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Narrative Microstructure and Macrostructure Skills of Persian-Speaking Children with Autism Spectrum Disorder

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Abstract

Background: Studies examining narrative production skills in children with autism spectrum disorder (ASD) have demonstrated variable and inconsistent results. This study aimed to investigate to what extent narrative difficulties in children with ASD reflect difficulties with language.

Methods: Accordingly, the spoken narrative skills of 16 children with ASD were compared with those of their 16 chronological age-matched (CAM) and 16 language-matched (LM) peers. A Kruskal-Wallis non-parametric test was then used to examine the differences between groups in regard to NTC, NSG and SI variables .For other studied variables (NTW, number of T-units, ATL and total score), one-way analysis of variances (ANOVA) was also used.

Results: At the level of microstructure, the results showed that productivity (number of total words, total clauses, and T-unites) and syntactic complexity (average of T-unit length and subordination index) were predominantly similar in ASD and LM children. However, children with ASD scored lower than their CAM counterparts ($P < 0.001$). At the macrostructure level, we found that the total score of story grammar elements and the number of story grammars in the narrative production of children with ASD were lower than those in both CAM and LM children ($P < 0.001$).

Conclusion: The present study, thus, showed that creating a coherent narrative could be more demanding for children with ASD than productivity and syntactic complexity.

Keywords: Autism Spectrum Disorder, Narration, Microstructure, Macrostructure, Child

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Introduction

Autism spectrum disorder (ASD) is a neurodevelopmental disorder characterized by deficits in social communication, and repetitive or restrictive behaviors and interests (1). One of the components of social communication is the ability to express narratives, an area where we expect children with ASD to face challenges. Studies examining narrative production in children with ASD have demonstrated variable and inconsistent results. Kenan et al. indicated that children with ASD used fewer clauses in their narrative than the typical development (TD) children,

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↑What is "already known" in this topic:
- Children with ASD have been shown to face serious challenges in their narrative production.
- Studies examining narrative production skills in children with ASD have demonstrated variable and inconsistent results.

→What this article adds:
- Most of the studies have been focused on English-speaking participants, who are linguistically and culturally different from Persian speakers.
- Given that only one study has been done in the Persian language, which is different from the present study, we decided to comprehensively examine the narrative abilities of children with ASD.

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while their sentences were more syntactically complex (2). Some studies, however, reported that children with ASD had functions similar to those of their age-matched peers in some narrative skills, such as syntactic complexity (3) and productivity (4, 5). There are, however, inconsistent results comparing children with ASD to those of the same age. Some reasons for these discrepancies in findings in related studies include the wide age range of participants (6), using various elicitation methods (story generation or story retelling) (7), and finally, not matching the study groups in terms of language ability (8).

Narrative production in children with ASD, as compared to language-matched (LM) children, has also been studied, with some results being contradictory. The findings of some studies have shown that children with ASD produce narratives with fewer numbers of words and sentences (9), less syntactic complexity (4, 10, 11), and shorter sentences (11), as compared with the LM TD children. On the other hand, some studies have reported that there is no significant difference in indicators such as length of narration (12), length of utterance (13), number of words (12-14), variety of words (15), number of clauses and syntactic complexity (12, 14) in children with ASD, as compared to LM TD children. It should be noted that close matching of groups in terms of age, language, and cognition can have a great impact on the performance of children with ASD, which can lead to misleading interpretations of the results.

In some studies, narrative production skills of children with ASD have been examined at the macrostructure level, which shows that children with ASD produced narratives with fewer story grammar elements, as compared with their TD peers (2, 4, 10, 11, 13). Other studies, however, have shown that ASD and TD groups performed similarly at the macrostructure level (5, 16). The reason for these conflicting results can be attributed to various factors, such as the way of matching the groups for age and/or language and the elicitation methods.

There are limited studies that have compared children with ASD with both controls. Also, most of these studies have been focused on English-speaking participants, who are linguistically and culturally different from Persian speakers. In Persian, only one study was found, which is different from the present study in terms of the studied groups, the type of variables and the elicitation method (10). Therefore, by using microstructure and macrostructure analysis, we decided to comprehensively examine the narrative abilities of children with ASD by applying two control groups. These two groups were matched according to the chronological age and language skills of children with ASD separately. The present study aimed to investigate whether there was a significant difference in the narrative retelling of Persian-speaking children with ASD, as compared with the control groups. We also investigate whether the language level can compensate for the differences found.

Methods

Participants

In this study, three groups participated: the ASD group (n=16), the CAM group (n=16), and the LM group (n=16). According to the inclusion criteria, all participants were monolingual Persian-speaking with no history of neurological dysfunction, seizures, brain damage, sensory problems, or visual or hearing impairments. Also, all of these children had at least the ability to express spontaneous three-word utterances. Children with ASD were selected through convenience sampling from autism centers and speech therapy clinics in Tehran. These children, who were in the age range of 5 to 7 years, were diagnosed by an experienced pediatric psychiatrist based on the DSM V criteria. Further, after diagnosis by a psychiatrist, Gilliam Autism Rating Scale–second Edition (GARS-2) was performed by parents to complete the diagnosis. All of these children were in the middle and high level in terms of socioeconomic conditions, according to the forms that the authors designed for this purpose. The medical history of children with ASD was extracted from the medical records in the psychiatric clinic.

Children in the CAM and LM groups were randomly selected through kindergartens from the same areas that were centers for children with ASD. Tehran was first divided into three areas (north, center and south). Then, six kindergartens were randomly selected from these areas. All of these children were in the middle and high level in terms of socioeconomic conditions, according to the reports included in the child's file in the kindergarten. The medical history of these two control groups was extracted from the medical records of children in kindergartens. Based on the informal assessment of the speech therapist (i.e., observing the child during interaction with parents and peers), children in CAM and LM groups did not have language delay disorders. The CAM group was in the age range of 5 to 7 years and gender-nonverbal intelligence and age-matched with children in the ASD group. The LM group could be individually matched with children in the ASD group on gender, language ability and nonverbal ability.

For all participants, the Persian version of Wechsler Preschool and the primary scale of intelligence (WPPSI), were performed to determine nonverbal intelligence (17). To be included in the study, they had to obtain intelligence quotient (IQ) scores equal to or above 85. Also, the Persian version of the test of language development (TOLD-P: 3) was accomplished by a speech therapist to assess the language skills of the children (18).

At the beginning of the study, 25 children with ASD participated in the study. During the study, however, only 16 children with ASD participated in all three evaluation sessions, and the rest of the participants were excluded from the study. The exclusion criteria were the inability of the child or family to participate or failure to participate in three evaluation sessions.

Sample

The sample size was calculated with G-Power 3.1.3. Considering the one-way analysis of variances (ANOVA), between factors with an effect size of d 0.3, assuming alpha 0.05 and power 0.8, each group's sample size required 37 participants (n = 111) for each group (9).

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Measures

Gilliam Autism Rating Scale–Second Edition (GARS-2)

The scale includes 3 subtests of stereotyped behavior, communication, and social interaction. This scale consists of 42 questions scored on a 4-point Likert scale from 0 to 3. The Persian version of GARS-2 was used in this study. The cut-off point of the test is 52, and the sensitivity and specificity of the scale are 99% and 100%, respectively. The reliability of this scale has also been estimated to be %۸۹ using Cronbach's alpha coefficient (19).

Persian version of Wechsler preschool and primary scale of intelligence

WPPSI has a total of 11 subtests divided into two parts: a verbal part (six subtests) and a non-verbal one (five subtests). The test was standardized on 396 children (203 girls and 193 boys) in the age range of 5.0-6.6 years. The reliability coefficients of the verbal and non-verbal sections were calculated to be 83% and 90%, respectively. The validity of this test is confirmed after examining the correlation between the subtests. Participants in this study were matched based on the non-verbal part of Persian WPPSI, including animal house subtests and completion of images, mazes, geometric designs and block designs (17).

Persian version of the test of language development (TOLD-P: 3)

TOLD-P: 3, which is standardized in Persian for children in the age range of 4.0-8.11 years, consists of 9 main subtests. The six main subsets include picture vocabulary (30 items), relational vocabulary (30 items), oral vocabulary (28 items), grammatical understanding (25 items), sentence imitation (30 items), and grammatical completion (28 items). The test was standardized on 1235 children (4.0-8.11 years) in 100 schools and 100 preschools (18). The reliability of this test has been obtained by using the internal consistency method of the alpha coefficient in the sub-tests and considering the age ranges from 0.74 to 0.96. Using the test-retest method, reliability for all subtests has been shown to vary from 0.82 to 0.88. Validity has also been examined using the methods of content validity, criterion validity and construct validity. Regarding the validity of this test, the correlation coefficients between several subtests of this test and the standard tests have been determined, among which the coefficients of 0.57, 0.71, 0.42 and 0.70 can be mentioned.

Farsi narrative norms instrument (FNNI)

Farsi narrative norms instrument (FNNI) consisted of six pictures in two sets of stories (A and B) that were designed to collect language samples of 5 to 10-year-old children. The psychometric features of FNNI were investigated in 30 Farsi-speaking children. The results showed that the instrument's content validity was 92.28%, and the inter-rater reliability was 97.1% (20). The story used in the present study was the Horse/Elephant story from set A3.

Procedure

Participants were selected according to the inclusion criteria. Then written consent was obtained from the parents of the eligible children to participate in the study. The relevant tests were then performed on all participating children individually during three sessions. In the first session, the non-verbal part of the Persian WPPSI test was performed. In the second one, the Persian TOLD-P: 3 test and in the third session, FNNI were performed. To ensure that the children understood the task, we performed a pilot story. The examiner told the story while the children looked at the pictures; they were then asked to retell it while looking at the pictures.

All sessions were audio-recorded by a digital voice recorder, Kingston DVR-902, and later transcribed by a skilled speech therapist blinded to the characteristics of children. The transcribed stories were then analyzed separately by the first author manually.

Coding of narratives

For the microstructure, the evaluation of narrative production was based on the productivity of indicators and syntactic complexity. The number of total words (NTW), number of total clauses (NTC) and number of T-unites were chosen to examine narrative productivity. The average T-unit length (ATL) and subordination index (SI) were calculated to assess the syntactic complexity (21). For macrostructure analysis, the number of story grammars (NSG) and the total score of story grammar elements were examined. NSG was defined by focusing on the number of story grammar elements consisting of setting, plan, and initiation of event, action, internal response, consequence and reaction (22). The scoring of this part was based on the Schneider scoring method (23). The score ranged from 0 to 40. The scoring method and description of each story element are provided in Appendix A.

Reliability

One of the ways to control the measurement error is to check the stability of the measurement between the evaluators. After the stories were transcribed by a trained speech therapist blinded to the group of children, they were analyzed by two other trained speech therapists independently in terms of microstructure and macrostructure components. At the microstructure level, NTW, NTC and the number of T-units were scored. At the macrostructure level, NSG and the total score of the story grammar elements were scored. To determine the inter-rater reliability, the percentage of agreement among speech therapists was used. For this purpose, 31% of the data were randomly selected and re-calculated by the second speech therapist. The percentage of agreement among the examiners was calculated using an intra-class correlation coefficient (ICC). Findings showed that ICC among examiners was strong for NTW (0.98), NTC (0.96), T-unit (0.98), ATL (0.95), SI (0.89) and NSG (0.95).

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Data analysis

Statistical analysis was conducted using SPSS software (version 26). The normality of the data was assessed by the Shapiro-Wilk test. Mean and standard deviation (SD) were used for the normal distribution data; otherwise, they were reported as median and Interquartile range. Also, a percentage frequency distribution was used for each distinct value. A Kruskal-Wallis non-parametric test was then used to examine the differences between groups in regard to NTC, NSG and SI variables. The Dunn test was also applied as a post hoc multiple test. For other studied variables (NTW, number of T-units, ATL and total score), one-way analysis of variances (ANOVA) and Bonferroni method were also applied as post hoc multiple tests. If the homogeneity of variances was not met using Mauchly's test of sphericity, the Greenhouse-Geisser estimate was used.

Results

A total of 48 children participated in this study; they included three groups: 16 ASD, 16 CAM, and 16 LM children. The demographic characteristics of the participants are provided in Table 1.

Narrative microstructure: Productivity and syntactic complexity

Considering productivity, the results obtained from one-way ANOVA showed that the mean NTW ($P< 0.001$) and T-units ($P < 0.001$) scores in children with ASD were significantly lower than those for the CAM children (Table 2). However, the mean NTW ($P =0.969$) and T-units ($P =0.986$) scores in children with ASD were not significantly different from those of their LM peers (Table 2).

The results of the Kruskal-Wallis test and the Dunn post hoc tests also showed that the mean NTC score in children with ASD was significantly lower than that in the CAM ones ($P =0.013$); however, the mean NTC score ($P = 0.863$) was not significantly different from that in LM children (Table 3).

In terms of syntactic complexity, the results obtained from one-way ANOVA and post hoc comparison tests showed that the mean ATL score ($P < 0.001$) in children with ASD was significantly lower than that for the CAM children, but the mean of this variable was not significantly different from that of LM children ($P = 1.00$) (Table 2). The results of the Kruskal-Wallis test and the Dunn post hoc test also showed that the mean SI score in children

Table 1. Description of participants' demographic characteristics

Variable	Groups			Group comparisons	
	G1:ASD (n=16) M(SD)	G2: LM (n=16) M(SD)	G3: CAM (n=16) M(SD)		
Age (months)/Range	68.31 (4.40)/ (61-75)	58.18 (6.40)/ (50-70)	68.37 (4.50)/ (61-74)	F = 20.46	LM< ASD, p <0.001 ASD = CAM, p = 0.973
Gender (girl/boy)	5.11	5.11	5.11		
TOLD-P:3 Quotient	92.06 (2.26)	91.68 (2.05)	101.31 (5.47)	F = 36.28	ASD = LM, p = 0.948 ASD < CAM, p <0.001
WPPSI Quotient	113.87 (9.78)	107.68 (13.51)	115.50 (11.52)	F = 2.03	ASD = LM, p = 0.426 ASD = CAM, p = 1.00
GARS-2	83.37 (4.5)	0	0		

G: Group; ASD: Autism Spectrum Disorder; LM, Language Match Groups; CAM, Chronological Age Match Groups; TOLD-P, 3: Test of Language Development-Primary, Third Edition; WPPSI: Persian version of Wechsler preschool and primary scale of intelligence; M: Mean; SD: Standard deviation.

Table 2. The productivity and syntactic complexity score of narrative production in the groups

Variable	Groups			Group comparisons	
	G1: ASD (n=16) M(SD)	G2: LM (n=16) M(SD)	G3: CAM (n=16) M(SD)		
NTW	57.50 (18.81)	59.68 (10.37)	103.68 (23.09)	F = 32.76	ASD = LM, p=0.969 ASD < CAM, P <0.001
T-unit	19.68 (5.27)	20.18 (3.83)	26.37 (5.43)	F = 9.23	ASD = LM, p=0.986 ASD< CAM, P <0.001
ATL	2.92 (0.66)	2.99 (0.40)	3.93 (0.49)	F = 18.21	ASD = LM, p =1.00 ASD< CAM, P <0.001

G: Group; ASD: Autism Spectrum Disorder; LM, Language Match Groups; CAM: Chronological Age Match Groups; M: Mean; SD: Standard deviation; NTW: Number of Total Words; ATL: Average of T-Unit Length.

Table 3. The comparison of the number of total clauses and subordination index in three groups.

Variable	Groups						Group comparisons*
	G1: ASD (n=16)		G2: LM (n=16)		G3: CAM (n=16)		
	Median	Interquartile range	Median	Interquartile range	Median	Interquartile range	
NTC	25.50	11.75	30.50	6.50	40.00	14.00	ASD = LM, P =0.863 ASD < CAM, P = 0.013
SI	1.17	0.28	1.40	0.28	1.57	0.31	ASD < LM, P = 0.036 ASD < CAM, P < 0.001

G: Group; ASD: Autism Spectrum Disorder; LM, Language Match Groups; CAM, Chronological Age Match Groups; NTC: Number of Total Clauses; SI: Subordination Index.* Kruskal-Wallis test.

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with ASD was significantly lower than that for both CAM ($P < 0.001$) and LM children ($P = 0.036$) (Table 3).

Narrative macrostructure: Number of story grammars and total score of story grammars

The results of one-way ANOVA and post hoc comparison tests showed that the total score of story grammar elements in children with ASD were significantly lower than those obtained for both CAM ($P < 0.001$) and LM ($P < 0.001$) groups (Figure 1). The results of the Kruskal-Wallis test and the Dunn post hoc test also showed that the mean NSG in children with ASD was significantly lower than that for both CAM ($P < 0.001$) and LM children ($P = 0.027$) (Figure 2).

Discussion

The purpose of the present study was to compare the spoken narrative of children with ASD with that of two groups of CAM and younger LM children through the analysis of microstructure and macrostructure.

At the level of microstructure, this study revealed that children with ASD had a lower performance than the CAM children in all components of spoken narrative. Regarding productivity, the results showed that children with ASD used fewer NTW, NTC, and T-units in their narratives, thus indicating that children with ASD produced narratives with fewer words and clauses, as compared to the CAM participants. This is in line with the previous studies (2, 16, 21, 24) and also impaired in children with ASD than in the age-matched TD participants. This also implied that the narrative of children with ASD contained less information than the control group. Regarding the complexity, the results showed that children with ASD scored lower than the CAM groups on ATL and SI measures. This, thus, indicated that children with ASD produced narratives with less syntactic complexity which is consistent with the findings of the previous studies (11, 25, 26). Similarly, Colozzo et al. found that 6-10-year-old children with ASD performed more weakly than their aged-matched TD peers in terms of both productivity (number of words, clauses and C-unites) and syntactic complexity (27). Similarly, Kuijper et al. reported that syntactic complexity, in terms of the number of complex clauses in 6-12-year-old children with ASD, was lower than that in the age-matched TD group (28).

Some previous studies, contrary to the results of this research, have shown that children with ASD have functions similar to those of age-matched TD children in terms of productivity and syntactic complexity (5). One possible reason for these discrepancies could be the tests used and how the groups were matched. Another possible reason for such differences might be the wide age range of study participants, which could lead to the heterogeneity and development of some language skills at older ages (6).

In comparison to younger LM children, our findings were in line with some prior studies (12, 14, 15), showing that both ASD and LM children performed the same on the measure of productivity. Banney et al. also found that the total number of words and T-units in the narrative production of 9-15-year-old children with ASD were as sophisticated as those in LM children(6). This, thus, revealed that the amount of information expressed in the

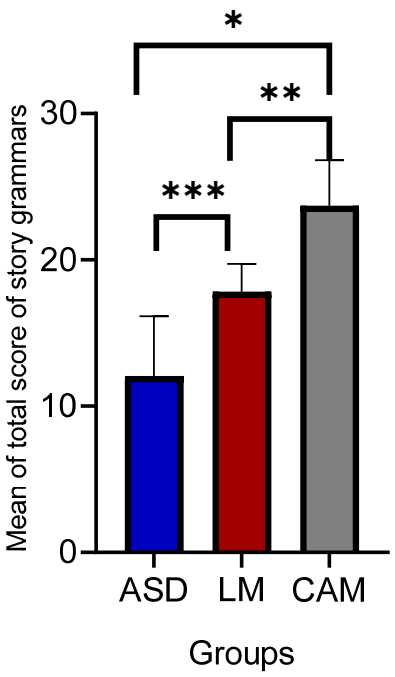

Figure 1. The total score of story grammars assessed using the Farsi narrative norms instrument (FNNI) compared between the three groups of children: ASD autism spectrum disorder (n = 16, M=12.06, SD=4.06), LM language-matched (n = 16, M=17.81, SD=1.9) and CAM chronological-age-matched (n = 16, M=23.68, SD=3.11). Panel: the bars represent the mean of the total score of the story grammars. *$P < 0.001$, **$P < 0.001$, ***$P < 0.001$.

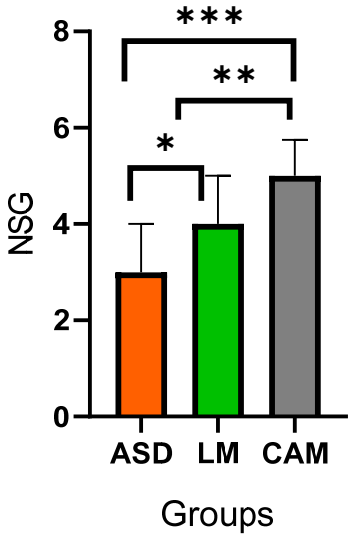

Figure 2. The number of story grammars assessed using the Farsi narrative norms instrument (FNNI) compared between the three groups of children: ASD autism spectrum disorder (n = 16, Median=3, Interquartile range=2), LM language-matched (n = 16, Median=5, Interquartile range=2, and CAM chronological-age-matched (n = 16, Median=4, Interquartile range=0.75). Panel: the bars represent the number of story grammars (NSG). *$P < 0.027$, **$P < 0.001$, ***$P < 0.001$.

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narrative of children with ASD was similar to that of the younger LM ones. Regarding syntactic complexity, the results showed that the ATL score was relatively similar in both groups, although the SI score was lower in children with ASD, as compared with the younger LM children. The similarities between these two groups in some components of the microstructure (NTW, NTC, T-unit, and ATL) could be attributed to the matching criteria used in this study, where children with ASD were matched according to their scores in TOLD-P: 3 with the TD peers. This shows that the language level can be an important influencing factor on the narrative microstructure components.

On the other hand, our findings showed that SI was the only component of microstructure that differed significantly in the two groups of children with ASD and their younger LM peers. This finding was consistent with some previous studies (4, 25, 29) showing that language skills alone cannot affect the development of SI in the narrative production of children with ASD. The findings of our study were, however, not consistent with the results of some studies that had shown a significant difference in the narrative microstructure (productivity and syntactic complexity) of children with ASD in comparison with their LM peers (24). One of the possible reasons for this discrepancy may be due to the matching criteria of the participants. King et al., for instance, used the mean length of utterance index in the analysis of narratives, which is not valid for children aged 11-14 years. Although children with ASD had significant differences in CELF IV standard scores in two groups of CAM and LM children, they used indicators such as sentence repetition task and BPVS II standard score to match children with ASD to those of the control groups (24).

At the level of macrostructure, our results showed that children with ASD obtained lower scores in NSG than both CAM and younger LM peers. Moreover, the total score of story grammar elements in children with ASD was lower than that in the other two control groups. These results were in line with the previous investigations (2, 4, 10, 12, 15, 21, 24), indicating that children with ASD used fewer story elements in their narration and their stories were less coherent than those of the TD groups. These results can be justified by the weak central coherence theory, which declares that instead of paying attention to integrated information in a holistic mental representation, children with ASD attend to details, which leads to problems in organizing information in the form of continuous and coherent narratives (30).

However, contrary to our findings, Geelhand et al. reported that participants with ASD matched for age, gender, and IQ, performed in a way similar to that of their TD peers, as there was no difference between the two groups in the total number of main story elements (16). One reason for such discrepancies could be the older ages (15-60 years) of the participants which might have caused them to acquire the necessary skills for narration. Another explanation could be the close matching criteria between the two groups, which could help participants with ASD to function as their TD peers did.

One of the limitations was the widespread coronavirus pandemic and nationwide closures during our research. In this research, 37 individuals were considered for each group. However, due to the implementation of sampling under the pandemic conditions, some participants refused to participate or continue to cooperate in the study. Therefore, due to the limited access to samples and the long evaluation process (2 to 3 sessions), 16 people (n=48) were selected for each group. This, thus, calls for further research with a larger sample size. Another possible limitation of this study is that we only used one story to examine the narrative production skills of children with ASD. Since using several narrative production tasks can help to better understand the narrative abilities of children with ASD, it is suggested to be considered in future studies.

Conclusion

Overall, the present study showed that narrative microstructure was delayed in ASD participants. At the macrostructure level, children with ASD used fewer story grammar elements in their narration, and their stories were less coherent in comparison to those for both CAM and younger LM groups. This showed that creating a coherent narrative could be more demanding for children with ASD and it might not be fully justified by their language skills. Setting and action were the most used elements in the story retelling of children with ASD.

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Ethical consideration

The current research was approved by the Ethical Committee of Iran University of Medical Sciences (Code no. IR.IUMS.REC.1398.615). All of the parents completed the consent form for the recruitment of their children in this research. Children who did not like to participate in testing were not included.

Conflict of Interests

The authors declare that they have no competing interests.

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Appendix A. The scoring method and description of each story element from set A3 based on Schneider scoring

Story grammars	Descriptions	Scoring
Character 1	Horse / Ass / male/ boy (or just an animal like a Horse) (Pronoun: unacceptable)	(0, 1)
Character 2	Elephant / woman / girl (or just some kind of animal like a Cow)/ (Pronoun: unacceptable)	(0, 1)
Setting	The Donkey and the Elephant were playing with a plane / The Horse made the plane / The Donkey was gone, the plane was bought / This Horse had brought a plane	(0, 1)
Initiating event	The Donkey flew the plane / He was not tall, he could not reach it, but the Horse took it/ He went to the Elephant / When he built the plane, the plane moved/ Then it flew	(0, ٢)
Internal response	"Can you give me one to play with?" said the Elephant/ The Elephant wanted it / He said I have to play / He wanted to catch	(0, 1)
Internal plan	He wanted to take the plane from him / "Let me throw it away," he said/ "Let me play," said the Elephant/ Then he wanted to throw it away	(0, 1)
Action	Then the Donkey gave him the plane / The Elephant took his plane from him / He flew the plane / Then they both threw it/ the Elephant took it from him / Then the Elephant threw it up	(0, 2)
Consequence	It got stuck in a tree / It went and stayed on top of the tree / The plane then went to the top of the tree / The plane went to the sky / Then suddenly the plane hit a tree / Then it broke	(0, 2)
Horse reaction	The horse was upset / Then this Horse got angry / He cried/ He said it's all your fault / Tell me why you dropped the plane / I did not throw it badly / You always do bad things	(0, 1)
Elephant reaction	The Elephant was upset/ The Elephant was sad / "I'm sorry I did that," he said/ "I'm sorry I forgot," he said/	(0, 1)
Both reactions or un-known	Suddenly they saw him, he was upset that it went into the tree / He went to say goodbye to him / He was not happy / He got angry/ (only as a replacement for character 1 or 2, which should not be more than two reactions in total)	(0, 1)
Character 3	Another Elephant / big Elephant / his mother / a girl	(0, 1)
Initiating event	Then he came and said, "It is there"/ Elephant's mom had come/ Elephant's mom came from around / "What happened?" she said/ He went to his mother	(0, 2)
Internal response	Elephant / Horse hopes the big Elephant (character 3) can help / The big Elephant (character 3) wants to help	(0, 1)

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Appendix A. Continued

Story grammars	Descriptions	Scoring
Internal plan	The Elephant goes and tells his mother, "come and bring it down"/ He showed his mother and said "it is here, above the tree"/ The Elephant went to his mother and said to her, "can you come here and get the plane Horse out of the tree?"/ "You have to leave something," says his mother/ (Unacceptable: Elephant tells character 3 (without specifying what he is saying)	(0, 1)
Action	She reaches up on her toes to bring it / He went and put up a ladder/ He went up / She pulled her truck / She died with her snout to bring it down	(0, 2)
Consequence	Elephant 's mom could not bring it / The Elephant was not tall enough to catch a plane/ Her truck was not long / Then it did not come / It remained in the tree	(0, 2)
Character 1	The Horse cried / He was upset too	(0, 1)
Character 2	The Elephant was upset	(0, 1)
Character 3	The Elephant's mother was upset/ Mom said "too high, I cannot bring it" / "Your plane crashed into a tree, I cannot do anything," she said	(0, 1)
Both reactions or un-known	They are crying / He was upset after he thought mom could not / They do not know what to do/ (only as a substitute for another character's reaction; there should not be more than three reactions in total)	(0, 1)
Character 4	Then he went to his father / He went forward / Elephant's father came	(0, 1)
Initiating event	Character 4 wants to help / He knows how to bring a plane / He says I will help you	(0, 2)
Internal response	Now I understand, I take the ladder and climb it / He wanted to hold it with his hand / Suddenly he said "it can be done with a stool"/ The Elephant went and called his father	(0, 1)
Action	His father brought a ladder and climbed it / The father came to climb the ladder, and bring it/ The man went up, picked it up / Then he took it and brought it to give to the Horse and the Elephant/ He took it for them / He took	(0, 2)
Consequence	He gave the plane to the Horse / Now the Horse took the plane / He took his plane from that man	(0, 2)
Character 1	The ass was also very happy / The Horse was happy / He played with the elephant	(0, 1)
Character 2	The Elephant was happy / The Elephant thanked	(0, 1)
Character 4	His father was also very happy / Elephant's father was happy	(0, 1)
Both reactions or un-known	They were very happy / They became happy, they went and played / They became friends / "Let him stay and play together," he said. He thanked his parents (Only code as a substitute for another character's reaction; there should be no more than three reactions in total)	(0, 1)
	Total score	40

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