



# The Effect of Narrative Intervention on Spoken Narrative and Reading Comprehension Abilities in Farsi-Speaking Children with Autism Spectrum Disorders: A Randomized Clinical Trial

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## Abstract

**Background:** Children with autism spectrum disorders (ASD) show prominent deficits in pragmatic aspects of language such as spoken narrative. Deficits in spoken narrative in school years lead to deficits in reading comprehension. Therefore, this randomized clinical trial research examined the influence of narrative intervention on spoken narrative and reading comprehension abilities in children with ASD.

**Methods:** In the current double-blind, randomized clinical trial study, 21 students with ASD from second to seventh grade participated in the study. Two intervention methods were provided three times a week and a total of 24 sessions of 45 minutes. The experimental group received the Supporting Knowledge in Language and Literacy (SKILL) program and the control group received Traditional Language Therapy (TLT). The score of macrostructures, microstructures, perspective-taking index, narrative complexity, Story knowledge index, and reading comprehension score were measured pre and post-intervention. ANCOVA was used for between- within-group comparisons analysis.

**Results:** The experimental group indicated significant improvement in macrostructure ( $P < 0.001$ ,  $\eta^2 = 0.614$ ), microstructure ( $P = 0.012$ ,  $\eta^2 = 0.303$ ), narrative complexity ( $P < 0.001$ ,  $\eta^2 = 0.585$ ), story knowledge index ( $P < 0.001$ ,  $\eta^2 = 0.574$ ) and perspective taking index ( $P < 0.001$ ,  $\eta^2 = 0.553$ ) compared to the control group. However, the difference between the two groups in reading comprehension skills was not significant in post-intervention ( $P = 0.457$ ,  $\eta^2 = 0.031$ ).

**Conclusion:** The results showed the efficacy of the three stages of the SKILL program compared to TLT in spoken narrative. Also, the results of the study showed that the SKILL program and TLT have the same effect on improving reading comprehension.

**Keywords:** Autism Spectrum Disorders, Narrative Intervention, Reading Comprehension, Language, Language Therapy

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## Introduction

Autism spectrum disorder (ASD) is a complex neurodevelopmental disorder characterized by unusual profiles of behavior, communication, and social interactions. Unusual behaviors consist of inflexibility in life routines, restricted patterns of interest, preoccupation with details and parts of

objects, and repetitive and stereotyped movement behaviors. Differences in communication and social interactions include abnormal play, unwillingness to develop communication with peers, difficulty maintaining conversation and use of stereotyped and repetitive language (1). Based

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### ↑What is “already known” in this topic:

- Students with ASD show deficits in spoken narrative and reading comprehension.
- The spoken narrative is improved by providing narrative interventions to these students.
- The effect of narrative intervention on reading comprehension is unknown in these children.

### →What this article adds:

- The current clinical trial study shows only the SKILL intervention improves the spoken narrative.
- Both SKILL and TLT have an effect on reading comprehension in Farsi-speaking students with ASD.

on the results of previous research, children with ASD have prominent difficulty in the pragmatic aspects of language (2), such as understanding and producing spoken narratives (3).

Narration is a type of discourse that is beyond the sentence level in which a person can tell imaginary stories or real experiences in a logical sequence and temporal order (4, 5). Spoken narrative has two structural levels in the linguistic dimension, including macrostructures and microstructures (6). The level of macrostructures contains story grammar elements (SGE) such as character, settings, initiating event, internal response, attempt, consequence and reaction (7). At this level, causal relationships between characters and story events (8), Perspective Taking Index (internal response + initiating event + attempt + plan + consequence) and Story Knowledge Index (mental/linguistic verbs + internal response + plan), are considered (9). Also, the level of microstructures contains linguistic verbs, mental verbs, adverbs, elaborated noun phrases, subordinating conjunctions and coordinating conjunctions (10). Previous studies have shown that competence in socialization and academic skills, especially reading comprehension, is correlated to the ability to produce coherent and cohesive narratives (11). Reading comprehension and spoken narrative both have a common foundation (12).

Based on the results of previous research, children with autism spectrum disorder (ASD), those who are known as high functioning, experience deficits in spoken narrative and, subsequently reading comprehension (3, 11). Due to the characteristics of ASD, deficits in comprehension and production of narrative and subsequently reading comprehension will not improve without appropriate intervention (11). Therefore, these defects expand well throughout the lives of these children (11).

Narratives created or retold by verbally fluent children with ASD, despite the similarities in the microstructures, show notable differences in the macrostructures (13, 14). Lack of coherence and appropriate causal connections between story elements in ASD children (13, 15) affects the reading comprehension skills of these children (16).

Most studies with the purpose of improving narrative proficiency in ASD children have been conducted in children with ASD at different ages (6 to 12 years) and with a variety of intensities (minimum 12 and maximum 33 sessions) (9, 11, 17-19). These single-subject design studies focus on spoken narrative and contain explicit instruction about linguistic complexity and SGE. Although these studies showed the efficiency of interventions on spoken narrative, the impact on literacy skills, especially reading comprehension, remains unexplored.

The Supporting Knowledge in Language and Literacy (SKILL) program is one of the narrative intervention methods (20) that was developed to promote narrative abilities in children with language and reading difficulties. This intervention method is rooted in psycholinguistics and discourse processing.

Unlike the deficits that children with ASD show in spoken narrative and reading comprehension, to date, the intervention studies that have been documented to improve these difficulties have used single-subject designs. While

these designs have benefits, but randomized clinical trial designs with a comparison group and more participants provide more external validity. Also, the intervention can be generalized to a wider population. In addition, the effect of narrative intervention on narrative proficiency has been investigated in past studies, but the effect of narrative intervention on reading comprehension has not been investigated. Therefore, we have conducted the present research to investigate the effect of narrative intervention based on SKILL on the spoken narrative and reading comprehension in elementary school children with ASD, which was compared with the control group that received the Traditional Language Therapy (TLT) program.

## Methods

### Trial Design

The present research was a clinical trial with an experimental condition and a control condition. It is registered in the Iranian Registry of Clinical Trials ([www.irct.ir](http://www.irct.ir), Registration ID in IRCT20190505043477N1). Parents of children signed a written informed consent form before randomization. Parents were informed about the purpose, procedure and conditions of research through this form. Also, they were aware of the non-compulsion to participate in the research, the safety and non-invasiveness of the research, the confidentiality of the information and the non-payment of fees.

Sampling coincided with the Covid-19 pandemic. Therefore, some changes were made in the sample size and the blinding method. The sample size was reduced from 30 to 24. The blinding method was changed from blind-trained assessors to blind-trained analysts.

### Participants

The sampling method in this study was consecutive sampling. After selecting the sample, random allocation has been done. Based on the sample size formula, it was supposed to 30 children selected for the study. Sampling coincided with the Covid-19 pandemic. The rehabilitation clinics were closed. Therefore children were selected based on advertising by posters on the channels and pages of social media such as WhatsApp, Telegram and Instagram. These channels and pages were related to clinics and rehabilitation centers that were closed during the COVID-19 pandemic.

One hundred and eight children with ASD who had received a diagnosis of autism by a psychiatrist based on the DSM-V criteria were assessed, but just 24 children met the inclusion criteria. Power was recalculated for a sample size of 24. Because the power was more than 80, this sample size was selected.

These children are aged 8 to 12 years (second to seventh grade). They were native and monolingual in Farsi and characterized as verbally fluent. Their non-verbal IQ was 70 and above. None of the participants had previously received the narrative intervention program. These children recognized the written words appropriately but they scored below the standard in reading comprehension. They did not have any hearing impairment, neurological difficulties and

other psychiatric disorders except ASD and attention deficit hyperactivity disorder (ADHD).

### Sample size

At first, the sample size calculation was performed for an independent sample t-test using G\*Power version 3.1.9.2 (Faul et al., 2009). Since we planned to incorporate the baseline score in the analysis using analysis of covariance (ANCOVA), we multiplied this number by a design factor of  $(1 - \rho^2)$ , where  $\rho$  is the correlation coefficient between the baseline and the post-intervention scores (Borm et al., 2007). With an effect size of 1 (Cohen's d) for macrostructure score, a power of 0.8, an alpha value of 0.05, and using  $r=0.6$  to account for the correlation between baseline and post-intervention scores, 11 children would be necessary in each group. Assuming a potential drop-out rate of 10%, 12 children were needed in each group.

### Procedure

The first author conducted the evaluation and intervention for all participants. The intervention sessions were conducted for both experimental and control groups in the developmental language lab of the rehabilitation faculty of Tehran University of Medical Sciences. The participants were referred to the developmental language lab located in the speech therapy clinic and received interventions. In the first meeting, the parents of children with ASD were interviewed, and the personal information form prepared for this purpose was completed. After confirming the eligibility, the code of the subject was assigned to them and pre-intervention evaluations were done.

In this study, the subjects' ability to produce narratives was evaluated by the Farsi version of the Language Sample Analysis Test (LAS) (21). Also, the reading and dyslexia test (22) was used to evaluate reading comprehension ability. All children's narrative samples and the answers to the questions were recorded by a SAMSUNG YP-U3ZB Digital voice recorder made in South Korea. The evaluation was done twice - before and after the intervention. Then, the sample of the collected voices was provided to the trained and blinded analyst. In order to analyze study variables, Narrative samples were transcribed, and answers to reading comprehension questions were recorded on the sheet. Finally, the data was entered into SPSS software for further analysis.

### Measurement instruments

**Language Sample Analysis Test:** Language Sample Analysis Test (LAS) is a reliable tool for extracting language samples for Farsi-speaking children. This test includes two sets of picture stories to extract language samples. The stories of this test are designed and written based on the Stein and Glenn story grammar model (1979), in which there are problems in the story that the main characters try to solve. The stories of the two collections correspond to each other two by two. Its content validity and reliability were 92.28% and 97.1%, respectively (21).

A three-episode story (A3) was used to collect narrative samples in the current study. This story consisted of 14 wordless pictures and various adventures. The present

study used set (A) in the pre-intervention evaluation and set (B) in the post-intervention evaluation (21).

**Reading and dyslexia test:** This standardized test was designed by Kormi Nouri et al. (2012) to evaluate the reading skills of Farsi-speaking students in elementary school. The content validity and reliability of this test are 0.86 and 0.98, respectively (22).

In the present study, reading comprehension was evaluated by the text comprehension subtest. The text comprehension subtest in reading and dyslexia test includes two subtests. There is a common text for all grades and two specific texts (a) and (b) for each grade. To evaluate reading comprehension in pre-intervention, the special text (a) and post-intervention, the special text (b) was used (22).

### Interventions

The intervention was provided in a quiet, noise-free room. Two intervention methods consisted of 3 sessions per week for 2 months. Each session was 45 minutes. The interventions have been introduced below (Table 1).

#### TLT

The TLT was taken from the reference for language interventions (23). The targets of this program were to teach prepositions, conjunctions, elaborate noun phrases, increase vocabulary, sentence imitation, complete sentences, phrasing, increase semantic skills, answers to questions, and auditory comprehension.

#### SKILL

The SKILL intervention program was designed by Gillam et al. for English-speaking children. The electronic version of the SKILL program was received through email with the permission of Dr. Gillam as the developer of it. This program was revised according to the culture and structures of the Farsi language. Changes in linguistic structures were confirmed by a linguist. Finally, the changes made in the SKILL program were approved by the developer of it.

The SKILL intervention schedule was designed in three treatment stages: Stages 1: Training SGE and Causal Language (17 lessons); Stages 2: Training Stratagems for Creating a Situation Model (11 lessons); Stages 3: Training Stratagems for Assimilation into Long Term Memory (8 lessons).

### Outcome Measures

A trained speech and language pathologist who was blind transcribed children's stories. Communication Units (CU) were considered to segment the stories. The first author checked each transcript. Disagreements were resolved by listening for the third time by two transcribers. Coding and analysis of macrostructures and microstructures in stories based on the Monitoring Indicators of Scholarly Language (MISL) indicators were done by a blind research assistant. The narrative complexity (macrostructures + microstructures), Story knowledge Index (internal response + initiating event + attempt + plan + consequence), and Perspective Taking Index (mental/linguistic verbs + internal response +

Table 1. Lesson plans for sessions

Sessions	Supporting Knowledge in Language and Literacy (SKILL)	Traditional Language Therapy (TLT)
1	- General introduction of story elements - Character, Setting	- Teaching prepositions - with, from
2	- initiating event, internal response	- Practice and consolidate the preposition - with, from - Teaching the preposition - to, for
3	- Plan, attempt	- Practice and consolidate the preposition - with, from, to, for - Teaching the preposition - at, above
4	- consequence, reaction	- Practice and consolidate the preposition - with, from, to, for, at, above - Teaching the preposition - under, on
5	- Retelling Story Created During the previous sessions	- Practice and consolidate the preposition - with, from, to, for, at, above, under, on
6	- Review the lessons of the previous session - Story Element Identification in Re-telling	- Teaching conjunctions - because, if
7	- Parallel Story Retelling With and Without Visual Support	- Practicing and consolidating the conjunction - because, if - Teaching the conjunction - and, then
8	- literature-based activity	- Practicing and consolidating the conjunction - because, if, and, then - Teaching the conjunction- until, or, that
9	- literature-based activity - Before/After	- Practicing and consolidating the conjunction - because, if, and, then - Teaching the conjunction- and
10	- Comprehension Extension Activity	- Practicing and consolidating the conjunction - because, if, and, then, until, or, that, and - Teaching Elaborated noun phrases
11	- Introduction to Elaboration	- Practicing Elaborated noun phrases - Creating complex and compound sentences
12	- Comparison of Simple and Elaborated Stories - Elaborating on Character - Dialogue	- Practicing Elaborated noun phrases and creating complex and compound sentences - Teaching describes the sequential pictures with emphasis on complex and compound sentences and answering questions about pictures - story 1 and 2
13	- Using Plan, Action, Complication, Sequences (PACS) - Parallel Story Development Parallel Story Retelling With and Without Visual Supports	- Teaching describes the sequential pictures with emphasis on complex and compound sentences and answering questions about pictures - story 3 and 4
14	- Elaborating on Actions (Adverbs) in the Wordless Picture Book and Single Scenes - Elaborating on Setting - Elaborating on Feelings	- Teaching describes the sequential pictures with emphasis on complex and compound sentences and answering questions in telling sequential pictures - story 5 and 6
15	- Vertical Structuring Using Feeling Words - literature-based activity	- Teaching vocabulary in story 1
16	- literature-based activity	- Emphasizing complex and compound sentences and Elaborated noun phrases in story 1 - Teaching vocabulary in story 2
17	- Elaborated Noun Phrases - Comprehension Extension Unit	- Emphasizing complex and compound sentences and Elaborated noun phrases in story 2 - Teaching vocabulary in story 3
18	- literature-based activity	- Emphasizing complex and compound sentences and Elaborated noun phrases in story 2 - Teaching vocabulary in story 3
19	- If/Then - Use the Self-scoring	- Teaching vocabulary in story 3
20	- Use the Self-scoring Storyboard to Check for Elaboration in Stories	- Emphasizing complex and compound sentences and Elaborated noun phrases in story 3 - Teaching vocabulary in story 4
21	- Use the Self-scoring Storyboard to Check for Elaboration in Stories	- Teaching vocabulary in story 4
22	- Co-creating and Editing Stories Developed Using Sequenced Pictures - Retelling Stories Created During the previous session	- Emphasizing complex and compound sentences and Elaborated noun phrases in story 4 - Teaching vocabulary in story 5
23	- Co-creating and Editing Stories Developed Using Single-scene Prompts - Retelling Stories Created During the previous session	- Emphasizing complex and compound sentences and Elaborated noun phrases in story 5
Session 24	- Comprehension Extension Unit	- Reviewing complex and compound sentences and Elaborated noun phrases in story 5 - Retelling and answering the questions - story 5

plan) were measured by the MISL rubric (24). To determine the reading comprehension scores, the total scores of recorded comprehension questions were calculated by the blind research assistant.

### Randomization

Twenty-four children with the inclusion criteria were assigned to two intervention and control groups using random blocks. Blocks of size four were used for randomization.

According to the sample size of 24 that was determined, 6 blocks of four were produced using the online site ([www.sealedenvelope.com](http://www.sealedenvelope.com)). Therefore, twelve participants were randomly assigned to group 1 and received the SKILL program. Twelve participants were assigned in group 2 and received the TLT program.

Out of 24 participants, three subjects were excluded from the study. Two subjects were excluded from the study due to being infected with COVID-19 extending the recovery process. One of the two subjects was in the experimental group and was excluded after the 16th session. Also the other was in the control group and was excluded after the 13th session. One subject was dropped from the study after the seventh session due to the unwillingness of the family to receive the continuation of the intervention. This subject was in the experimental group.

### Blinding

Extraction and analysis of data were done by an analyzer that was blinded to the grouping of children, their demographic characteristics, the time period of the research and the type of intervention received by each child.

The participants and their parents were unaware of the composition of the groups and did not meet each other during the assessment and intervention sessions.

### Data Analysis

An ANCOVA with baseline score as a covariate was performed to investigate differences between the SKILL and traditional groups after intervention. The effect size was

presented in partial eta squared ( $\eta^2$ );  $\eta^2$  values of 0.01-0.06, 0.06-0.14, and  $>0.14$  were considered as small, medium, and large effect sizes, respectively (25). Data analysis was carried out with SPSS for Windows, version 16.0. The level of significance was set at 0.05.

### Results

The flow of children with ASD through the trial is in [Figure 1](#). A total of 108 children with ASD were screened, and 24 children underwent randomization. The first child was recruited in November 2019 and the last in May 2022. Of these, follow-up data were available for all children to be included in the intention-to-treat analysis ([Figure 1](#)).

[Table 2](#) shows the demographic and clinical characteristics of the children with ASD. The mean age of the children was 10.08 (SD = 1.68) years, and 90.5% were male. The mean of IQ was 123.0 (SD = 17.3) and the mean of GARS was 84.4 (SD = 11.7). Demographics and clinical characteristics were well balanced between traditional and SKILL groups ([Table 1](#)).

[Table 3](#) shows the between-group comparison of spoken narrative and reading comprehension for the group receiving the SKILL and TLT. After adjusting for baseline scores, children in the SKILL group scored, on average, 7.31 (95% CI: 4.44 to 10.18) points higher on the macrostructures score than children in the TLT group at the post-intervention measurement ( $F_{(1,18)} = 28.63$ ,  $P < 0.001$ ,  $\eta^2_p = 0.614$ ). The effect size, calculated using partial eta squared, was 0.614, which is considered to be large. The same results were obtained for microstructures scores ( $P = 0.012$ ,  $\eta^2 =$

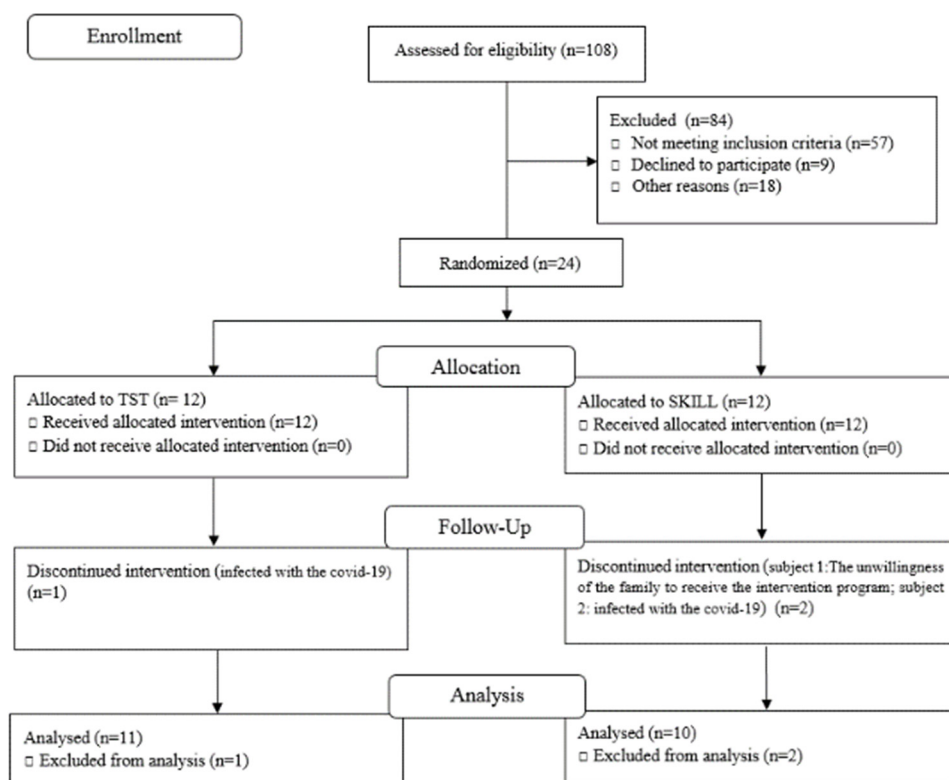


Figure 1. The CONSORT flow diagram of study participants

Table 2. Baseline characteristics of study participants

variable	Total (n=21)	Group	
		TLT (n=11)	SKILL (n=10)
Age (years), mean (SD)	10.08 (1.68)	10.22 (1.89)	9.92 (1.50)
Gender, n (%)			
Male	19 (90.5)	11 (100)	8 (80.0)
Female	2 (9.5)	0 (0)	2 (20.0)
Grade School	3.57 (1.40)	3.45 (1.57)	3.70 (1.25)
Normal	19 (90.5)	9 (81.8)	10 (100)
Special	2 (9.5)	2 (18.2)	0 (0)
IQ, mean (SD)	123.0 (17.3)	120.2 (20.4)	126.1 (13.7)
GARS, mean (SD)	84.4 (11.7)	87.6 (14.7)	80.9 (6.2)
GARS, n (%)			
High probability	11 (52.4)	8 (72.7)	3 (30.0)
Average probability	10 (47.6)	3 (27.3)	7 (70.0)

Note. SD: Standard Deviation; IQ: Intelligence quotient; GARS: Gilliam autism rating scale; SKILL: Supporting Knowledge in Language and literacy; TLT: Traditional Language Therapy

Table 3. Results of ANCOVA examining group effect on post-intervention scores of the Narrative spoken and reading comprehension

Scale	TLT (n=11)	SKILL (n=10)	Adjusted mean difference (95% CI) <sup>a</sup>	F <sub>(1,18)</sub>	P	η <sup>2</sup>
Macrostructure						
Pretest	8.00 (4.92)	6.20 (4.29)				
Posttest	8.55 (5.16)	14.70 (2.79)	7.31 (4.44 to 10.18)	28.63	<0.001	0.614
Microstructure						
Pretest	5.55 (3.64)	6.00 (4.50)				
Posttest	6.27 (3.80)	9.80 (2.94)	3.28 (0.81 to 5.75)	7.81	0.012	0.303
NC						
Pretest	13.55 (8.01)	13.10 (6.94)				
Posttest	15.00 (8.04)	24.50 (5.44)	9.82 (5.73 to 13.91)	25.39	<0.001	0.585
SKI						
Pretest	6.55 (4.54)	4.80 (4.08)				
Posttest	6.91 (4.91)	11.70 (2.54)	5.98 (3.43 to 8.53)	24.20	<0.001	0.574
PTI						
Pretest	4.36 (3.35)	3.80 (2.35)				
Posttest	3.73 (2.45)	7.40 (1.83)	3.90 (2.16 to 5.64)	22.27	<0.001	0.553
RC						
Pretest	4.55 (2.16)	5.30 (1.95)				
Posttest	7.91 (2.55)	9.10 (2.60)	0.83 (-1.45 to 3.10)	0.58	0.457	0.031

Note. CI: Confidence Interval; SKILL: Supporting Knowledge in Language and Literacy; TLT: Traditional Language Therapy; NC: narrative complexity; SKI: Story Knowledge Index; PTI: Perspective Taking Index; RC: reading comprehension  
Data are mean (SD), unless otherwise specified.

<sup>a</sup>Adjusted for pretest scores.

η<sup>2</sup><sub>p</sub> values of 0.01-0.06, 0.06-0.14, and >0.14 were considered as small, medium, and large effect size, respectively.

0.303), Narrative Complexity scores ( $P < 0.001$ ,  $\eta^2=0.585$ ), Story Knowledge Index ( $P < 0.001$ ,  $\eta^2 = 0.574$ ), and Perspective Taking Index ( $P < 0.001$ ,  $\eta^2 = 0.553$ ). However, at the post-intervention measurement, there was no statistically significant difference in reading comprehension scores between the TLT and SKILL groups ( $P = 0.457$ ,  $\eta^2 = 0.031$ ).

## Discussion

The purpose of the current research was to examine the effect of the SKILL schedule compared to TLT on the ability to produce spoken narrative and reading comprehension in Farsi-speaking children with ASD. SKILL program is designed based on language and cognitive skills that are the basis of spoken narrative. In addition to teaching the story grammar elements, this intervention program devotes much time to teaching microstructural features such as using complex syntax, learning vocabulary, causal and temporal relationships, story cohesion and clarity. Also, the SKILL program focuses on teaching the metacognitive skills needed to internalize narrative understanding and generalize it to literacy instruction. In contrast, the TLT program

focuses on teaching language aspects such as syntax, semantics, and vocabulary. Unlike the SKILL program, this program does not address the cognitive and social aspects that underlie narrative. Also, there are no lessons that teach the macrostructures and story grammar elements that are necessary for coherence in the story. It was assumed that the SKILL program interventions would help increase the Narrative Complexity, Story Knowledge Index, mental states and causal language, as well as participants' reading comprehension.

The current study demonstrated that the SKILL program improves the narrative components compared to TLT, and it supports the effectiveness of the SKILL program on the Narrative Complexity, increasing the score of the macrostructures and microstructures, Perspective Taking Index, and Story Knowledge Index.

Also, the study results indicate a large effect size for each of these indicators. These findings are in accordance with the research of Gillam et al. (9). This finding is due to the nature of the SKILL program, which focuses on creating coherence by training SGE and causal structures, as well as creating cohesion by listening to specific linguistic structures. This focus has increased the score of macrostructures

and microstructures. Increasing the score of both components has led to an improvement in the complexity of narrative or storytelling, as well as the Perspective Taking Index and Story Knowledge Index. The three stages that were designed in the SKILL program provided an opportunity to gradually increase the Narrative Complexity and its indicators. In stage 1, Children were taught SEG and causal connections, and they were given opportunities to practice creating coherent and cohesive stories. During stage 2, the child was introduced to special linguistic structures, essential concepts and vocabulary, and how to elaborate stories and also, there are lessons that are specifically focused on teaching mental state, linguistic verbs, and causal connections. The development of metacognitive skills happens in stage 3. It was targeted in order to review the stories. Children were given more responsibility for the integration of the story's macrostructure and microstructure elements during stages 2 and 3, which was accompanied by an obvious emphasis on the causal relations among happens of the story and the characters' reaction to the happens. While in the current study, most TLT tasks were not directly related to narrative. It was just focused on linguistic structure such as improving syntax, semantics, and vocabulary. Therefore, the specific tasks used in the SKILL program to teach narrative structures can explain the observed difference between two groups. In the current research, the improvement obtained in the Perspective Taking Index is consistent with the study of Peristeri et al., Gillam et al., Tsunemi et al. and Dodd et al.. Previous studies showed that mental state verbs are not used in the narratives of children with ASD and these children have difficulties in telling the story from the point of view of various characters (9, 17, 26, 27). Understanding and producing a narrative requires understanding the mental state, feelings, goals, and intentions of the characters (11, 26, 28). For comprehension and production of the narratives, it is required to consider a character's perspective and mentally represent of the character's emotional state. Repeated exposure to narrative increases the ability to take a social perspective in children with ASD (27). In the SKILL program, the child receives numerous versions of the narrative in each stage. Moreover, in stage 2 of the SKILL program, there are lessons that help develop Perspective Taking in children.

The results post-intervention revealed that reading comprehension scores increased in both groups receiving the intervention program compared to pre-intervention, but the differences were not statistically significant between the two groups. These results are consistent with the study of Gillam et al. and Capin et al. (12, 20). Reading comprehension is related to language areas such as syntax, semantics, and vocabulary (12). Both types of intervention have improved language skills such as lexical, syntactic and semantic knowledge in children. In addition, much of the instruction offered in the SKILL program is related to the teaching of story grammatical elements and causal relationships that are associated with reading comprehension and also cover language areas. Also, it seems that increasing in reading comprehension scores in the TLT group was due to the increase in listening comprehension and various aspects of

language abilities. Hence, improvement in reading comprehension skills is expected in both groups. According to the effect size of 0.03, which is equivalent to a small effect size, it can be supposed that none of the interventions are higher than other interventions in improving reading comprehension skills.

Based on the results of the present study, the SKILL intervention program improves the quality and complexity of spoken narrative in children with ASD. Therefore, speech and language pathologists can use this program to improve storytelling in children with ASD. In addition, considering the effectiveness of both intervention approaches on reading comprehension skills, speech and language pathologists can use both approaches to improve reading comprehension. Considering that the SKILL program is effective in both spoken narrative and reading comprehension, it is better to use the SKILL intervention program.

### *Clinical Implications*

Based on the results of the present study, the SKILL intervention program improves the quality and complexity of spoken narrative in children with ASD. Therefore, speech and language pathologists can use this program to improve comprehension and production of narratives in children with ASD. In addition, considering the effect of both intervention approaches on reading comprehension skills, speech and language pathologists can use both approaches to improve reading comprehension. Considering that the SKILL program is effective in both spoken narrative and reading comprehension, it is better to use the SKILL intervention program.

### *Limitations and Future Research*

It is necessary to pay attention to some limitations in this research. First, although the design of this research was a randomized controlled trial and we found significance, the small sample size may restrict the generalization of the results. Second, due to the time limitation, it was not possible to check the intervention maintenance. Future studies should investigate the maintenance of the treatment. Third, due to the time limitation and the time-consuming nature of the intervention, we could not investigate the effect of the narrative intervention on other discourse contexts such as conversational speech. It is suggested to be considered in future studies. Fourth, it is suggested to compare the effectiveness of the SKILL program with other narrative intervention programs such as narrative-based language intervention in future studies.

### *Conclusion*

These results revealed the SKILL program could be an effective intervention approach to improve the complexity and adequacy of spoken narrative in children with ASD. The positive effects obtained in the story complexity reflect improvement in both the knowledge of the story structure and the mental state and the causal language. Children with ASD who participated in the study showed great benefits in a short period of time. A potential reason is related to the

lessons that were used in the three phases of the intervention program. In addition, the visual support that this approach provides can compensate for the weakness in the verbal memory of children with ASD and play an important role in ensuring children's success in teaching spoken narrative. Also, this intervention can improve the skills of organization, coherence and cohesion of narrative. Students need these skills throughout their academic careers to achieve success in reading.

Although the TLT program, compared to the SKILL program, did not improve the storytelling skills of children, it seems to be a suitable approach to increasing language skills in children. The increase in reading comprehension scores in a short period of time seems to confirm the increase in language skills. This intervention program includes tasks to improve the aspects of syntax, semantics and vocabulary that are related to reading comprehension.

### Authors' Contributions

EM: study design, Material preparation, acquisition of data, interpretation of the results, Writing-original draft; ZS: Supervisor, study design, interpretation of the results, review and editing; YM: participation in revising the SKILL program according to the culture and structures of the Farsi language; SM: statistical analysis; FM: She was the blinded analyst who data extraction from voice samples. All authors read and approved the final manuscript.

### Ethical Considerations

The present study received approval from the ethics committee of Tehran University of Medical Sciences in Iran (IR.TUMS.FNM.REC.1398.087).

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### Conflict of Interests

The authors declare that they have no competing interests.

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