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# The use of Arabic Language Sample Analysis as a screening tool in kindergarten Egyptian bilingual children

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## Abstract

**Background** Language sample analysis is a naturalistic method used for measuring child's expressive language abilities. It is used in case of difficulty in direct interaction in remote places or pandemics.

**Aim of the work** The aim of this study is to evaluate the use of a language sample analysis as an easy applicable screening tool for narrative ability in kindergarten Egyptian bilingual children in order to reach a better understanding of their language profile. Subjects and methods: 150 bilingual Egyptian preschool male and female children exposed to Arabic and English languages were included and divided into two groups according to their age. All were subjected to the BEA-LSA narration assessment including macrostructure, microstructure items, and conversation assessment including verbal and nonverbal items.

**Results** The results revealed that bilingual children showed better performance in English than Arabic in most of the narration and conversation tasks. However, there was equal development between both age groups in English language regarding temporality, connectives, and reference clarity. The older age group showed higher code switching than younger age group and code switching occurred more from Arabic to English language. Both age groups bilingual children showed better frequency of words and mean length of utterance in narration. While in conversation, both age groups showed better type token ratio. Language sample analysis showed good test-retest reliability.

**Conclusion** Language sample analysis could identify the characteristic profile of bilingual kindergarten Egyptian children and was a reliable method to analyze both narration and conversation skills of bilingual children.

**Keywords** Bilingualism, Bilingual English Arabic Language Sample Analysis, Narration, Conversation

## Background

Bilingualism could be defined as a person who can understand or use more than one language [1]. The percentage of bilingualism has reached in Europe to 67%, in Canada to 55%, in India to 25% and in the USA to 20% in 2017 [2]. There are limited researches to determine the statistical data of bilingualism in Arabic countries and

Egypt. However, a research was done by Gration [3] and revealed that 24 million adult people in the United Arab Emirates population are considered bilingual, which is approximately 36% of adult population.

Bilingual children may show differences in narrative and communication production in each of their two languages compared to their monolingual peers [4]. This can lead unfortunately to misdiagnose bilingual children with a language disorder. Therefore, while assessing bilingual children, a lot of considerable questions should be asked including the differentiation between a language difference or an actual language disorder [5]. A language difference is illustrated by differences in sentence structure,

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speech sound production, vocabulary, and the pragmatic uses of language that are to be expected when a child learns a new language. While a true language disorder is evident in every language the child speaks and is defined as deficits in understanding others or sharing thoughts, ideas, and feelings completely [5].

Assessing bilingual children can take several ways. The most recent new technique is using language sample analysis. It has been grown substantially in recent years in order to provide guidance for clinicians seeking to utilize this tool with bilingual children in a remote way [6]. Language sample analysis (LSA) has many properties that make it an effective tool as it captures a child's language use in naturalistic settings that mirror the communication demands of everyday social situations [7].

Moreover, language samples can be analyzed in depth and with descriptive detail, and phoneticians can repeatedly collect language samples to monitor progress over time [8]. It provides rich descriptive data about syntactic, semantic, morphology, fluency, narrative skills, and the evaluation of the child's conversational skills. A variety of methods has been employed to collect language samples, including encouraging the child to play with toys in free-play interactions, through conversation or retelling stories. Each method has its own advantage and disadvantage [9, 10]. It also can be used within a dynamic assessment protocol to assist with the accurate identification of children with language impairments [11].

The difficulties and limitations of direct testing of children by using standardized language tests in the era of pandemic crisis raised the utmost interest to study the reliability and validity of language sample analysis. Structured language sample could be used as a method that helps screening some of the language skills in bilingual children by the help of their parents at a home setting assessment. This could help definite diagnosis and differentiation between language difference and delay and also may allow future planning for the appropriate intervention in delayed children. The aim of this study is to evaluate the use of a language sample analysis tool as an easy applicable screening tool for narrative ability in kindergarten (KG) Egyptian bilingual children in order to reach a better understanding of the language profile in these children.

## Methods

### Study population

This study was conducted on 150 bilingual Egyptian preschool male and female children exposed to both Arabic and English languages. Their age ranged from 4 to 4 years, 11 months. Participants of this study were divided into two groups according to their age: Group A included 75 children with age range from 4 years to

less than 4 years, 6 months old and Group B included 75 children with age range from 4 years, 6 months to 4 years, 11 months old. The children were selected from the children in English private international schools. The two groups were gender and socio-economic standard matched. This study was conducted in the period from December 2020 to July 2023. The study was approved by the ethical committee of Cairo university medical school under reference number 160–2021.

Inclusion criteria for the study group were the following; children recruited from international English schools with regular attendance, children enrolled in KG1 and KG2 and aged between 4 and 4 years, 11 months old. English (second language (L2) as the language of instruction at school while Arabic and English as the languages of use at home, an average of 5 h daily exposure to second language at school or at nursery with exposure to primary language only in Arabic classes, children of normal Arabic language development and without any apparent features that may cause delayed language development and bilingual parents with good English language proficiency and Arabic as their native.

### Methodology in details

Approval was obtained from the administration of three of private English international schools in greater Cairo area to apply the test on their KG students. The first contact with the parents was through an announcement from the preschool teachers or preschool parents' groups on What's App and close friends about the idea of the test. The interested parents were contacted by the assessor for more clarification of the idea. The parents were asked some questions in a short online zoom interview or through a phone call. These questions included if the child was traveling abroad and exposed to different culture/language in his/her first 3 years of life. It also included inquiring about the main language used at home, nursery and school, the main language of exposure through the external entertainment, the preferred language used by the child to express his needs, and the time of exposure to second language at home or nursery. This interview was important to It also can be used within exclude any child with unsuitable criteria for this study and to collect data about the surrounding language acquisition circumstances. The short interview was carried out on a total number of 168 parents. Eighteen children were excluded as they were not fulfilling the inclusion criteria of the study such as being delayed language or not within the same age range.

After selecting the suitable children for the study, approvals from the parents were obtained by written consent which was sent through What's App, Telegram, Facebook Messenger, or Email before starting the study,

filled in by the parents and resent back. The materials of the test were sent in a PDF format written in Arabic and English and audio recorded instructions to guide the parents in applying the test. These were sent through the previously mentioned social connecting applications. The included instructions were as follows;

For setting: The assessment room should be quiet and of good lightening. For recording: The parents should set a good-quality camera before starting the test in a steady place showing the child clearly from the front view. The recording should be of a good voice quality. Short recorded videos of average of 10 min to facilitate easy sending to the assessor. Guide for the parents: Parents should grasp their children full attention by making the assessment enjoyable as possible. They should use a loud and clear voice with normal speech rate. They should instruct their children to respond in the same language used avoiding mixing between the two languages as possible. The test should be applied first in the mother tongue (Arabic) then in English language. Parents should avoid interfering with the child's response through repairing or rephrasing of what the children said especially during retelling in narration or conversation test.

All the recordings were evaluated once they were sent to the assessor. Seven recordings were excluded as the parents did not follow the required instructions either by the presence of distraction, parent's interfering with the child's response, the child was inattentive or unclear recording with bad voice quality. Therefore, the assessor asked these parents to reassess the children again putting into consideration following the required instructions precisely. Three out of the seven resent recordings were discarded due to the inability to meet the requirements of testing.

A pilot study was done on 10 bilingual Egyptian children to test the applicability of the test. After observing and analyzing their videotape recordings, there were two questions that needed to be modified in the conversation test to make them more clear for the children and to help inducing more lengthy responses from the children. The time of administration of the test was calculated and was found to be on average of 25 to 30 min for each sitting, a sitting for each language, divided into two to three recordings. The average time of applying the narration section was between 20 and 25 min for each language while the average time of applying the conversation section was between 3 and 5 min in each language.

The used Bilingual English Arabic Language Sample Analysis (BEA-LSA) testing tool consists of (1) The Bilingual English Arabic Test (BEAT) narration Sect. (2) The designed conversation section of (BEA-LSA).

## **The BEAT narration section [12]**

### **Story 1: The doll**

The elicitation method of testing was through story retelling method. This story was designed in the form pictorial organized story and sent through social communication applications or platforms. The story was wordless and contained 20 events that were first narrated by one of the parents guided by a script written in a separate booklet. The children were asked first to look at the pictures and listen carefully to the story told by the parents. Then, the children were asked to retell the story. The story was told in both languages. The children's responses were videotaped. Then resent by the parents to the assessor to analyze the child's response using the assessment protocol at both the macrostructure and microstructure levels (Additional file 1). Safwat et al.'s [13] protocol of assessment was used and included the macrostructure level items related to story frame features and narrative productivity; total number of words (TNW), Mean Length of Utterance (MLU), type token ratio (TTR); and code switch (as a specific feature of bilinguals). While the microstructure level included; language structure (descriptive words, temporality, connectives, and reference clarity), sentence structure (compound sentence), phrase structure (adjective, adverb, negation, and interrogative phrase), noun form (regular and irregular plurals, possession, colors, and conjoined noun phrase), and verb form (present tense, past tense, future tense and auxiliary verb (in English only).

### **Story 2: The boy and his grandpa**

The story was designed to test the ability of the child to repeat sentence and to measure the bilingual language mixing (code switch). The story was wordless and had 10 colored pictures, one in each page. All the events were narrated by one of the parents guided by a written script in a separate booklet. The children were asked to repeat the sentences that were said by the boy in a loud voice to help his grandpa with hearing difficulty to hear it clearly. The story consists of 20 events. The children were asked to repeat four sentences out of five as the first one was used as trial and the other four were the target sentences that the bilingual children were asked to repeat. The number of words in each of the four sentences ranged between 6 and 10 words. The parents sent the video recording to the assessor and the assessor analyzed the findings and calculate the scores (Additional file 1). Afterward, the total narration was calculated by summation of the scores of first and second stories in each language separately.

### The second section of BEA-LSA; Conversation section

Conversation skills of children were assessed in details by analyzing the responses of each bilingual child by selecting an interesting topic to the children to talk about. As 3 pictorial imaginary characters drawn specifically by a professional artist were shown to the children. Each child was asked to choose one of the characters and to respond in a conversation with the parents about it using both Arabic and English languages; one language at a time in response to organized structured questions. The guiding questions used in the conversation included description of the features of the selected character; shape, size, color, and clothes of the character and the reason beyond his/her choice.

The parents were instructed to use a unified set of questions in a semi-structured setting that help in guiding the interaction with the children and help eliciting the children's response. The children's conversation recording was analyzed by the assessor at two aspects; the verbal and the nonverbal conversational skills. The verbal aspect included; productivity, code switch, errors, and repairs. The errors were considered as a language breakdown that was counted in conversation. They were classified into either Receptive errors or Expressive errors. Receptive errors indicated errors in understanding the parents' words. Receptive errors were given a score on a scale of 2, 1, 0 according to the presence of this error. A score of two was given when the child understood parents' words in same language, one was given when the child did not understand parents' words with the same language but understood their expressions in the other language and zero if the child did not understand parents' words with same or different language. While Expressive errors included two types: semantic errors and syntax errors. On the other hand, repair of these errors could be seen in four forms self-initiated/self-repair, other-initiated/self-repair, and other-initiated/other-repair.

The nonverbal aspect of the assessment depends mainly on observation of the child and the way of his/her interaction with his/her parent. This defines his/her conversational skills development. The assessor analyzes the findings and writes down remarks of interaction between the child and his parents guided by the following 10 items including the child listens carefully to his/her parent all through the conversation, maintains a good eye contact with his/her parent, can stay on the same topic, uses appropriate voice volume, is able to interact by asking questions, is able to interact by making comments, can preserve the turn-taking with his/her parent, demonstrates appropriate personal space, shows interest in the task and topic, and is able to end the conversation appropriately.

Reassessment was done for children 3 weeks apart from testing for the first time for the purpose of reliability study.

### Data management and statistical analysis

Data were fed to the computer and analyzed using IBM SPSS software package version 20.0. (Armonk, NY: IBM Corp) Qualitative data were described using number and percent. The Shapiro–Wilk test was used to verify the normality of distribution. Quantitative data were described using range (minimum and maximum), mean, standard deviation, median, and interquartile range (IQR). Significance of the obtained results was judged at the 5% level.

The used tests were as follows: paired *t*-test for normally distributed quantitative variables, to compare between two periods and Wilcoxon signed ranks test for abnormally distributed quantitative variables, to compare between two periods.

## Results

### Demographic data

This study was conducted on 150 Egyptian bilingual children including 61 males (40.6%) and 89 females (59.3%). The younger age group (A) contains 32 males (42.2%) and 43 females (57.3%); while the older age group (B) contains 29 males (38.6%) and 46 females (61.3%); the sample was gender matched (with non-significant *P* value of 0.45 between the two age groups). Seventy-five children aged from 4:0 to <4:50 with percentage of 50% and seventy-five children aged from 4:50 to 4:11 years with percentage of 50%. The mean age was 4.45 years  $\pm$  0.31SD.

### Narration test results

The comparison between the scores of Arabic and English narration tests in the first story for the whole age groups showed higher performance with significant difference in English than Arabic in all the scores of macro- and microstructure items of the narration test and all the items of narrative productivity except for the score of code switching from Arabic to English and the score of the total narrative productivity in which the bilingual children showed higher performance in Arabic than English language as demonstrated in Table 1 and Figs. 1 and 2.

The comparison between the two age groups regarding the scores of the first story of Arabic narration test showed higher performance of group B with significant difference than group A bilingual children in all the scores of the macro- and microstructure items of narration test and all the items of narrative productivity except for absence of interjection and absence of neologistic

**Table 1** Comparison between the scores of Arabic and English narration tests in the first story for the whole age group

First Story items	First Arabic story		First English story	
	Mean	SD	Mean	SD
Story frame features	8.8	1.78	10.26*	1.35
Events	17.52	1.9	19.3	1.07
Language structure	4.24	1.12	5.21*	1.01
Temporality and connectives	3	0.7	3.95*	0.38
Reference clarity	2.43	0.68	2.97*	0.18
Sentence structure	1.35	0.68	2*	0
Phrasal structure	9.35	1.8	11.16*	1.3
Noun forms	6.91	1.1	7.56*	0.98
Verb forms	5.29	0.86	6.69*	1.29
Frequency of words per minute	36.8	6.03	39.35*	4.40
Mean length of utterance level	2.38	0.61	2.45*	0.56
Type token ratio level	2.32	0.72	2.63*	0.60
Code switch/ code mixing	4.2*	2.03	0.03	0.21
Absence of interjection	2	0	2	0
Absence of neologistic words	2	0	2	0
Total narrative productivity	49.81*	7.03	48.43	5.27
Total	108.71	12.26	117.52*	7.63

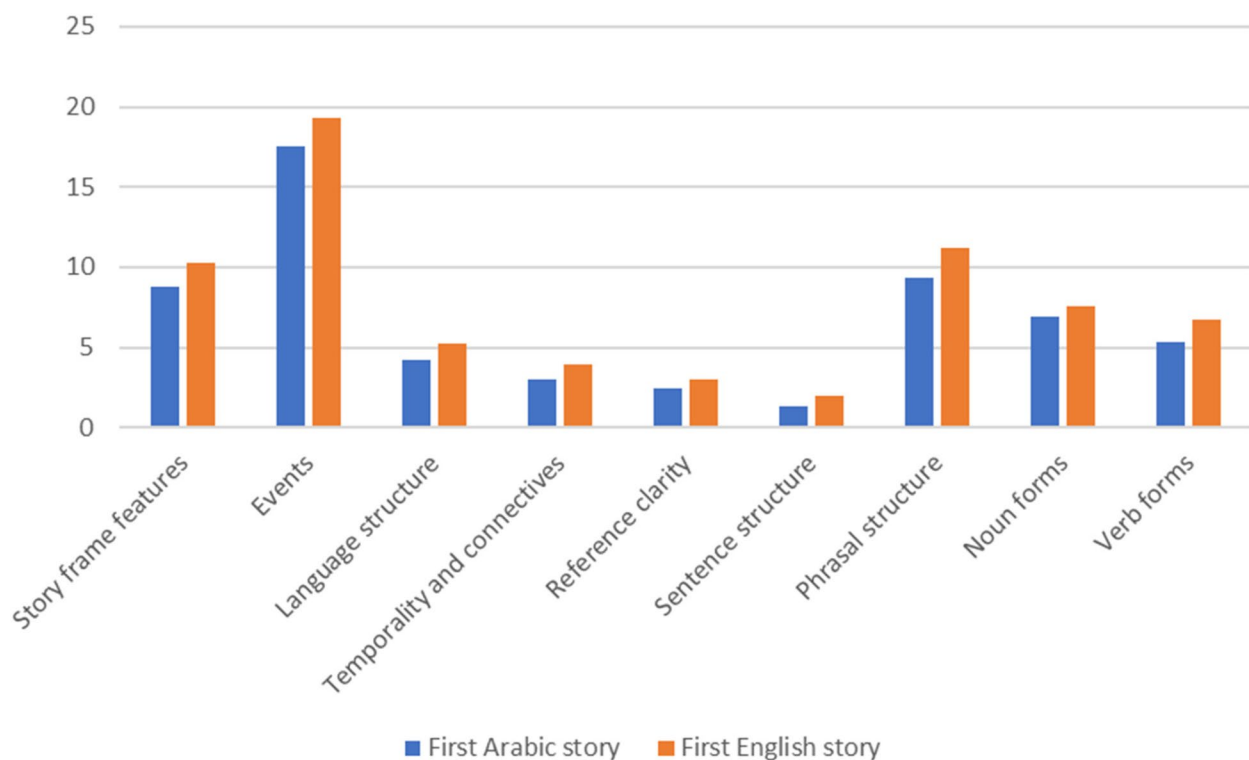
SD Standard deviation. \*Significant  $p$  value < 0.05

word items showed constant scores as demonstrated in Table 2 and Figs. 3 and 4.

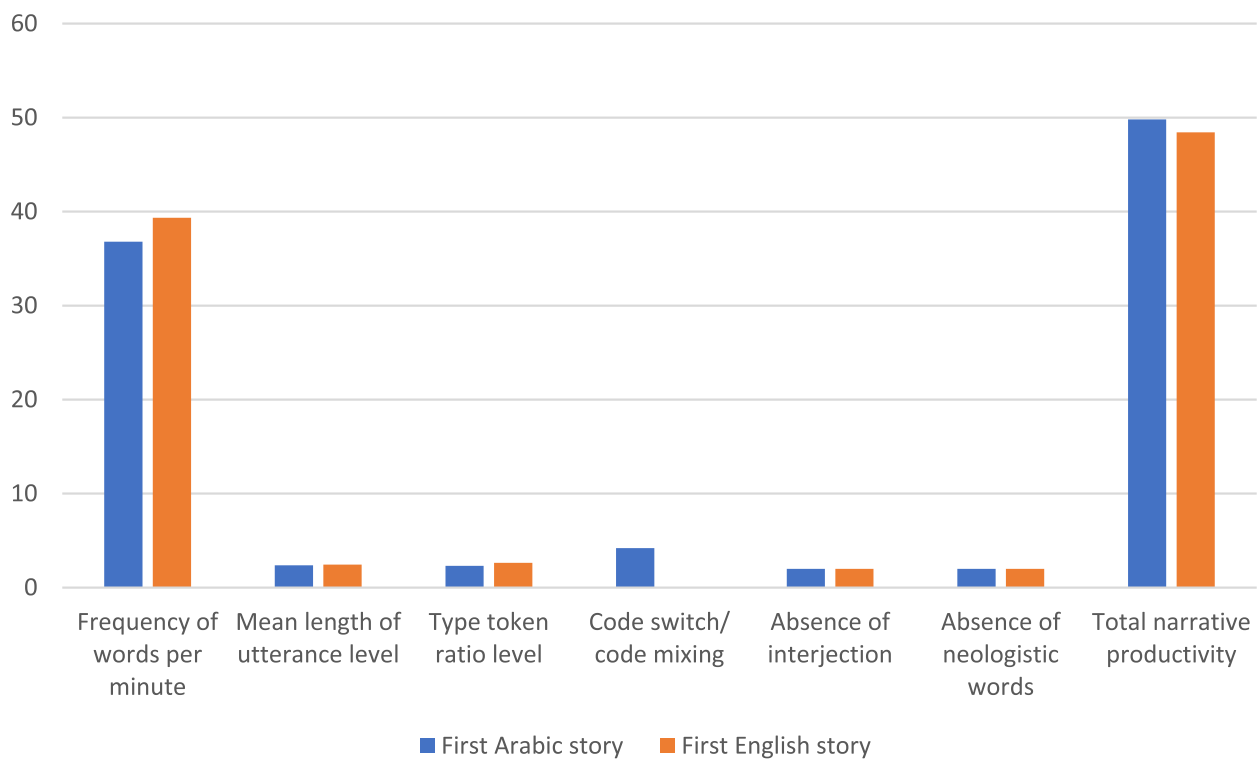
The comparison between the two age groups regarding the scores of the first story of English narration test showed higher performance of group B with significant difference than group A bilingual children in all the scores of the macro- and microstructure items and all the items of narrative productivity except for temporality and connectives and reference clarity that showed no significant difference between the two age groups and for absence of interjection and absence of neologistic words items that showed constant scores as demonstrated in Table 3 and Figs. 5 and 6.

The comparison between the scores of the Arabic and English narration tests in the second story for the whole age groups showed higher performance of bilingual children with significant difference in sentence repetition and the total score of second story in English than Arabic language, while they showed higher performance in code switch to English in Arabic story than code switching to Arabic in English story as demonstrated in Table 4 and Fig. 7.

The comparison between the two age groups regarding the scores of the second story of Arabic narration test showed higher performance of group B with significant difference than group A in sentence repetition,

**Fig. 1** Comparison between the scores of Arabic and English narration tests in the first story regarding the subitems macro and microstructure tasks for the whole age group





**Fig. 2** Comparison between the scores of Arabic and English narration tests in the first story regarding the subitems of narrative productivity task for the whole age group

**Table 2** Comparison between the two age groups regarding the scores of first story of Arabic narration test

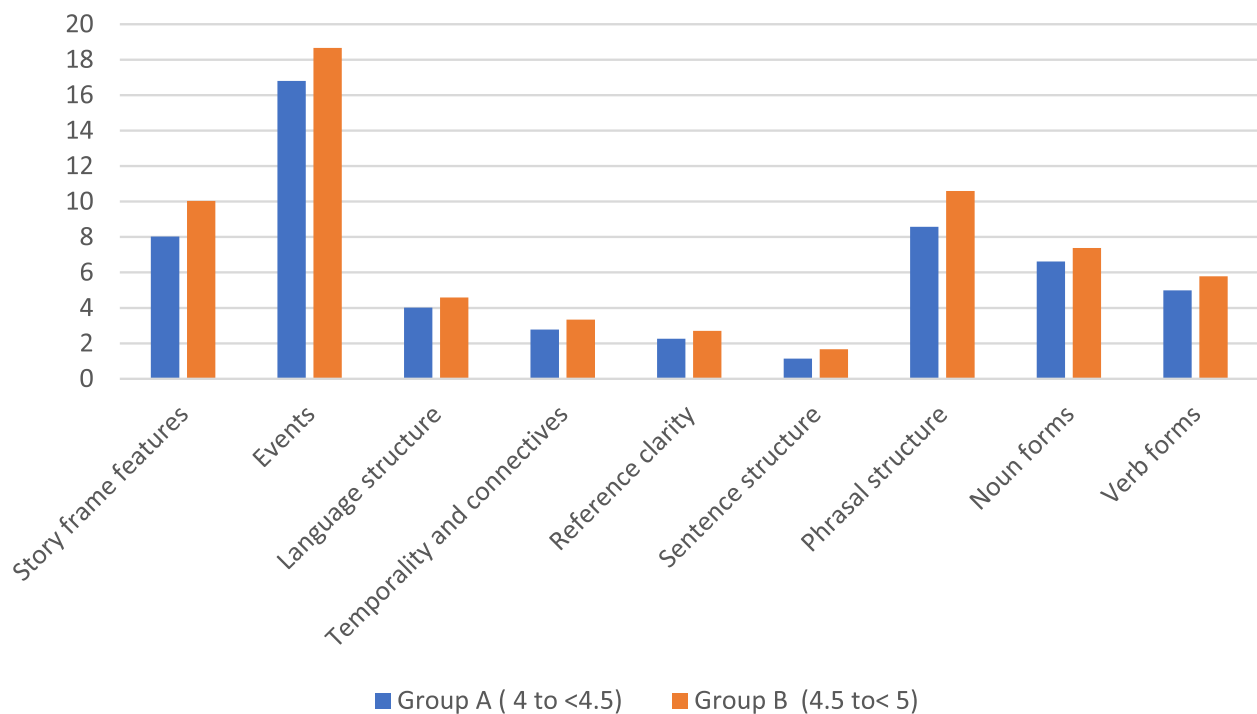
First Arabic story	Group A (4 to <4.5)		Group B (4.5 to <5)	
	Mean	SD	Mean	SD
Story frame features	8.02	1.64	10.03*	1.21
Events	16.8	1.92	18.66*	1.19
Language structure	4.02	1.03	4.59*	1.17
Temporality and connectives	2.78	0.74	3.34*	0.48
Reference clarity	2.26	0.74	2.71*	0.46
Sentence structure	1.14	0.7	1.67*	0.47
Phrasal structure	8.58	1.7	10.59*	1.16
Noun forms	6.62	1.15	7.38*	0.83
Verb forms	4.99	0.91	5.78*	0.46
Frequency of words per minute	35.3	6.41	39.17*	4.5
Mean length of utterance level	2.25	0.62	2.59*	0.53
Type token ratio level	2.09	0.74	2.69*	0.5
Code switch/ code mixing	4.2	2.03	4.36*	1.57
Absence of interjection	2	0	2	0
Absence of neologistic words	2	0	2	0
Total narrative productivity	47.9	7.38	52.84*	5.21
Total	103.12	11.66	117.59*	6.73

SD Standard deviation. \*Significant  $p$  value < 0.05

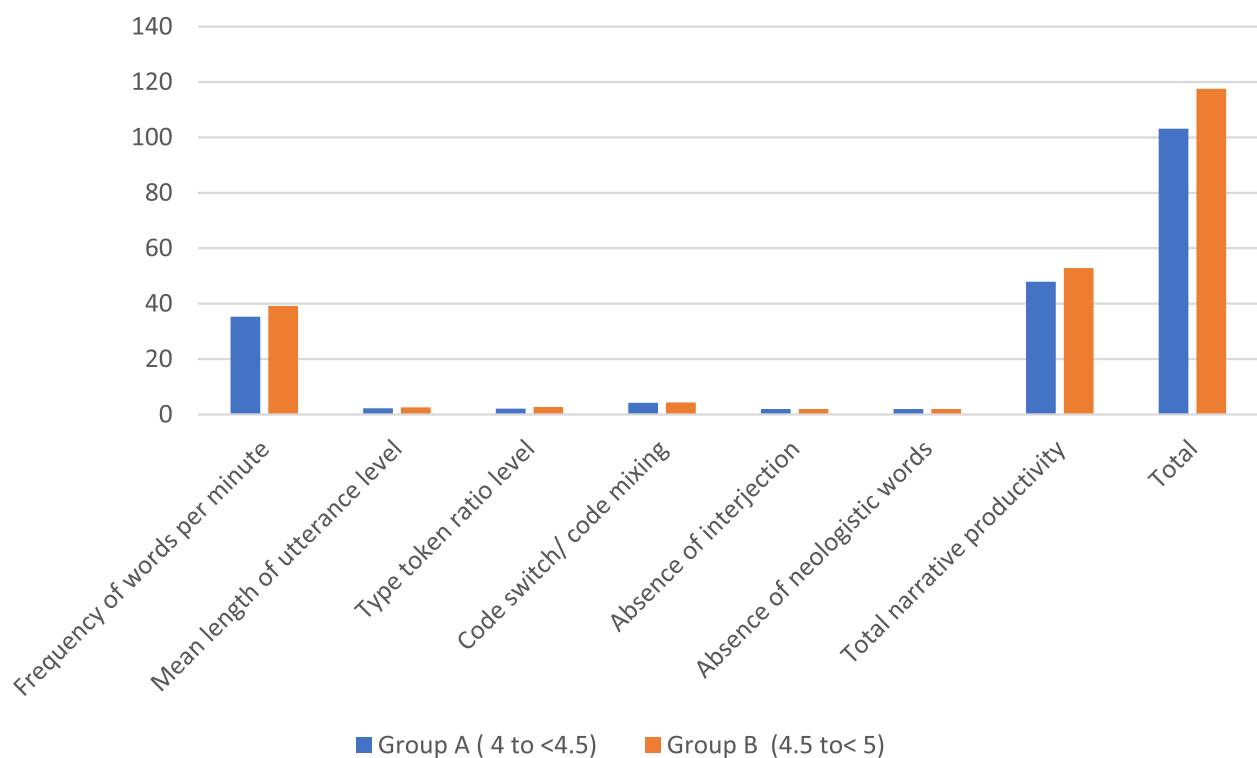
code switch from Arabic to English and the total score of second story of Arabic narration test as demonstrated in Table 5 and Fig. 8. Meanwhile, the comparison in the second English story showed higher performance of group B with significant difference than group A in code switch to Arabic and the total score of second story of English narration test. However, both age groups showed no significant difference regarding the scores of sentence repetition as demonstrated in Table 5 and Fig. 9.

### Conversation test results

The comparison between the scores of Arabic and English conversation tests and its two sections (verbal and nonverbal) in the whole age groups showed higher performance of bilingual children with significant difference in the scores of the total score of conversation and the scores of all items of verbal section in English than Arabic except for number of interjections, number of code switch to English, number of errors, and number of repairs from Arabic to English in which bilingual children showed higher performance in Arabic than in English. However, there is no significant difference between the scores of two languages regarding the nonverbal section of conversation test as demonstrated in Table 6 and Fig. 10.



**Fig. 3** Comparison between the two age groups regarding the subitems scores of macro and microstructure tasks of the first story of Arabic narration test



**Fig. 4** Comparison between the two age groups regarding the subitems scores of narrative productivity task of the first story of Arabic narration test

**Table 3** Comparison between the two age groups regarding the scores of first story of English narration test

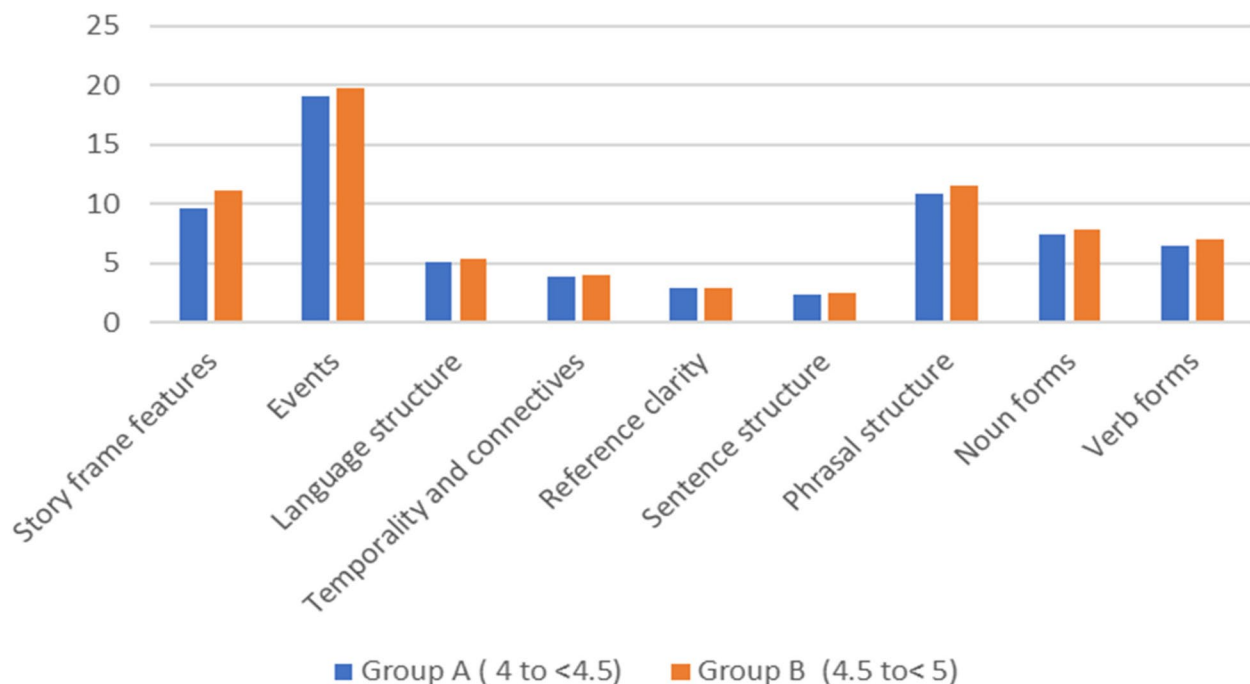
First English story	Group A (4 to <4.5)		Group B (4.5 to <5)	
	Mean	SD	Mean	SD
Story frame features	9.7	1.26	11.16*	.93
Events	19.03	1.2	19.72*	.64
Language structure	5.07	1.05	5.43*	.9
Temporality and connectives	3.93	0.36	3.97	.26
Reference clarity	2.98	0.15	2.95	.22
Sentence structure	2.43	0.17	2.54*	.11
Phrasal structure	10.89	1.46	11.59*	.82
Noun forms	7.39	1.14	7.83*	.57
Verb forms	6.50	1.24	7*	1.31
Frequency of words per minute	37.88	4.26	41.69*	3.55
Mean length of utterance level	2.32	0.57	2.67	.47
Type token ratio level	2.55	0.65	2.74	.48
Code switch/code mixing	0.03	0.21	0.09	.34
Absence of interjection	2	0	2	0
Absence of neologistic words	2	0	2	0
Total narrative productivity	46.72	5.21	51.14*	4.13
Total	114.21	7.13	122.78*	5.03

SD Standard deviation. \*Significant  $p$  value < 0.05

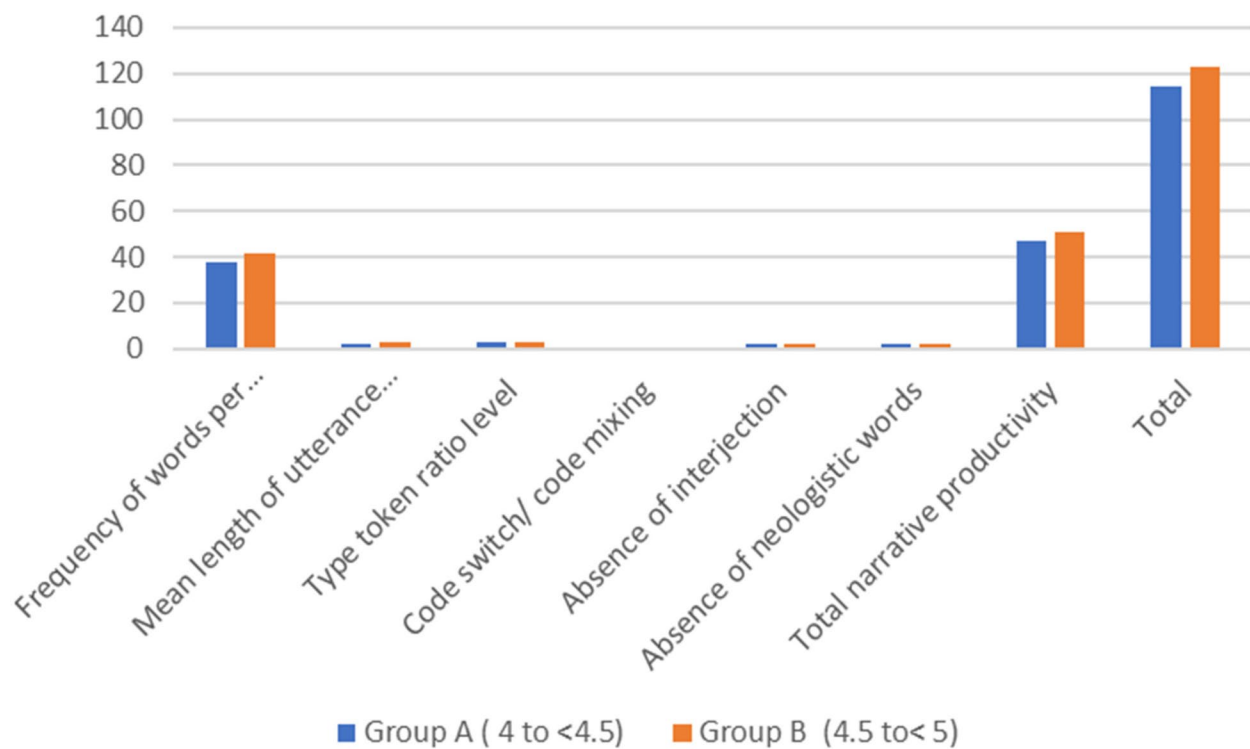
The comparison between the two age groups regarding the scores of the Arabic and English conversation tests, in Arabic, showed higher performance of group B with significant difference than group A in total score of English conversation test and the scores of all items of the verbal section. However, group A showed higher number of errors in Arabic than group B. There is no significant difference between the two age groups regarding number of interjections and the scores of nonverbal section of conversation test, while in English, it showed higher performance of group B with significant difference than group A in the total score of English conversation test and the scores of all items of the verbal section except for number of interjections, number of errors, and the number of repairs in addition to the scores of nonverbal section of conversation test which showed no significant difference between the two age groups as demonstrated in Table 7 and Figs. 11 and 12.

#### Narration versus conversation results

The comparison between the scores of narration and conversation productivity items in Arabic and English languages. In Arabic, it showed higher performance of bilingual children with significant difference in narrative skills than conversation skills regarding frequency of words, mean length of utterance, and the total narrative productivity in Arabic language. While the bilingual children showed higher performance with significant difference regarding type token ratio in conversation skills

**Fig. 5** Comparison between the two age groups regarding the subitems scores of macro and microstructure tasks of the first story of English narration test





**Fig. 6** Comparison between the two age groups regarding the subitems scores of narrative productivity task of the first story of English narration test

than narrative skills in Arabic language, while in English, it showed higher performance of bilingual children with significant difference in narrative skills than conversation skills regarding frequency of words, mean length of utterance, and the total productivity in English language. While the bilingual children showed higher performance with significant difference regarding type token ratio in conversation skills than narrative skills in English language as demonstrated in Table 8 and Figs. 13 and 14.

#### Reliability

The reliability statistics using Cronbach's alpha that showed good reliability of the first story of narration test in both Arabic (0.82) and English languages (0.89) and also

showed acceptable reliability of conversation test in both Arabic (0.76) and English language (0.76). The test–retest reliability statistics of narration and conversation tests of the language sample analysis. It showed a highly significant positive correlation between test–retest in all the items of macro- and microstructure, narrative productivity of first story, sentence repetition and code switch of the second story in narration test, and verbal and nonverbal sections of the conversation test in both Arabic and English languages with *p* values ranging between 0.5 and 0.9.

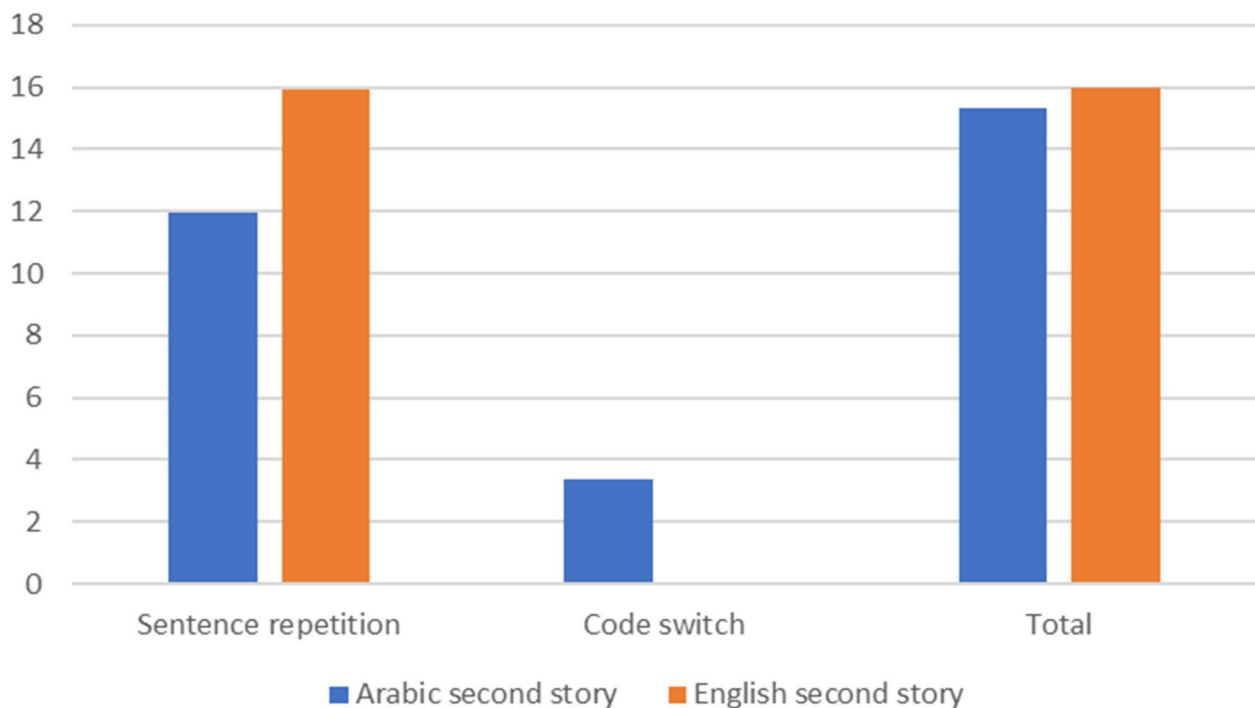
#### Discussion

Previously, standardized tests were used to assess bilingual children's language. However, standardized tests have some limitations. It can create major stress as the child can feel

**Table 4** Comparison between the scores of the Arabic and English narration test in the second story for the whole age group

Second story	Languages			
	Arabic		English	
	Mean	SD	Mean	SD
Sentence repetition	11.97	1.47	15.93*	.32
Code switch	3.39	1.15	0.06*	.31
Total	15.34	1.13	15.96*	.26

SD Standard deviation. \*Significant *p* value < 0.05



**Fig. 7** Comparison between the total and subitems scores in Arabic and English narration test in the second story for the whole age group

**Table 5** Comparison between the two age groups regarding the scores of the second story of Arabic and English narration tests

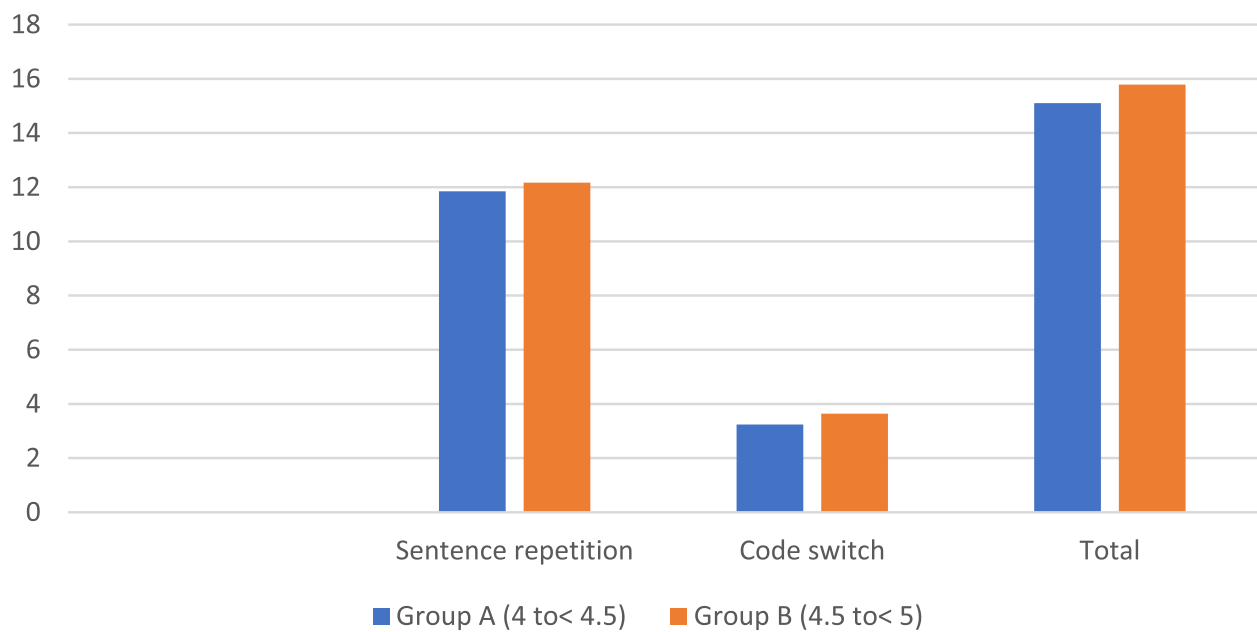
Second Arabic story	Age groups			
	Group A (4 to < 4.5)		Group B (4.5 to < 5)	
	Mean	SD	Mean	SD
Sentence repetition	11.85	1.56	12.17*	1.31
Code switch	3.24	1.11	3.64*	1.18
Total	15.10	1.33	15.79*	0.49
Sentence repetition	15.93	0.32	16.0	0
Code switch	0	0	0.16*	0.49
Total	15.93	0.32	16*	0

SD Standard deviation. \*Significant  $p$  value < 0.05

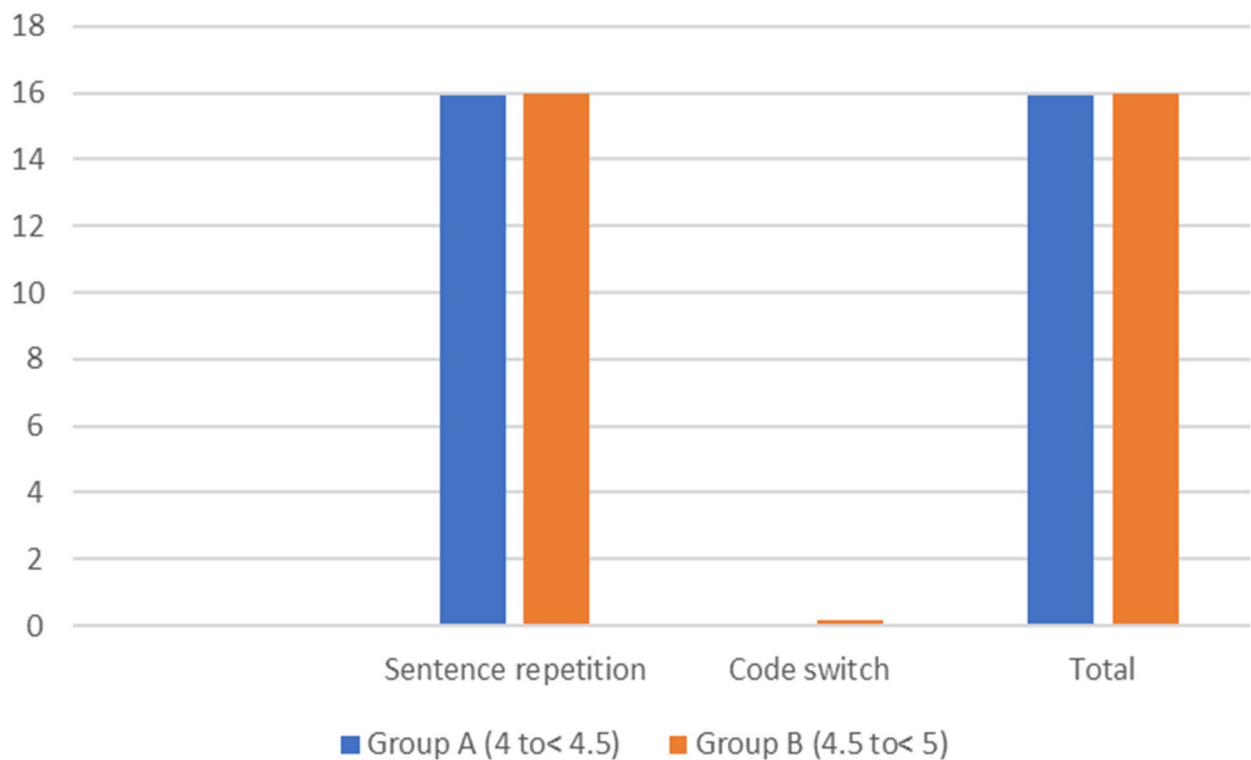
the pressure when it comes to performing well on tests. Standardized tests do not consider factors like test anxiety, lack of motivation, home life, or the fact that some kids are extremely bright but just do not test well. In addition, more time and effort are spent on test performance. All these factors can affect children confidence which will affect scores of the test. Standardized tests were carefully used by phoneticians in assessing bilinguals because they were designed to assess certain language in monolingual children, other than it can cause cultural or linguistic bias [14].

Therefore, it was necessary to find an alternative method to assess bilingual children using additional

descriptive assessments especially in COVID 19 pandemic; the time when this study was conducted. The pandemic caused limitation of direct interaction. This raised the need to evaluate the use of a language sample analysis tool as an easy applicable screening tool. The tool was used to assess narrative and conversation abilities in kindergarten (KG) Egyptian bilingual children in order to reach a better understanding of their language profile. This will help in exploring associations among their oral language skills and presenting the features and characteristics of development of various language components in bilingual children.



**Fig. 8** Comparison between the two age groups regarding the scores of the second story of Arabic narration test



**Fig. 9** Comparison between the two age groups regarding the scores of the second story of English narration test

Comparison between the scores of Arabic and English narration tests in the first story for the whole age group revealed higher performance in English language

than Arabic regarding the story frame structure and story events narrated as shown in Table 1 and Fig. 1. This is interpreted by the preference to use of the second

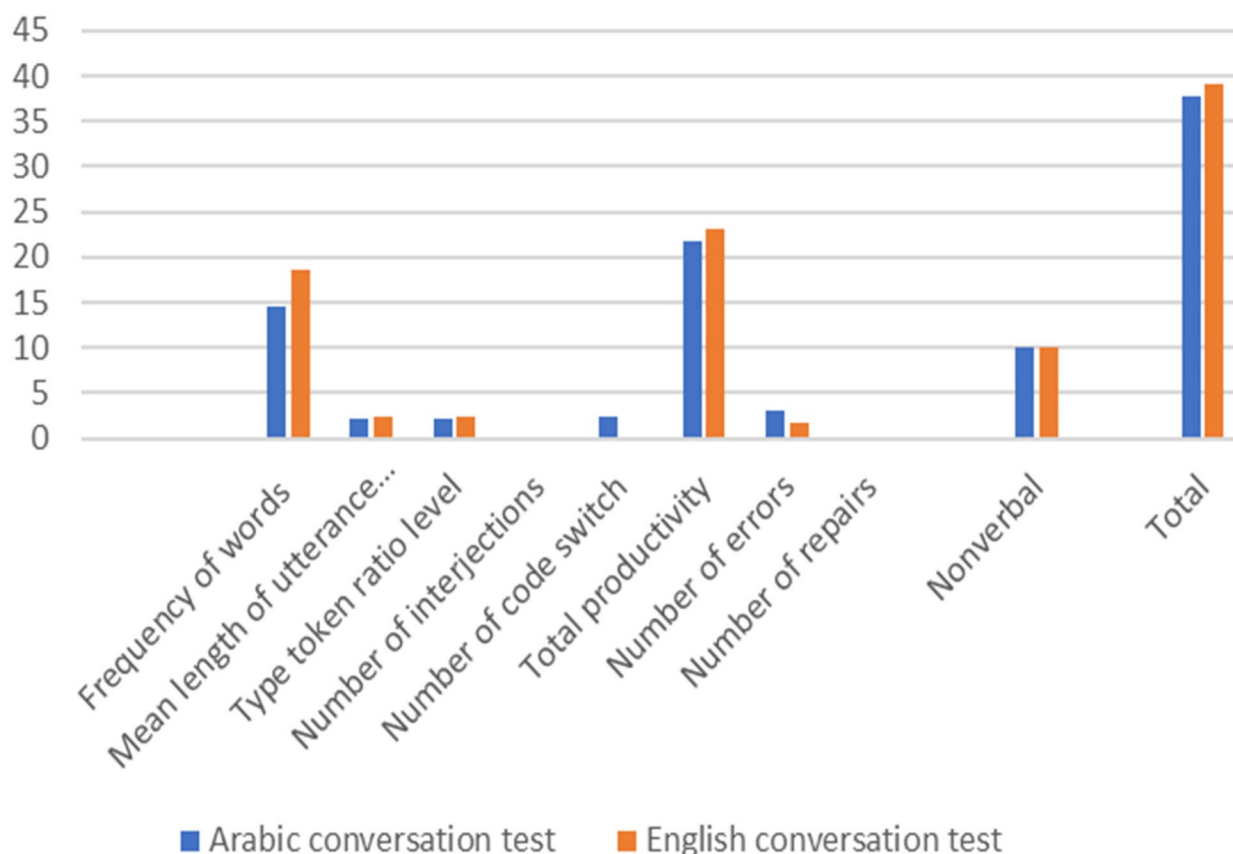
**Table 6** Comparison between the scores of Arabic and English conversation tests and the two sections (verbal and nonverbal) in the whole age groups

Conversation test items	Arabic		English	
	Mean	SD	Mean	SD
Frequency of words	14.56	2.57	18.66*	2.99
Mean length of utterance level	2.27	0.68	2.48*	0.64
Type token ratio level	2.21	0.68	2.39*	0.62
Number of interjections	0.13*	0.44	0	0
Number of code switch	2.3*	1.57	0.01	0.08
Total productivity	21.87	3.37	23.15*	3.91
Number of errors	3*	0	1.80	0.65
Number of repairs	0.06*	0.33	0	0
Nonverbal	9.96	0.20	9.98	0.14
Total	37.87	3.79	39.13*	3.91

SD Standard deviation. \*Significant  $p$  value  $< 0.05$ 

language and the easier recall in second language for bilingual children under the study. This goes with a research done by Uccelli et al. [15] who revealed that bilingual children produced better performance in narration in English (L2) than in Spanish (L1). Interestingly, the author interpreted these findings as evidence of positive “carry-over across languages,” offering initial evidence that warrants further research on cross-linguistic associations.

Comparison between the two age groups regarding the scores of first story of Arabic and English narration test revealed that older age group children were more proficient in both languages regarding language structure, temporality and connectives, reference clarity, sentence structure, phrasal structure, noun forms, and verb forms than younger age group as shown in Tables 2 and 3 and Figs. 3 and 5. This means that language structure development is directly related to the age. This could be interpreted by Fitamen [16] who stated that working memory capacity increases throughout childhood and such an increase is considered as a major source of cognitive development.

**Fig. 10** Comparison between the scores of Arabic and English conversation tests and the two sections (verbal and nonverbal) in the whole age groups

**Table 7** Comparison between the two age groups regarding the scores of the Arabic and English conversation test

Arabic conversation test	Group A (4 to < 4.5)		Group B (4.5 to < 5)	
	Mean	SD	Mean	SD
Frequency of words	13.82	2.41	15.74*	2.37
Mean length of utterance level	2.02	0.68	2.55	0.6
Type token ratio level	2.23	0.74	2.64*	0.48
Number of interjections	0.18	0.53	0.05	0.22
Number of code switch	2.71	1.52	1.66*	1.42
Total productivity	20.96	3.01	23.33*	3.42
Number of errors	2.87*	0.39	1.83	0.57
Number of repairs	0	0	0.16*	0.52
Nonverbal	10	0	9.9	0.31
Total	36.76	3.18	39.62*	4.05
English conversation test				
Frequency of words per conversation	18.09	2.95	19.57*	2.84
Mean length of utterance level	2.1	0.61	2.67*	0.47
Type token ratio level	2.02	0.66	2.5*	0.6
Number of interjections	0	0	0	0
Number of code switch	0	0	0.02*	0.13
Total productivity	22.21	3.83	24.64*	3.57
Number of errors	0	0	0	0
Number of repairs	0	0	0	0
Nonverbal	10	0	9.95	0.22
Total	38.21	3.83	40.59*	3.59

SD Standard deviation. \*Significant  $p$  value < 0.05

Comparison between the scores of Arabic and English narration tests in the first story for the whole age group revealed that bilingual children performed higher in English narrative productivity items regarding the total number of words, mean length of utterance, and type token ratio than in Arabic language as shown in Table 1 and Fig. 2. That revealed that bilingual children although exposed to both languages at home and school, they tend to use longer and more complex sentences with more vocabulary size and diversity in second language being an easy language to acquire for most of bilingual children. This reflected the great effect of rich exposure to the second language in the environment of bilingual children under the study that helped their acquisition of the second language. Similarly, a study made by Merrikhi [17] on Arabic and English languages showed that bilingual children tend to exhibit unequal performance in their two languages. Bilingual utterance length (MLU) and type token ratio (TTR) were much higher in second language than first language. They interpreted these findings to the increase of sentence complexity and variability in

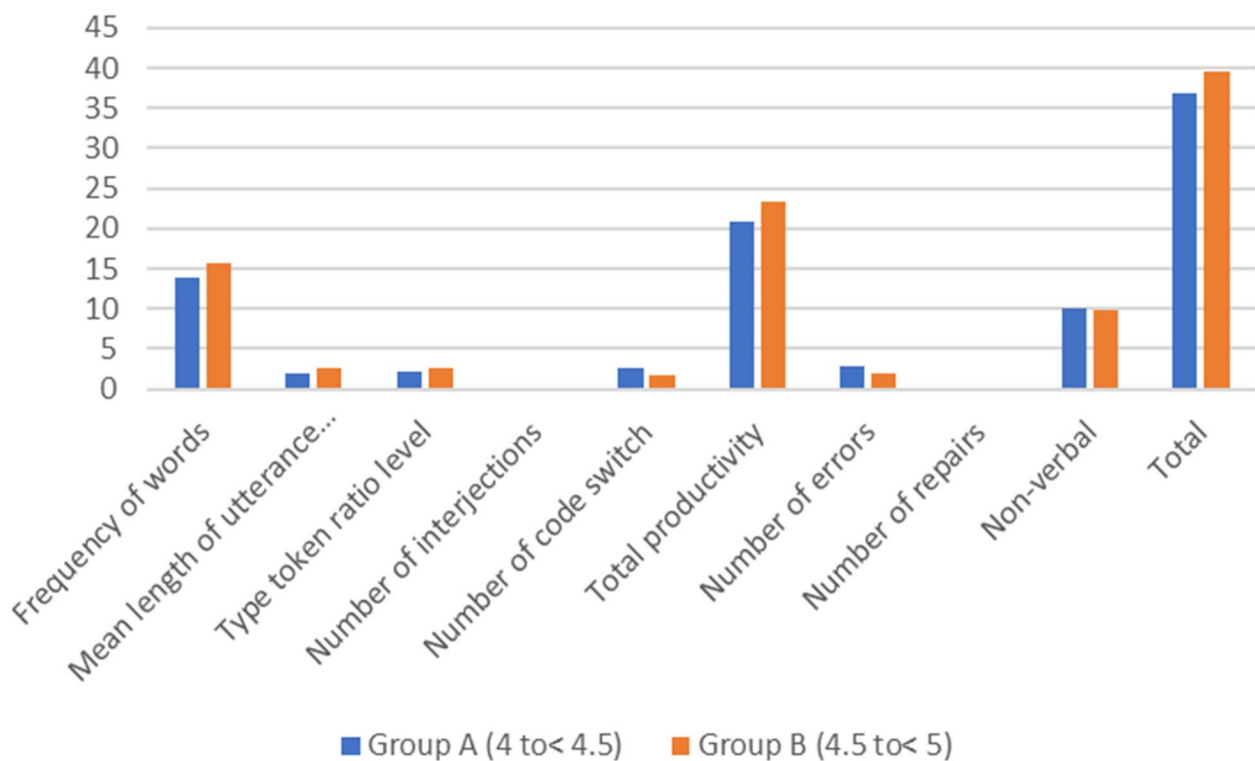
vocabulary of second language that outperformed the native language.

The current result is not in agreement with a study done by Fiestas and Peña [18] who assessed 4 to 6 years old bilingual Spanish–English-speaking children and found no differences in the MLU across storytelling from a pictorial descriptive story across both languages. The reason they assumed beyond this was the more developed cognitive assumption that allowed the children to expand their vocabulary knowledge gained from mother tongue and second language. Hence, increasing the length of utterance in advance.

An explanation of the presence of non-significant difference in MLU in the two languages in the current study is that MLU was measured by counting the number of words not morphemes. It was chosen to count in words as it is easier as supported by other researches such as Ezeizabarrena and Fernandez [19]. Arabic language is a rich complex language in which words can consist of multiple morphemes.

Comparison between the scores of Arabic and English narration tests in the first story for the whole age group revealed that bilingual children had a higher rate of switching from Arabic language to English than from English language to Arabic as shown in Table 1 and Fig. 2. This could be interpreted by the lack of vocabulary acquainted in primary language and so, cause a lag which is corrected and covered by substitution of the more gained vocabulary of the second language. This was confirmed by a study done by Gathercole [20] which showed that growing up as a bilingual, whether learning two languages simultaneously or sequentially, can have wide ranging ramifications that can ultimately affect children's vocabulary acquisition, their cognition and their performance of second and primary language at home, school, and surrounding. Code switching is affected by language exposure which reflects the relative and absolute amount of language input to a child, and language proficiency which reflects the level of the child's acquisition and usage in each language.

Comparison between the two age groups regarding the scores of first story of Arabic and English narration test revealed significant difference between the two age groups regarding the narrative productivity items and code switching where the older age group showed higher performance than younger age group as shown in Tables 2 and 3 and Figs. 4 and 6. This reflects the age development proficiency between languages and the increase in MLU (Mean Length of Utterance/ Average Sentence Length) as sentence complexity and length increase gradually with age. This agreed with the fact in literature related to language development milestones and the increase of MLU with age. MLU at 4 years is 4.4 words, 4.5 years is 5 words, and 5 years is 5.6 words [21].



**Fig. 11** Comparison between the two age groups regarding the scores of the Arabic conversation test

Comparison between the scores of Arabic and English narration tests in the first story for the whole age group revealed that both age groups showed higher performance in English more than Arabic in all microstructure items including language structure, temporality and connectives, reference clarity, sentence structure, phrasal structure, noun form, and verb form as shown in Table 1 and Fig. 1. This can be interpreted by the preference of the use of English language that reflects more grammatical and syntactic development in English language than native language during language sample analysis.

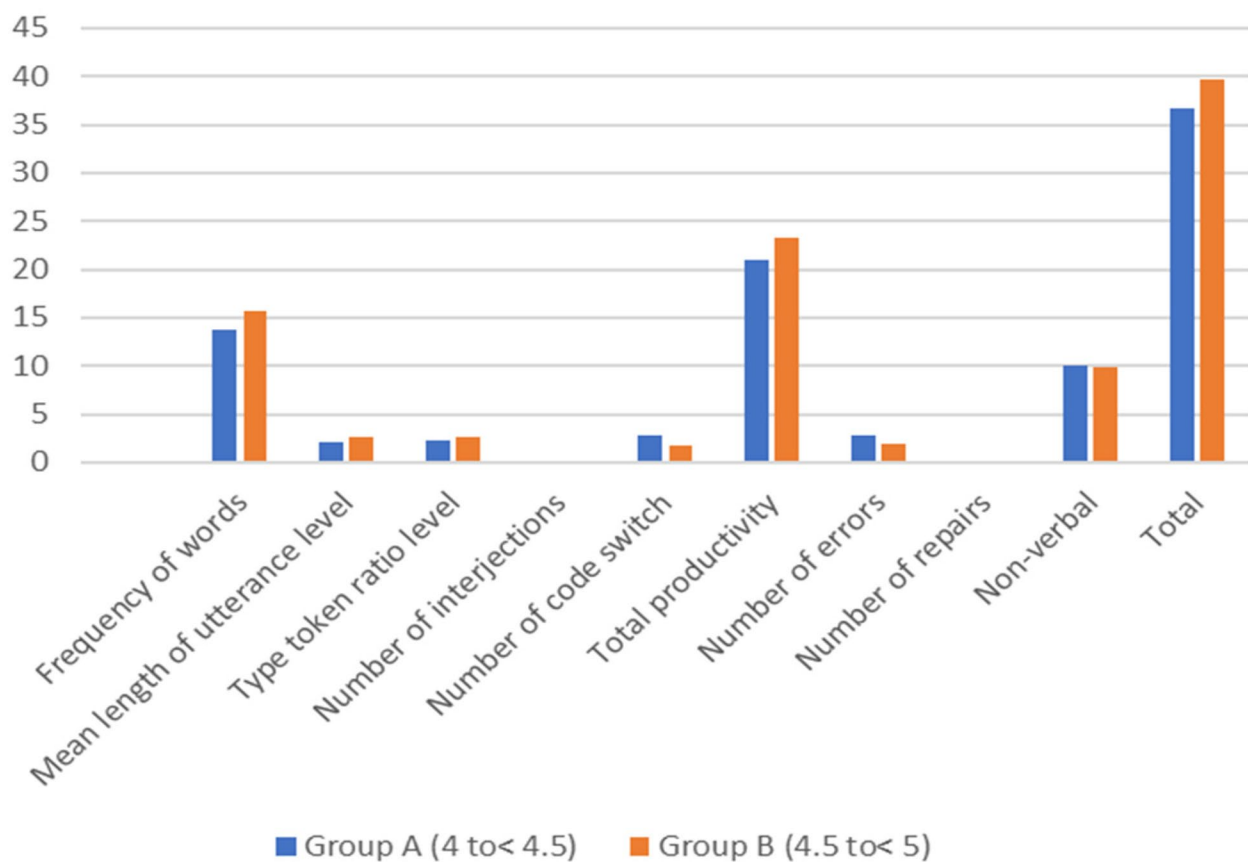
Comparison between the two age groups regarding the scores of first story of Arabic narration test revealed that older age children showed higher performance in microstructure items including language structure, temporality and connectives, reference clarity, sentence structure, phrasal structure, noun forms, verb forms than younger age group in Arabic languages as shown in Table 2 and Fig. 3. This may be due to the development of language complexity and sentence structure with age gaining more linguistic skills; morpho-syntax as a reflection of cognitive development of children with age. The age of 4.5 to 5 years old children will keep getting better at storytelling as at this age, they will speak in increasingly complex and lengthier sentences by using connective words like “and” or “because.” They will be able to use long sentences up to

nine words. They will develop the ability to use different grammatical aspects as verb tenses, irregular plural, and pronouns [22].

Comparison between the two age groups regarding the scores of first story of English narration test revealed that the older age group showed higher performance in language structure, phrasal structure, sentence structure, noun forms, and verb forms than younger age group except for temporality and connectives and reference clarity that showed no significant difference between the two age groups as shown in Table 3 and Fig. 5. This means that temporality, connectives, and reference clarity develop at the young age group but other parameters continue to develop with age. It has been reported that the children are sensitive to the conceptual complexity of the connective and increasing exposure to the second language which lead to increase the number and the quality of the connectives used in second language [23].

The second story is used to evaluate the children’s ability to repeat sentences presented to them in an interactive way so as to detect any characteristic errors in this area. Errors observed during the current study were few as the children were chosen to be typically developed. Most of the expected errors by bilingual children in sentence repetition task were either grammatical errors as an effect of bilingualism on language





**Fig. 12** Comparison between the two age groups regarding the scores of the English conversation test

in the form of mixing between both languages or memory errors. The memory errors can be presented in the form of omission or deletion of one or more of the presented words in the administered sentences or in the form of commission in the form of substitution of the words by other words of the same language. This

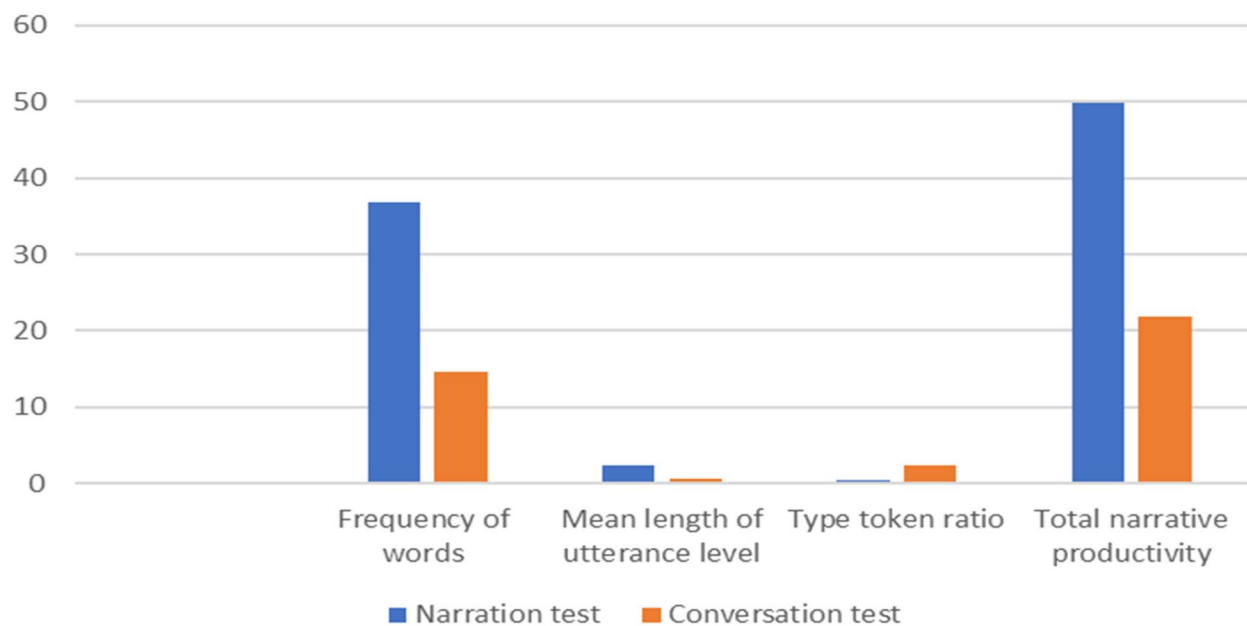
was in agreement with Klem et al. [24] who claimed that sentence repetition appears to be a valuable tool for language assessment because it draws upon a wide range of language skills as sentence repetition offer a window into grammatical skills, phonology, morpho-syntax, and semantics in order to be able to repeat the sentences by processing and reconstructing their meaning. This can only happen if the participant has already acquired and developed the grammatical structures and other narrative skills [25].

Comparison between the scores of Arabic and English narration tests in the second story for the whole age group revealed that less errors were detected in sentence repetition task in English than in Arabic as shown in Table 4 and Fig. 7. This was secondary to the bilingual children's use of code switching more from Arabic to English language, and this was to fill in the linguistic gap produced from deficient vocabulary of the native language. Also, bilingual children tend to use code mixing which showed more influence of English language on the native language as it depends on the levels of proficiency in the two languages. This confirmed that sentence repetition errors in bilingual children under

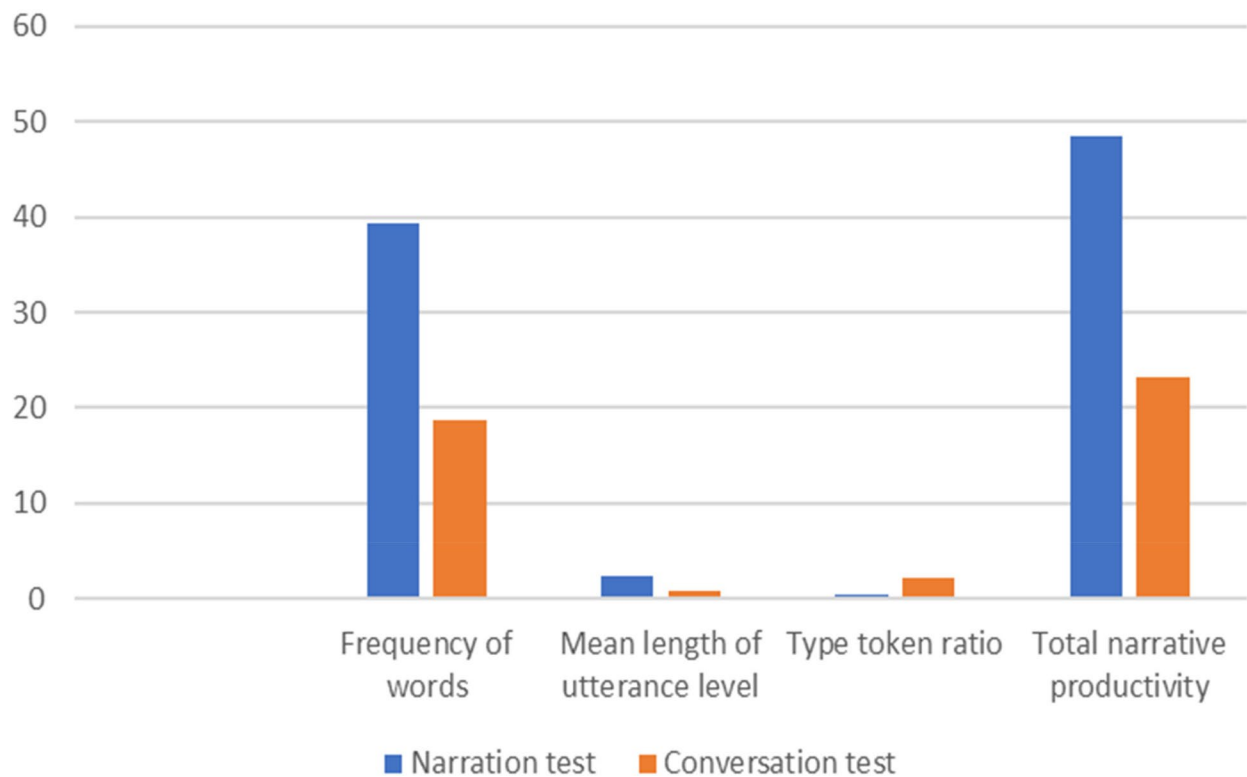
**Table 8** Comparison between the scores of narration and conversation productivity items in Arabic and English language

Items	Narrative		Conversation	
	Mean	SD	Mean	SD
Frequency of words	36.8*	6.03	14.56	2.57
Mean length of utterance level	2.38*	0.61	0.69	0.09
Type token ratio	0.45	0.03	2.39*	0.68
Total narrative productivity	49.81*	7.03	21.87	3.37
Frequency of words	39.35*	4.40	18.66	2.99
Mean length of utterance level	2.45*	0.56	0.76	0.07
Type token ratio	0.39	0.02	2.21*	0.68
Total narrative productivity	48.43*	5.27	23.15	3.91

SD Standard deviation. \*Significant  $p$  value < 0.05



**Fig. 13** Comparison between the scores of narration and conversation productivity items in Arabic language



**Fig. 14** Comparison between the scores of narration and conversation productivity items in English language

the study were more linguistic than memory errors and are present in Arabic more than in English language. This is supported by a study done by Muñoz [26] which

revealed that bilingual children have intact cognitive skills such as memory and attention as they have more efficient and faster recalling and monitoring systems.

Comparison between the two age groups regarding the scores of second story of Arabic narration test in language revealed that older age group performed higher in Arabic language than younger age group in sentence repetition task as shown in Table 5 and Fig. 8. Moreover, comparison between the two age groups regarding the scores of second story of English narration test revealed that there was no significant difference in sentence repetition between both age groups regarding English language as shown in Table 5 and Fig. 9. This may be due to that the early introduction of English language in the first 3 years of the children's life allowed better development of the second language and increased their English proficiency in early age. This leads to the mastery of the sentence repetition skill as young as 4–4.5 years of age. On the other hand, their proficiency of Arabic increased with age and led to higher ability of older children to recall sentences in sentence repetition task.

Comparison between the scores of Arabic and English narration tests in the second story for the whole age group revealed that the bilingual children switch more from Arabic to English language than from English to Arabic as shown in Table 4 and Fig. 7. The most possible reasons beyond code switching were either to fill in the linguistic gap produced from deficient vocabulary of the native language or may be a confusion between the two languages. This finding could be interpreted by the explanation provided by Yow et al. [27] who stated that young bilingual children may not be able to express themselves fully and accurately in both of their languages yet. Thus, code switching allows them to explore and use both languages (the weaker language with the stronger one) while keeping the intended meaning intact. Bilingual children mix or switch languages because they are confused and cannot differentiate between the two languages or they are linguistically incompetent. Another explanation was that the level of language proficiency has also been found to impact the pattern of neural activity in the second language as revealed by Nauchi and Sakai [28]. It is broadly accepted that bilingual speakers have both languages continuously co-activated. Words in the non-target language are activated even when words are being produced in the target language, and can interfere with production in the target language (code switching/ mixing) [29].

Comparison between the two age groups regarding the scores of second story of Arabic and English narration test revealed that older age group children used code switching from Arabic language into English and to a less extent from English to Arabic language more often than younger age group children as shown in Table 5 and Figs. 8 and 9. This is explained by the ability of bilingual children to keep intact understandable conversation by

balancing between the two languages through filling in the gap, shifting in using vocabulary between the two languages. The results demonstrated that code switching is a marker of linguistic competence.

The same findings were found in the previous study of Aziz et al. [12] except for sentence repetition task in English language showed significant difference between both age groups. This also can be interpreted by that the naturalistic home setting of LSA had a great effect on younger age group as it broke the environmental anxiety present in standardized assessment that affect language production mainly in young age.

Comparison between the scores of Arabic and English conversation tests and its two sections in the whole age groups revealed that the measure of the total number of words, mean length of utterance, and type token ratio in English language are better than in Arabic as shown in Table 6 and Fig. 10. This confirmed again the fact that bilinguals do not generally have exactly the same competencies or skills in their two languages. This declares that the English language sentences are lengthier with more sentence complexity, well-structured grammatical form, and higher vocabulary diversity than Arabic language.

Comparison between the two age groups regarding the scores of the Arabic and English conversation test revealed that older age group speaks with a higher TNW, MLU and TTR than younger age group in both Arabic and English languages as shown in Table 7 and Figs. 11 and 12. This clarifies the effect of age on the capacity of storage of vocabulary, sentence length and complexity, and size of the vocabulary diversity in the conversation context. This was similar to Hart and Risley [30] who interpreted that the age of bilingual children also matters with their native and second language development as the older children's vocabulary knowledge is cumulative from previous different language exposure and so allows different children's linguistic experiences in both languages. In addition to development of cognitive skills during the school years is also considered including developmental increases in knowledge, filtering out of irrelevant distractions, encoding and rehearsal strategies, and pattern formation [31].

Comparison between the scores of Arabic and English conversation tests and its two sections in the whole age groups and comparison between the two age groups regarding the scores of the Arabic and English conversation test showed the same results of code switch in which bilingual children especially older age group had higher rate of switching from Arabic language to English as shown in Tables 6 and 7 and Figs. 10, 11, and 12). This clarified the dominance of one language over the other which is actually more common than balance between both languages. In addition, naturalistic

conversation allows bilingual children to mix between languages to facilitate expression. This was supported by Deuchar and Quay [32] who revealed that the bilingual children in a naturalistic setting tended to mix more their non-dominant language (L1) with their dominant ones (L2) as to facilitate expression in their less proficient language.

Comparison between the scores of Arabic and English conversation tests and its two sections in the whole age groups revealed that bilingual children produced more errors in Arabic than English language. However, the repair of these errors was high in Arabic than English language as shown in Table 6 and Fig. 10. As mentioned before, this could be due to the confusion between both languages. On the other hand, repairing of these errors gave a clue of normal development of these bilingual children which were able to self-monitor and detect the error and mostly correct it spontaneously or to a lesser extent by parents' direction that was minimized as instructed during data collection.

Comparison between the two age groups regarding the scores of the Arabic conversation test revealed that younger age group showed higher number of errors with less repair while older age groups had lower number of errors with more repairs as shown in Table 7 and Fig. 11. However, the comparison between the two age groups regarding the scores of the English conversation test showed that both age groups showed no significant difference in number of errors and repairs in English language as shown in Table 7 and Fig. 12. This can be interpreted by the fact that the older the age, the higher the cognitive skills, the ability to recognize and repair errors, and the faster processing speed in addition to the more language competence.

Comparison between the scores of Arabic and English conversation tests and its two sections in the whole age groups and comparison between the two age groups regarding the scores of the Arabic and English conversation tests showed no significant difference between two languages and between two age groups regarding the items of the nonverbal communication as shown in Tables 6 and 7 and Figs. 10, 11, and 12. This demonstrated one of the inclusion criteria that the chosen children under the study have to be typically developing children with no appropriate cause of language delay or disorder. The number of turns of child in the conversation section of the study range from 4 to 6 turns according to the context guided by structured questions. This gave a picture of efficient conversational interaction between the parents and the children. This was supported by Lobel et al. [33] who revealed that turn-taking is important when it comes to effectively participating and interacting with

others. Turn-taking allows active listening and therefore results in a productive discussion.

Comparison between the scores of narrative and conversation in productivity items in Arabic and English languages revealed higher performance of bilingual children with significant difference in narrative skills than conversation skills regarding the frequency of words and the mean length of utterance in both languages. While the bilingual children showed higher performance with significant difference regarding the scores of the type token ratio in conversation skills than narrative skills in both languages as shown in Table 8 and Figs. 13 and 14. This means that narration gives a higher mean length of utterance helped by the nature of the task of story retelling that depends on memory of remembering sentences of structured story and guided by the events produced through pictorial illustration, while conversation contains more complex and lexical diversity (higher TTR) than narration. Conversation depends mainly on sentence planning and though it forms a sentence with lower MLU but with more lexical diversity structure.

The previous finding goes also with Wagner [34] who compared the conversational and narrative language samples of 28 children ages 4.11 to 5.4. They found that conversational samples yielded more intelligible utterances and more complex noun and verb forms. In narratives, the children had a higher MLU, used more complex sentence, grammatical morphemes, and phrasal expansions. These researchers concluded that higher MLU in narratives was due to the increased number of forced productions, and so longer units of speech than in conversation that had higher demands of planning.

In conclusion, both narration and conversation are important skills that should be tested simultaneously in language sample analysis. Each of them provides a perspective view of language that completes the full analysis picture. This was supported by previous studies which proved that narratives allow an evaluation of how a child perceives information and communicates the information to a listener using cognitive, social, and linguistic skills [35].

However, the previous result is not in agreement with Westerveld and Gillon [36] who argued that retelling tasks are more complex because they involve memory processes underlying successful comprehension. While story retell provides a smaller sample, it produces the same developmental data as a full-length narrative [37].

In this study, the value of reliability coefficient is 0.8 or higher for first story narration test in both languages which is considered "good" and that obtained for conversation is 0.7 or higher which is considered "acceptable" for both Arabic and English tests. This

was similar to Peña et al. [38] in Bilingual English–Spanish Assessment (BESA) which revealed reliability of all data was just under 0.8 and was in the acceptable range. In addition, language sample analysis reliability testing by Manning et al. [39] determined that language sample analysis is reliable with a range of 82–98% (0.8–0.9). These reliability percentages are in line with previously published studies of toddler language samples [40].

Test–retest reliability showed highly significant positive correlation between the scores of the test and retest in all items of macro- and microstructure, narrative productivity of first story, sentence repetition and code switch of the second story in narration test, and verbal and nonverbal sections of the conversation test in both Arabic and English languages and showed a range from 0.5 to 0.9. The highest value was for the number of code switch in conversation section in Arabic language and the lowest value was for the frequency of words in conversation section in Arabic language.

## Conclusion

The current study was an attempt to evaluate the language sample analysis with a semi-structured method applied and sample collected by parents on their bilingual kindergarten typically developed children and guided by full instructions and then analyzed by the assessor. The language sample analysis method could identify the characteristic language profile of bilingual children under the study. It represented a valid and reliable assessment of that can be used in situation with difficult direct interaction as pandemics or remote places. It is suggested to be used as an easy, remote, less time-consuming method in evaluating the language ability to help the early differentiation between language difference versus language impairment in bilingual children.

## Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s43163-024-00569-6>.

**Additional file 1.** Bilingual English Arabic Language Sample Analysis.

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Not applicable

## Authors' contributions

SM applied the protocol, collected data, and shared in writing the manuscript. DMO and AAA shared in constructing the idea and revising the manuscript. AF constructed the idea, shared in interpreting the results, and prepared the manuscript. All authors read and approved the final manuscript.

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## Availability of data and materials

The datasets used or analyzed during the current study are available from the corresponding author on reasonable request.

## Declarations

### Ethics approval and consent to participate

The study was approved by the ethical committee of Cairo University Medical School under reference number 160–2021. After selecting suitable children for the study, approvals from the parents were obtained by written consent before starting the study.

### Consent for publications

Not applicable.

### Competing interests

The authors declare that they have no competing interests.

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