disadvantages to standardized assessments include the following: (a) The standardized formats may be unfamiliar or out of the range of a child's compliance, (b) the time demands may be beyond the child's attention range, (c) timed assessments may be invalid, (d) test items may be culturally invalid for a child's social background, (e) previous negative experiences with formal testing may interfere with willingness to complete assessment tasks and (f) using standardized tests in non-standard ways or with populations outside the norming sample may challenge the validity. To this end, previous work has highlighted the potential issues of using standardized measures in assessing the language abilities of children with ASD (Eigsti et al., 2011; Wittke et al., 2017). One possibility is that the core characteristics of ASD may affect performance on assessment and, therefore, may pose a threat to the validity of the results.

Nonstandardized assessments. In contrast to standardized assessments, nonstandardized methods vary widely. Often, the aim is to identify potential target areas of treatment in order to improve particular skills. In the case of autism, language sampling may show wide variability in the number of utterances, which in turn may present difficulties in comparing outcomes within and across samples (e.g., Wittke et al., 2017). Nonstandardized experimental measures may also present challenges to reproducibility, as the exact nature of experimental tasks may vary across studies (Open Science Collaboration, 2012). Altogether, both the selection of assessments and the advantages and disadvantages of using standardized assessments must be considerations in the assessment of language abilities in adolescents and young adults with ASD.

Selection of Standardized Assessments

The second consideration involves the selection of assessments, which, for underrepresented special populations, may not have great precedent in the literature. In the case of children with ASD, some standardized assessments have been used to probe the co-occurrence of LI. A description of these measures follows.

Clinical Evaluation of Language Fundamentals. The Clinical Evaluation of Language Fundamental–Third Edition (CELF-3; Semel et al., 1995) provides information on overall oral language ability. It is designed for children ages 5 years to 21;11 (years;months). The CELF-3 is composed of six untimed subtests, where each raw score can be translated into a standard score ($M = 10$, $SD = 3$). In turn, subtest standard scores can be translated into composite scores for expressive language, receptive language, and total language ($M = 100$, $SD = 15$). Examinees do tasks such as looking at pictures and talking about them, responding to questions or stimuli, and repeating words and sentences.

Multiple studies have used the CELF to assess language abilities in children with ASD with and without LI (Kjelgaard & Tager-Flusberg, 2001; Riches et al., 2010) and, sometimes, in comparison to children with SLI (e.g., Schaeffer, 2018). Critically, CELF scores have significantly correlated with measures of spontaneous speech, which

suggests they may measure the same underlying linguistic constructs (Condouris et al., 2003). The CELF has also been used extensively as a measure of overall oral language ability in a longitudinal study of children with SLI (Rice & Hoffman, 2015; Rice et al., 2009). Thus, the CELF may be a feasible measure to use with adolescents and young adults with ASD.

Test of Early Grammatical Impairment. The Test of Early Grammatical Impairment (TEGI; Rice & Wexler, 2001) provides information on grammatical and morphosyntactic abilities. It is designed for children in an age range of dynamic change in accuracy of morphosyntax beginning at 3 years and likely to show mastery by the upper age level of 8;11. It includes a phonological probe, to demonstrate that examinees are able to produce the sounds needed to mark tense in English (i.e., morphophonology), as well as four subtests, which can be summarized into an elicited grammar composite score and a screening test score. All are untimed. Examinees name pictures, look at pictures and talk about them, respond to questions or stimuli, and listen to sentences. In the BE/DO probe, examinees are asked to respond to stimuli by talking to an inanimate object (i.e., a puppet). Adultlike performance is about 95%.

Previous work has frequently employed the TEGI to investigate interindividual variation in children with fragile X syndrome who may or may not also have ASD (Haebig et al., 2016; Sterling, 2018; Sterling et al., 2012), as well as children with idiopathic ASD who may or may not also have LI (Modyanova et al., 2017; Roberts et al., 2004; Sterling, 2018). Given that the TEGI is a standardized measure that compares morphosyntactic performance relative to the adult grammar and that tense marking is a clinical marker of SLI (Rice & Wexler, 1996), it may be both applicable and useful for investigating the language of adolescents and young adults with ASD.

Wechsler Intelligence Scale for Children–Third Edition Digit Span. The Digit Span (D-Span; Wechsler, 1991) provides information on working memory. Unlike other subtests on the Wechsler Intelligence Scale for Children–Third Edition, the D-Span is untimed. It is designed for children aged 6–16 years. Examinees repeat progressively longer sequences of numbers either forward or backward until a ceiling effect is observed. Raw scores can be translated into a scaled score ($M = 10$, $SD = 3$).

Various studies have employed the D-Span to investigate working memory as a parameter of cognition in relation to language abilities relative in children with ASD (Riches et al., 2010; Schaeffer, 2018) and children with ALI (Allen et al., 1991). However, because the children in these studies were a select sample (i.e., those with “high-functioning autism”), it is unclear exactly how this measure may or may not be feasible with a wider range of individuals with ASD.

Columbia Mental Maturity Scale. The Columbia Mental Maturity Scale (CMMS; Burgemeister et al., 1972) is a measure of nonverbal intelligence (NVIQ) for children aged 3;6–9;11. Critically, it is untimed, does not require a

verbal response, and does not require the manipulation of objects. As such, it is appropriate for children with sensory, motor, or speech deficits. Examinees are presented with a set of images on a card and are asked to identify the image that is different by pointing. Raw scores may be calculated into standard, or age deviation, scores as well as maturity indices (i.e., an estimate of mental age). Maturity indices range from 5 to 9 years, with a “lower” level and an “upper” level within each age range (e.g., 8L = 8 lower and 8U = 8 upper).

In addition to being used extensively in a longitudinal study of children with SLI (Rice & Hoffman, 2015; Rice et al., 2006), the CMMS may also be used with older individuals from special populations. Previous work has used the CMMS to assess nonverbal intelligence in adolescents and young adults with ID, including adults with ID who received institutionalized care (Riviere, 1973; S. A. Warren & Collier, 1960). Since this work is significantly older and considering that the increased prevalence of ASD may be tied to a decrease in diagnoses of ID (Croen et al., 2002), one possibility is that some of the individuals with an ID diagnosis in those studies actually had ASD. Yet to our knowledge, no previous study has used the CMMS with adolescents and young adults with ASD.

Overall, these measures may be reliable for children with ASD. However, because many of the studies here focused on a subset of children with autism (e.g., Condouris et al., 2003; Kjelgaard & Tager-Flusberg, 2001; Riches et al., 2010; Schaeffer, 2018), the utility of these measures with a wider range of individuals with ASD (e.g., adolescents and young adults with ASD and extensive special education needs) is unknown.

Assessment Practices for Individuals of Nondominant Cultures

Assessment practices are an important consideration in working with individuals of nondominant cultures. We focus here on the ways in which researchers can facilitate participation in assessment within the context of research studies (Girolamo et al., submitted).

In minority communities, problems with logistics and inclusion may impact both assessment performance and the ability to complete assessment. Logistical barriers include concrete aspects of a research plan such as the distance between participant communities and where assessment takes place, the childcare needs of participants and their families, and the time availability of the participant (Brannon et al., 2013; Ratto et al., 2017). Inclusion refers to the aspects of a research design, such as cultural responsiveness, that may or may not create an environment that minorities feel is accessible to them (Ratto et al., 2017). If minorities do not feel like a setting for assessment is accessible, they may change their behavior in assessment or elect to not complete assessment (Lewis & Oyserman, 2016).

Strategies to maximize the likelihood of a successful assessment session for minorities are as follows. The first strategy is culturally responsive communication before, during, and after the assessment session. Culturally responsive communication may include the use of appropriate

language that is jargon free, translated as needed, and inclusive of the cultural values of participants into communications as appropriate (e.g., addressing the entire family instead of the individual participant when working with Latinx communities; Haack et al., 2014; Kennedy et al., 2010; Ratto et al., 2017; Yancey et al., 2006). Other parameters of culturally responsive communication may include frequent, face-to-face, and personalized contact with participants by research team members who either are from the participant community or have ties to the community (e.g., Brannon et al., 2013). Visual guides and interactive informed consent procedures may also help participants understand study purposes and procedures and their rights (e.g., Haack et al., 2014).

The second strategy, participant-centered assessment, entails making studying activities accessible to participants. Working with minority children with ASD in research may often require that their caregivers accompany them to and from assessment. Therefore, providing or paying for transportation or making assessment sites accessible to participants (i.e., in their neighborhoods or easily accessible via public transportation) may facilitate participation (Zamora et al., 2016). Planning activities around the lives of participants and their families to minimize disruption to their lives may also be useful (Zamora et al., 2016).

In summary, the use of standardized assessment with well thought-out assessment practices has implications for more general concerns relevant to meeting the needs of minority individuals with ASD across the life span. One such concern is diagnosis, which in turn has downstream effects for service eligibility.

Minorities With ASD May Face Disparities in Diagnosis and Research

Failure to carefully interpret performance on assessments may threaten the validity of assessment results. In the case of minorities with ASD, diagnosis may have subsequent effects on the receipt of services. While ASD may be diagnosed in early childhood and is a lifelong and heterogeneous disorder (Baio et al., 2018; Christensen et al., 2018), racial/ethnic disparities may exist in diagnosis and research.

Disparities in Diagnosis

Access to diagnostic services and diagnostic practices may vary among racial/ethnic groups, such that prevalence of ASD among minority children is lower than Caucasian children (Magaña et al., 2013). Specific disparities may include (a) age of diagnosis, (b) likelihood of receiving a diagnosis other than ASD, and (c) likelihood of requiring services for more time.

Overall, African American and Hispanic children may be less likely than Caucasian children to have a documented ASD, with an even greater difference for children with ASD and concomitant ID (Mandell et al., 2009). Furthermore, African American and Hispanic children may be more likely than Caucasian children to receive a delayed

diagnosis of ASD (Magaña et al., 2013; Mandell et al., 2002; Valicenti-McDermott et al., 2012) or to receive a diagnosis other than ASD first, such as attention-deficit/hyperactivity disorder, adjustment disorder, or conduct disorder (Mandell et al., 2007). Similarly, children of low socioeconomic status (SES) may be likely to receive a diagnosis later than children of high SES (Fountain et al., 2011). One consequence of such discrepancies is that minorities, who may already be less likely to receive a timely and accurate diagnosis, may require treatment for more time post-diagnosis (Mandell et al., 2002).

One implication of such racial/ethnic disparities in diagnosis is that minorities may be at risk for worse outcomes in adulthood. There is a need for empirical evidence on outcomes in minorities with ASD to understand what racial/ethnic disparities may exist.

Disparities in Research

As an activity that may enhance advocacy, knowledge, and treatment, research should be accessible to all communities (United Nations Educational, Scientific and Cultural Organization, 2005). Inclusion of minorities in research is also essential for furthering clinical science (National Institutes of Health Revitalization Act, 1993; Public Health Service Act, 1944). However, minorities may be underrepresented in research, and those who are multiply marginalized (e.g., minorities with significant disabilities) may be even more underrepresented (Durkin et al., 2015; Henrich et al., 2010; Hilton et al., 2010; Shattuck et al., 2012; West et al., 2016).

Most ASD research—including that used to develop diagnostic assessments—has largely focused on upper middle class, Caucasian children from western countries (Durkin et al., 2015). Conversely, individuals of low SES backgrounds, as well as those with severe ASD and/or severe ID, are underrepresented in research (Interagency Autism Coordinating Committee, 2017; Stedman et al., 2019). Adolescents and young adults with ASD are also underrepresented in research, amid a research landscape of little funding to understand individuals with ASD beyond childhood (Autistica, 2016; Interagency Autism Coordinating Committee, 2017; Kuo et al., 2018). These gaps hamper understanding of the experiences of adolescents and young adults with ASD, especially those with concomitant conditions (Z. Warren et al., 2012), as well as of the factors in adulthood outcomes (Shattuck et al., 2018). Underrepresentation of individuals in this age range may prevent the development of services to meet their needs and may even contribute to poor outcomes in adulthood (Howlin et al., 2004; Shattuck et al., 2018; Z. Warren et al., 2012).

In summary, minority adolescents and young adults with ASD and extensive special education needs may face disparities in diagnosis and research. There is a need to understand language abilities in this community and how to assess them. While standardized assessments have potential value in identifying a child's strengths and weaknesses relative to age peers, potential limitations (e.g., the challenges to engaging participants from underrepresented communities

in research) may have worked against a formal study of the possibilities.

Study Aims

This study aimed to evaluate the potential informativeness of standardized language assessments in underrepresented or overlooked individuals with ASD (i.e., minority adolescents and young adults with ASD and special education needs as described below). The questions of this study were as follows:

1. For minority adolescents and young adults with ASD who receive their education in self-contained special education settings with small class sizes, are their language abilities testable and variable using standardized assessments?
2. How does their performance on omnibus language measures relate to measures of grammar and working memory?
3. How does performance on grammar measures vary across participants?

Method

Ethics

The institutional review boards (IRBs) of The University of Kansas and the New York City Department of Education approved this study.

Inclusionary Criteria

This study had the following inclusionary criteria: (a) a minority adolescent or young adult (e.g., aged 14–21 years), (b) with a diagnosis of ASD, and (c) in a specialized special education setting (i.e., 100% special education self-contained setting with a least restrictive environment of six, eight, or 12 students to a class with one classroom teacher, one classroom paraprofessional, and individual crisis or health management paraprofessionals as needed, as well as exemption from state standardized assessments).

Recruitment and Retention Procedure

This study implemented an approach from the broader research program that evaluated an approach for engaging minority adolescents and young adults with autism in research (Girolamo et al., submitted). Central to this approach was making the completion of study activities accessible to participants and their families by shifting the burden of participation in research from participants and their families to the first author. A brief summary of recruitment and retention procedures follows.

Recruitment

The first author conducted recruitment in partnership with a trusted community organization that served exclusively individuals with a diagnosis of ASD who attended

a specialized public school. Individuals had to have a diagnosis of ASD in order to enroll with the organization. Most students at this school were a racial/ethnic minority, qualified for Title I funding and free/reduced meals, and exempt from state standardized testing. Furthermore, the least restrictive environment of most students was 100% in a self-contained special education setting in classes of six, eight, or 12 students to one classroom teacher and one classroom paraprofessional. Some had individual paraprofessionals as needed.

To earn the trust of the community organization, the first author met with leaders and staff of the organization 6 times over 3 years. Critical points of this partnership included developing the recruitment plan, which consisted of the first author distributing and collecting consent-to-contact forms at the organization. The first author scheduled visits at times in the day, such as early in the morning before programming began, to minimize disruptions to the schedules of potential participants. Furthermore, all recruitment materials were at the average literacy level of families (i.e., fourth grade).

After families either completed and returned forms to school or contacted the first author, the first author contacted each family to provide information about the study. The first author provided a jargon-free overview of the study and encouraged families to ask questions. Only after families expressed comfort and comprehension with the study procedures did they schedule a time and place convenient to them to meet with the first author. The purpose of this visit was to provide informed consent and assent, as well as to complete the assessment protocol.

Informed Consent, Assent, and Assessment

Providing assent and informed consent, as well as completing the assessment protocol, took place in a single session outside of school at a time and place convenient to families (i.e., nights and weekends). The first author traveled to the communities where participants lived and administered the assessment protocol in community settings, such as public libraries. Each session lasted approximately 70 min, with 10 min for obtaining assent and informed consent.

Given the communication needs of participants and that families may not have had prior research experience, obtaining informed consent and assent was treated as a dynamic process. The first author explained the consent and assent forms line by line and encouraged participants and their families to ask questions. Moreover, participants and their families engaged in verbal checks for understanding before signing assent and informed consent forms. Next, participants completed the assessment session. Their caregivers generally sat with them or nearby. The first author answered caregiver questions about assessment during the protocol as appropriate or acknowledged the question and answered it at the end of the task. Upon completion of the protocol, participants and their caregivers received compensation following IRB guidelines.

Participants

Participant demographics are reported in Table 1. The first author implemented the procedures described above to recruit minority adolescents and young adults (10 males, $M_{\text{age}} = 18.3$ years, age range: 15.3–21.3 years) with ASD and extensive special education needs. All participants were native speakers of mainstream American English and a racial minority (i.e., black/African American or multiracial), ethnic minority (i.e., Hispanic/Latino), or both a racial and ethnic minority.

Measures and Administration

Given the aim of investigating the feasibility of assessing a sample of minority adolescents and young adults with ASD with standardized language assessments, the protocol included a sample of standardized assessments on language, grammar, and NVIQ previously used with children who have ASD or ID: (a) CELF-3 (Semel et al., 1995), (b) TEGI (Rice & Wexler, 2001), (c) CMMS (Burgemeister et al., 1972), and (d) D-Span (Wechsler, 1991). The first author administered all assessments in this order and in the same manner across participants following the assessment manuals and extensive training from the Language Acquisition Studies Laboratory (principal investigator: Dr. Mabel L. Rice). Critically, passing such training included checks for reliability. Because the CMMS was designed for younger participants, the first author administered the oldest level (Level H, for ages 8–9;11) with a possible total raw score of 59.

Scoring and Analysis

Analyses included descriptive analysis (i.e., calculation of sample means, standard deviations, and maximum scores)

Table 1. Participant demographics.

Characteristic	<i>n</i>	%
Gender		
Male	10	100
Race		
Black/African American	6	60
White/Caucasian	1	10
Two or more races: Black & White	1	10
Other: Puerto Rican	1	10
Don't know	1	10
Ethnicity		
Hispanic/Latino	5	50
Age		
15	2	20
16	1	10
17	2	20
18	1	10
19	1	10
20	1	10
21	2	20

Note. All ages were rounded down to the nearest year, as that is what determines special education eligibility.

and extended analysis of TEGI responses (Modyanova et al., 2017). As this study was exploratory with no assumptions about the distribution of scores in the sample or the broader population of individuals with ASD, parametric and nonparametric measures were not considered. To compare performance across assessments with different scales, z scores were calculated for subtests of the CELF-3 (Total Language, Formulated Sentence, and Sentence Recall), subtests of the TEGI (Third-Person Singular and Past Tense Probes), and the D-Span. z scores represent performance as standard deviations from an assessment mean. Specific scoring and analysis for each assessment are as follows.

CELF-3

Raw scores were transformed into standard scores for each subtest, as well as the composite total language score.

TEGI

Following the manual instructions for standardized scoring, responses on the third-person singular present (3s) and past tense probes were counted as correct (i.e., finite), incorrect (i.e., nonfinite), unscorable (i.e., unelicited responses, such as progressive *-ing*), or no response (Rice & Wexler, 2001). Standardized scoring excluded unscorable responses. However, following the methods of Modyanova et al. (2017), extended scoring included all responses, regardless of whether they were scorable under standardized scoring. If the examiner prompted and received multiple responses, all responses were included in this secondary analysis. This is because the aim was to understand the types of responses that participants produced and specifically if they were likely to produce finite responses not captured by standardized scoring. For the purpose of TEGI z scores, means and standard deviations were used from children with normal language of ages 6;6–6;11, who, in the norming sample, had adultlike performance (i.e., ceiling scores; Rice & Wexler, 2001).

CMMS

Raw scores determined whether participants were performing below ceiling, which, again, had a possible total of 59. Furthermore, following the technical manual, raw scores were transformed into maturity indices. Maturity indices were coded as 0.0 for lower and 0.5 as upper within each level.

D-Span

As per the manual, raw scores were transformed into scaled scores.

Results

All participants completed the protocol in a single session. No participant demonstrated fatigue and needed a break. The sole exception was one participant, who verbalized extreme anxiety during the training item on the BE/DO probe of the TEGI. Thus, the first author used examiner

judgment and abandoned this one subtest for this one participant. Figure 1 presents assessment profiles of individual participants relative to mean performance, and Table 2 presents outcomes of the sample.

CELF-3 Scores Were Low

As Figure 1 and Table 2 display, CELF-3 expressive, receptive, and total language scores showed little variability ($M_{total} = 52.9$, $SD = 6.72$). Most participants showed a floor effect across all composite scores. One participant (#1) had missing data due to personnel error with protocol preparation, which resulted in missing data and the inability to calculate a receptive or total language score. Of the participants who did not show a robust floor effect (#3 and #6), scores were 2–3 SDs below the mean with a very little difference between receptive and expressive vocabulary scores.

TEGI Scores Showed Variability

Overall, TEGI scores were variable. Extended scoring of all responses on the 3s and past tense probes revealed that participants marked most responses for tense.

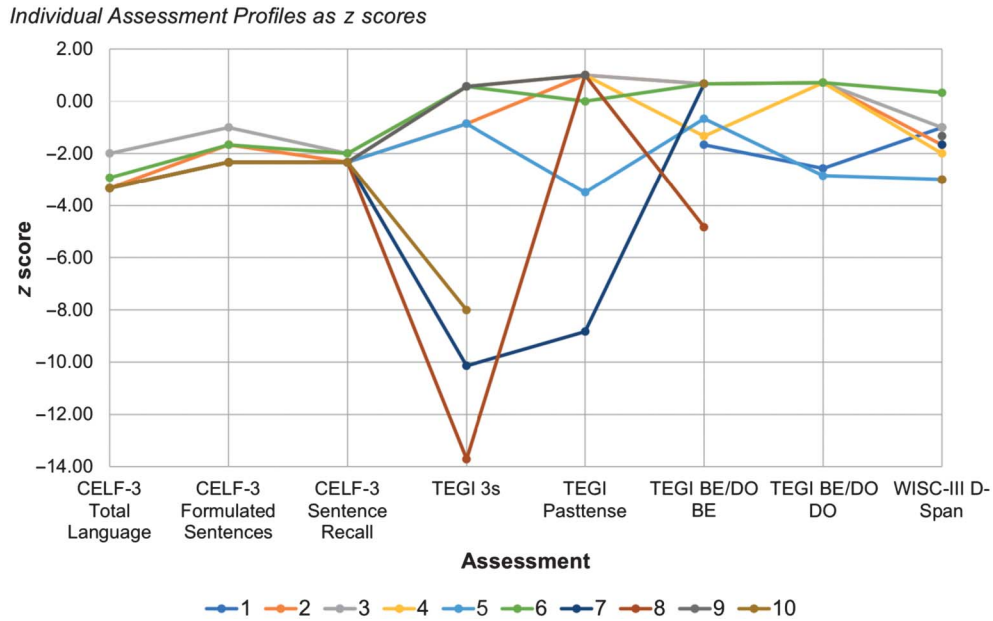
Standardized Scoring

All participants passed the phonological probe. As Table 2 displays, TEGI outcomes were variable under standardized scoring methods. Half of the sample had adultlike (ceiling) or near-adultlike performance on the third-person singular probe, past tense probe, and elicited grammar composite. However, as Figure 2 shows, four participants (#1, #7, #8, and #10) had at least one subtest where the data were unscorable. Again, one participant (#9) did not complete the BE/DO probe due to anxiety over the task, which required interacting with toy objects and talking to an inanimate puppet. The other participants with unscorable data completed all subtests. However, even with prompting as per the TEGI manual (Rice & Wexler, 2001), some responses remained unscorable. As the grammaticality judgment tasks required a binary yes/no response, rather than the production of an elicited utterance, the lack of unscorable responses was expected.

Extended Scoring

Figure 2 shows the proportion of correct, incorrect, unscorable, and “no response” responses per participant across all subtests. Participants produced relatively more unscorable responses on the third-person singular, third-person past tense, BE, and DO probes. In contrast, only Participant 10 had “no response” responses. Table 3 displays the frequency and percentages of response types on the third-person singular and past tense probes under extended scoring, which comprise the TEGI screener, as well as the number of participants who gave a given response type. Overall, about 50% of responses on each of the 3s and past tense probes were marked for finiteness. The next most common response type was present

Figure 1. Individual assessment profiles as z scores. CELF-3 = Clinical Evaluation of Language Fundamentals–Third Edition; TEGI = Test for Early Grammatical Impairment; WISC-III = Wechsler Intelligence Scale for Children–Third Edition.



progressive (i.e., auxiliary + *-ing*) on the third-person singular probe (19.4%) and past progressive (21.8%) on the third-person past tense probe. The third most common response type was nonfinite (i.e., a bare stem) on the third-person singular probe (11.6%) and third-person past tense probe (9.2%).

In summary, while a significant proportion of the sample had adultlike performance on some probes under

standardized scoring, a significant proportion also had unscorable responses. Extended scoring, which included responses that standardized scoring counted as unscorable, showed that the sample was about at chance for producing correct finite responses on the third-person singular and past tense probes. However, many of the other responses they produced were marked for both person and tense—just not the target form.

Table 2. Score summary across assessments and participants.

ID	Age	CELF-3			TEGI								CMMS		D-Span SS
		Total	Receptive	Expressive	3s	Past	BE	DO	-ing	Marker	Agr	EG	Raw score	MI	
1	21.1			50	100		86	54	75	50	69	83	29	7.5	7
2	16.6	50	50	50	90	100	100	100	90	100	50	100	44	9.5	5
3	20.1	70	72	72	100	100	100	100	80	95	100	100	49	9.5	7
4	19.5	50	50	50	100	100	88	100	100	85	80	97	48	9.5	4
5	15.3	50	50	50	90	73	92	50	90	75	85	78	35	8	1
6	15.9	56	53	65	100	94	100	100	100	100	95	99	36	8.5	11
7	17.2	50	50	50	25	41	100		70	75	75	55	20	5.5	5
8	18.9	50	50	50	0	100	67		67	50	50	56	24	6	1
9	21.3	50	50	50	100	100			88	75	83	100	41	9.5	6
10	17.3	50	50	50	40		100		0	13	0	70	38	9.5	1
M	18.3	52.9	52.78	53.7	74.5	88.5	92.56	84.00	76	71.8	68.7	83.8	36.4	8.3	4.8
SD	2.15	6.72	7.28	7.97	37.89	21.34	11.15	24.82	29.1	27.37	29.3	18.32	9.74	1.53	3.23
Max	21.3	70	72	72	100	100	100	100	100	100	100	100	49	9.5	11

Note. CELF-3 total and receptive scores not calculable for #1 due to missing data. BE and DO probe scores not calculable for #9 due to anxiety and subsequent task abandonment. All other missing scores were not calculable due to unscorable responses. CELF-3 = Clinical Evaluation of Language Fundamentals–Third Edition; TEGI = Test for Early Grammatical Impairment; CMMS = Columbia Mental Maturity Scale; 3s = third-person singular present; BE = BE/DO BE probe; DO = BE/DO DO probe; *-ing* = dropped *-ing*; Marker = dropped marker; Agr = dropped agreement; EG = elicited grammar composite; MI = maturity index, with upper within each age level coded as 0.5 and lower within each age level coded as 0.0; D-Span = Digit Span; SS = scaled score; gray cells = scores not calculable.

Figure 2. Individual Test for Early Grammatical Impairment (TEGI) performance.

Individual TEGI Performance Across Subtests

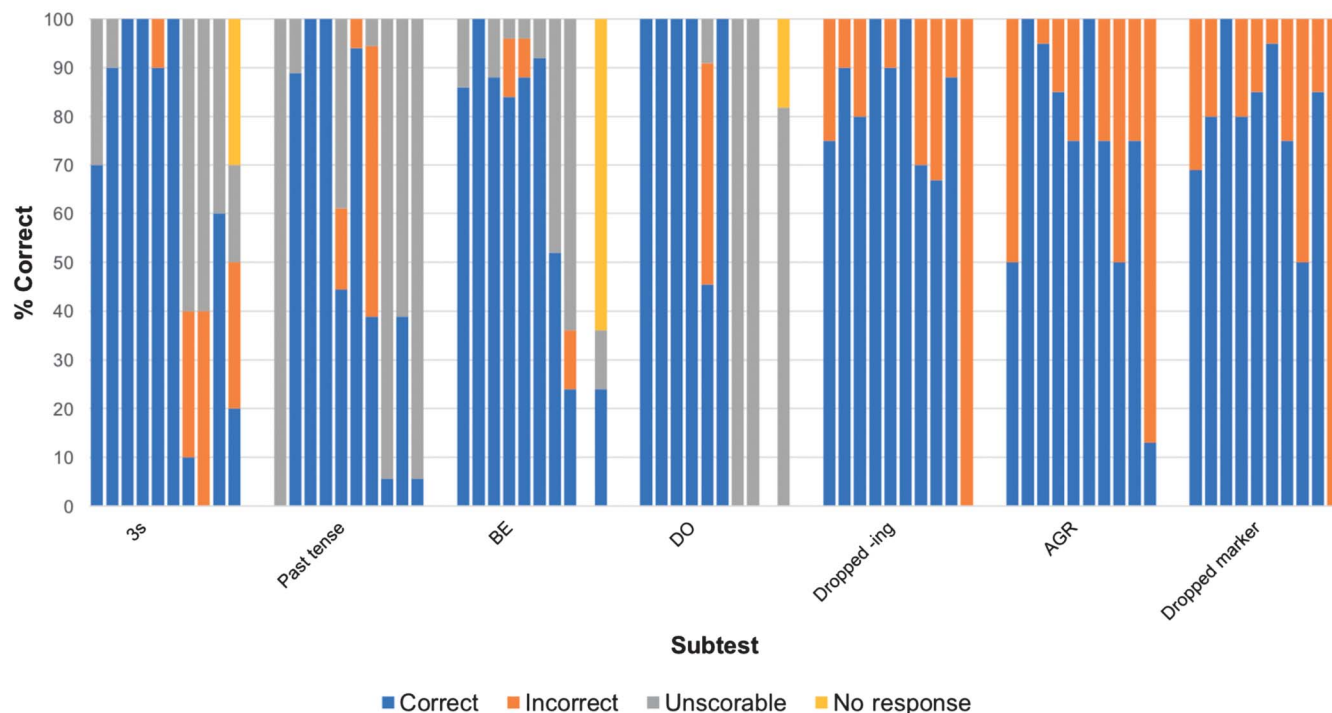


Table 3. Frequencies of Test for Early Grammar Impairment third-person singular present tense and past tense responses ($N = 335$).

Response type	Third-person singular present tense			Third-person singular past tense		
	Responses ($n = 129$)		Participants	Responses ($n = 206$)		Participants
	<i>n</i>	%	<i>n</i>	<i>n</i>	%	<i>n</i>
Past (finite)	0	0.0	0	102	49.5	7
3s (finite)	68	52.7	9	2	1.0	2
Bare stem (nonfinite)	15	11.6	5	19	9.2	4
Present progressive (aux + <i>-ing</i>)	25	19.4	7	8	3.9	2
Past progressive (aux + <i>-ing</i>)	0	0.0	0	45	21.8	5
Progressive <i>-ing</i> without aux	8	6.2	2	4	1.9	2
Present aux with omission of <i>-ing</i>	0	0.0	0	2	1.0	1
Future <i>is going to</i>	0	0.0	0	1	0.5	1
Pronoun + <i>is done</i>	0	0.0	0	2	1.0	2
<i>Done</i> (no copula)	0	0.0	0	1	0.5	1
<i>Does</i>	5	3.9	1	0	0.0	0
<i>Did</i>	0	0.0	0	17	8.3	1
Noun (no verb)	3	2.3	2	0	0.0	0
Wrong subject (<i>they</i> + verb)	2	1.6	1	0	0.0	0
No change verb (e.g., <i>put</i>)	0	0.0	0	1	0.5	1
Passive	0	0.0	0	2	1.0	1
No response	3	2.3	1	0	0.0	0

Note. Third-person singular present tense probe elicited 129 responses. Third-person singular past tense probe elicited 206 responses. 3s = third-person singular present; aux = auxiliary.

CMMS Scores Were Variable, But None Was at Ceiling

Table 2 demonstrates that CMMS raw scores and maturity indices were variable ($M_{\text{raw score}} = 36.4$, $SD = 9.74$; $M_{\text{maturity indices}} = 8.3$, $SD = 1.53$). Half of the sample had a maturity index at ceiling (i.e., 9.5 or 9 upper). However, the maximum raw score was 49 out of a total of 59 items. Thus, while maturity indices were relatively high, no participant had a raw score at ceiling on an assessment designed for much younger children.

D-Span Scores Were Mostly Low

Table 2 shows that, although the mean of the sample was about 1.75 *SDs* below the mean, D-Span scaled scores showed variation ($M = 4.8$, $SD = 3.23$). One participant (#6) scored above the mean. Two participants (#1 and #3) had scaled scores 1 *SD* below the mean.

Assessment Profiles Were Spikey Across Measures

As Figure 2 shows, performance on one measure did not necessarily correspond to performance on others.

CELF-3 and TEGI

CELF-3 scores across participants showed a relatively flat profile, with most performing at floor level. As Figure 2 shows, the two participants who scored above floor on the CELF-3 also had adultlike performance on the TEGI (#3 and #6). In contrast, several participants had a floor effect on the CELF-3 but mostly adultlike performance on the TEGI (#2, #4, and #9). Others had scores at floor level on the CELF-3 and low (#7 and #8) or middling performance (#1, #5, and #10) on the TEGI. Five of eight (62.5%) participants whose CELF-3 scores were at floor level had adultlike or near-adultlike performance on the TEGI screener (i.e., the average of the third-person singular and past tense probes; #1, #2, #4, #5, and #9). In summary, CELF-3 scores were overall low, and TEGI outcomes were variable.

CELF-3, TEGI, D-Span, and CMMS

In general, TEGI outcomes were the most variable and adultlike, and CELF-3 outcomes were the least variable and lowest. Variability in D-Span and CMMS scores fell somewhere in the middle. Referring to Table 2 and Figure 2, the two participants who scored above floor level on the CELF-3 and had adultlike performance on the TEGI also had relatively high performance on the CMMS and D-Span (#3 and #6). Similarly, the two participants with low performance on both the CELF-3 and TEGI also had relatively low performance on the CMMS and D-Span (#7 and #8). However, some participants with scores at floor level on the CELF-3 and adultlike performance on the TEGI had relatively high performance on the CMMS and D-Span scores more than 1 *SD* below the mean (#2, #4, and #9). Of the three participants who showed a floor effect on the CELF-3 and had middling performance on the TEGI, two of three had middling CMMS

scores and D-Span scores at floor level (#5 and #10). The third had a relatively lower CMMS score and a D-Span score 1 *SD* below the mean (#1). In this way, assessment profiles varied across participants.

Discussion

This study investigated the feasibility of using standardized measurements to assess language abilities in a sample of minority adolescents and young adults with ASD and extensive special education needs.

Findings

Overall, the results highlight the need for careful consideration in administration of assessments and interpretation of scores.

Language Abilities May Be Testable and Variable Using Standardized Assessments

The sample of this study, minority adolescents and young adults with ASD receiving their education in self-contained special education settings with small class sizes, had variable outcomes across assessments when assessed with participant-centered methods. Some assessments, such as the CELF-3, may have masked interindividual variation. It is possible that true scores of participants in this sample were actually low. Indeed, other studies that have used the CELF to assess language abilities in individuals with ASD found that outcomes were more variable (Condouris et al., 2003; Kjelgaard & Tager-Flusberg, 2001). Given that ASD is heterogeneous and that TEGI outcomes were indeed variable, this sample may have been unlike most other samples of individuals with ASD in research studies on language (Durkin et al., 2015; Schaeffer, 2018). This explanation might help account for the flat CELF-3 profiles in this study.

More broadly, performance on the CELF-3 was informative at showing that this particular assessment may have been inadequate at identifying relative strengths and weaknesses in the language system. Such understanding is important for informing entry points for treatment and development of speech/language service goals. Hence, clinicians and researchers, as well as assessment developers, must carefully consider what assessment performance means. In some contexts, such as using standardized test scores to decide eligibility for speech/language services, it would be highly relevant to consider the interpretation and use of the assessment performance (Messick 1990, 2000).

Performance on Various Assessments Must Be Considered in Context

The second finding was that performance on an omnibus language measure did not necessarily correspond to performance on measures of grammar, NVIQ, and working memory. Some participants had low performance on the CELF-3 and TEGI but had comparatively higher performance on the CMMS and D-Span. These findings may be

consistent with those of population-level studies, which have found that language ability and NVIQ may dissociate (Rice, 2017; Tomblin et al., 1997). Specifically, 12% of children with low NVIQ had typical language, whereas 8% had typical or above NVIQ and low language (Rice, 2017). In the case of ASD, the core criteria highlight that LI and ID are separate conditions that may or may not co-present with ASD (American Psychiatric Association, 2013; Rice, 2017). However, considering the participants who had low performance on the CELF-3, middling performance on the TEGI, and conflicting performance on the CMMS and D-Span (e.g., one score was relatively high and the other was low), there is a need to further examine how language and NVIQ relate to one another.

Performance on Grammar Assessment Also Must Be Considered in Context

Performance on the TEGI was consistent with previous work finding that individuals with ASD and low performance on language assessment may use tense (rather than omit it), but in a way that diverges from the elicited response (Modyanova et al., 2017; in contrast, see Bartolucci et al., 1980; Kjelgaard & Tager-Flusberg, 2001; Riches et al., 2010; Roberts et al., 2004). However, standardized scoring alone would not lead to this conclusion. Here, a closer examination of responses showed that a significant proportion of participants had unscorable responses, which were not included in the calculation of standard scores. Extended scoring revealed that about 50% of the responses on the 3s and past tense probes were correctly marked for finiteness and roughly an additional 20% of responses were present or past progressive forms that also corresponded to third-person singular and present or past tense. In contrast, only 10% of responses on each probe were nonfinite.

The take-home point of these findings is that researchers and clinicians must carefully consider how they administer the assessment. The examiner may need to consider how to present each task and adjust the training items or salience of the stimulus. For example, administration of the past tense probe on the TEGI might include only the second picture when the action is completed and the stimulus, as well as the direct object (e.g., *Tell me what he did to the leaves* for a picture of a boy who raked leaves). Increasing the salience of such tasks might also help mitigate task anxiety. Analysis of responses beyond standardized scoring may also help guide interpretation of assessment performance.

Selection of Assessments May Present Challenges

Performance on these assessments highlighted one difficulty facing clinicians and researchers working with special populations, namely, the selection of assessments. Specifically, it showed that (a) the CELF-3 may not have reflected the variability in this sample; (b) administration of standardized assessments, even highly structured ones such as the TEGI, may require special consideration; and (c) there is a need to find age-referenced measures that are both appropriate and capable of reflecting interindividual

variation in adolescence and young adulthood. One way of finding such measures might be comparing outcomes on measures that are likely to collapse interindividual variation, such as the CELF-3, with those that may not (e.g., assessments for younger children or other age-referenced omnibus oral language assessments). A similar comparison might be made with the CMMS and other age-referenced measures of NVIQ.

Nevertheless, without representation in research, it is difficult to determine what assessments might be appropriate for this sample of adolescents and young adults with ASD (Durkin et al., 2015). Inclusion of minority adolescents and young adults with ASD and special education needs, such as the participants in this study, is necessary to fill these gaps. Ultimately, the spiky assessment profiles highlight the importance of interpreting scores in context (i.e., considering the possibility that assessment may or may not accurately measure abilities).

Limitations of This Study

This study presented novel information on assessment of language abilities, NVIQ, and working memory in minority adolescents and young adults with ASD and extensive special education needs. However, there were limitations.

Sample Size and Bias

Given the exploratory nature of this study, the sample size was small. A larger sample size is necessary for both the development of hypotheses and sufficient analytical power, both of which would allow for a more concrete understanding of language abilities and their relationship to other outcomes (e.g., NVIQ). Furthermore, the sample may have been biased. All participants were male, and the participants and families who elected to complete study activities were those who were able to do so. One limitation beyond the control of the authors due to IRB requirements was that the families were required to be available for testing out of school. Raising a child with significant needs in a major urban area is no small charge. It is possible that some potential participants and families may have been interested in participating but were unable to do so even though all testing took place in their neighborhoods at a time and place convenient to them. Thus, there is a need to find ways to broaden sample diversity, even among already underrepresented communities in ASD research.

Study Cost

The cost of this study presented a challenge to feasibility. To recruit a community that is scarce in the research literature, the first author took the responsibility of facilitating participation in research (Girolamo et al., submitted). All research activities took place in participant neighborhoods, such that the first author traveled to them at their convenience. The total time cost of this approach was 47.5 hr (4.75 hr per participant) and included developing a community partnership to recruit participants, distributing

and collecting consent-to-contact forms, providing individualized consultation on the research study to potential participants, scheduling a time for assessment, and conducting assessment. The financial cost, including participant compensation and local travel within New York City, amounted to \$762, or \$76.20 per participant. These totals exclude the cost of airfare from The University of Kansas to New York City, the time of the first author (who received a stipend, versus hourly payment or salary, as a Graduate Research Assistant), and study supplies, which the lab of the second author provided. Thus, while the study presented novel information on an underrepresented sample in ASD research, it was expensive and might be prohibitively costly for a larger sample without additional research funding.

Conclusions and Further Work

The findings, conclusions, and limitations of this study highlight the need for further work in the way of selection of assessments and longitudinal study.

Expanded Selection of Assessments

Future work is needed to better understand the applicability of standardized measures for understanding the language abilities and other outcomes in minority adolescents and young adults with ASD. Comparison of performance on age-referenced overall oral language assessments, such as the CELF-3, where participants such as the ones in this study are likely to have scores at floor level, with other assessments—either ones designed for younger children or ones that are simply alternatives to the CELF—would provide insight on the ways in which assessments may or may not be appropriate. Likewise, comparison of performance on various measures of NVIQ would also be worthwhile. One challenge is identifying NVIQ assessments, which, in addition to being suitable for adolescents and young adults with ASD, are also suitable for individuals with limitations in fine motor skills. Finally, the inclusion of assessments for other areas, such as autism characteristics, family information, reading, vocabulary, quality of life, and self-determination, would create a richer context for understanding outcomes in adulthood.

Longitudinal Study

In order to further understand language abilities and how they relate to other outcomes in special populations, repeated assessment over multiple time points is necessary. As Eigsti et al. (2011) have highlighted, there is a need to study language abilities on a longitudinal scale. This study would allow for an understanding of within-subject development and intraindividual variation. In concrete terms, longitudinal study would further understanding of how language may impact outcomes in minority adolescents and young adults with ASD across the life span, as well as what supports may improve outcomes in adulthood for individuals with ASD.

In conjunction with study over time, there is a need to study more individuals in this age range from

underrepresented communities. While the participant-centered approach was feasible for this sample, an increased sample would increase the strength of the findings. A larger sample would allow for a stronger exploration of how various characteristics associated with ASD inform language outcomes. Furthermore, assessment performance from an increased sample might provide evidence for test developers of the need for a wider representation of individuals with ASD in the norming sample.

These suggestions for further work are based on the conclusion that minority adolescents and young adults with ASD and extensive special education needs are testable under appropriate circumstances and with careful interpretation of assessment performance. Critically, familiar noninstitutional settings for assessment may enhance cooperation and thereby add to the validity of outcomes. Inclusion of such individuals in research brings high value to our understanding of the experiences of all individuals with ASD. Ultimately, better understanding of their experiences will allow for the identification of treatment needs, the strengthening of advocacy efforts, and the development of supports suitable to diverse individuals with ASD. It is our hope that this study will be the first of many to improve understanding of assessment and clinical practice for this underrepresented community.

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