Unanalyzable Utterances in Language Sample Analysis Based on the P-LARSP: Preliminary Data of Typical Children Aged 18 - 60 Months

Masoomeh Salmani [1], Reyhaneh Noruzi [2, *], Fatemeh Askari [3], Soroor Gholamian [3], Ali Jafari Naeemi [3] and Mahdiyeh Mohammadi [3]

[1] Neuromuscular Rehabilitation Research Center, Semnan University of Medical Sciences, Semnan, Iran
[2] Department of Speech Therapy, School of Rehabilitation, Semnan University of Medical Sciences, Semnan, Iran
[3] Student Research Committee, Semnan University of Medical Sciences, Semnan, Iran

Corresponding author: Department of Speech Therapy, School of Rehabilitation, Semnan University of Medical Sciences, Semnan, Iran. Email: reyhanehnoruzi@yahoo.com

Abstract

Background: The Persian language assessment, remediation, and screening procedure (P-LARSP) is the first formal approach to the analysis of language samples.

Objectives: The present study aimed to investigate the unanalyzable utterances and mean length of utterances (MLUs: morpheme/analyzable text units) based on the first two sections of the P-LARSP.

Methods: Experienced speech and language pathologists (SLPs) collected and analyzed the 10-minute language samples from 96 typical children aged 18 - 60 months within the context of free play. The unanalyzable units included unintelligible utterances, symbolic noise, deviant, incomplete, ambiguous, and stereotyped units, repetition, and structurally abnormal text units.

Results: No significant differences were observed between the age groups in terms of the total number of the text units (P > 0.05) and unanalyzable text units (P = 0.08). Analyzable text units (P = 0.008) and MLUs (P = 0.004) were significant across the age groups. In addition, each category of the unanalyzable text units had a specific pattern, and the percentage of the incomplete utterances increased significantly from 18 to 60 months of age (P = 0.002).

Conclusions: By applying the first two sections of the P-LARSP, we could sieve the analyzable from the unanalyzable text units and demonstrate the increasing trend of MLUs across the age groups. Increased incomplete utterances with age should be considered by SLPs during intervention and evaluation.

Keywords: Development, Language, Utterance

1. Background

Language sample analysis (LSA) has been used as a diagnostic device for the differentiation of children with and without primary language impairment (1) and identifying intervention targets (2). The LSA is part of the assessment battery by more than 80% of Iranian speech and language pathologists (SLPs) (1). Numerous Persian studies have been conducted by LSA (1, 3-6). However, it is a complex process to determine the details on utterances considered as analyzable and unanalyzable in these studies. This issue could be due to the fact that an entire research project could not be published in a journal article, and SLPs do not have a guideline on the contents to be included in LSA reports (7).

Each Iranian study has applied a different LSA protocol (1, 3-5). Furthermore, language samples have a nonstandardized nature, which induces extreme variability in the reported language measures unless SLPs control the sampling context (8), length of the sample (9), and transcription, segmentation, and coding methods (7) to reach uniform outcomes. The first two variables have been evaluated in the Persian LSA, while the last parameter remains undiscovered. As such, researchers have used their customized protocols for this purpose. For instance, Afkhami and Sharifi (8) selected single words, individual phrases, and clauses as utterances. In addition, Kazemi et al. (5) assessed 75 consequent intelligible utterances with more than one word in their calculation of the mean length of utterance (MLU). In another study, Kazemi (1) used an adapted version of the systematic analysis of language transcripts (SALT) and the Persian transcription convention protocol to analyze language samples. The adapted version of the SALT is available for research but not for everyday clinical use. There seems to be an urgent need for systematic and formal procedures to analyze language

samples in research and clinical settings.

A substantiate ground to systematically segment transcriptions and define analyzable utterances has been provided in the language assessment, remediation, and screening procedure (LARSP) (10, 11). The Persian version of the LARSP (P-LARSP) (12) was introduced in 1996, with the authors keeping many parts of the device. The review of the literature shows only one Persian study based on the LARSP, while the P-LARSP has not been exploited so far (13). In a thesis, Ghelmani Pour (13) investigated some of the morphosyntactic features in 97 children aged between 1;06 - 2;06 years using the LARSP. In the variables of the mentioned study, various types of sentences, verb tenses, and MLUs were searched and investigated.

The P-LARSP has five sections with different purposes. To save time, the first section of the P-LARSP is comprised of unanalyzed and problematic utterances, which do not require further morphosyntactic analysis. Section two categorizes utterances based on the interaction between the client and communication partner. In this section, repetitions and structurally abnormal utterances (categorized in columns) do not require further morphosyntactic analysis either. The three other sections of the P-LARSP provide information on the morphosyntactic skills of the client based on the analyzable utterances. Although the utterances in the first and second sections do not require further morphosyntactic analysis, SLPs consider them for their clinical judgment. Furthermore, the LARSP segments utterances and analyzable utterances known as the A-unit ('a' stands for analyzable) and text unit, which have been elucidated in the following sections.

Persuasive evidence is required to convince SLPs on using P-LASRP. An effective approach in this regard would be to demonstrate the practical information provided by the P-LARSP to facilitate the procedures of the LSA. Moreover, applying formal procedures for the LSA helps comparing the results of national language studies and considering the findings of international cross-linguistic studies. Besides, SLPs could access a documented framework to compare their clients for a better clinical judgment.

2. Objectives

The present study aimed to provide information on the implementation of the first and second sections of the P-LARSP to determine the number of the text units that SLPs use to label various unanalyzable utterances and observe the changes in MLUs (morphemes/analyzable text units), as well as the types of unanalyzable text units, with age. Age groups have also been compared to assess the possible age differences affecting the study variables.

3. Methods

The Ethics Committee of the Semnan University of Medical Sciences granted ethics approval for the current research (code: IR.SEMUMS.REC.1395.27 and IR.SEMUMS.REC.1395.26).

3.1. Participants

The Semnan Welfare Organization randomly introduced seven kindergartens in the city. Via convenience sampling, more than 300 families received a flyer with information about the study and invited to contribute. In total, 232 families signed the consent forms, and 54 children were excluded due to speech problems and health issues (e.g., evident signs of neurological disorders, visual and auditory disorders). Teachers or kindergarten principals confirmed health conditions of children considering their routine evaluation of their auditory, visual, and health status. Prior to the collection of language samples, the health centers covering the children also confirmed the health status of the remaining 178 children.

Two senior SLP students trained by the first author were in charge of interacting with the children by attending the kindergartens earlier and spending a minimum of 30 minutes with the children in their classes. The procedure continued in another room to start language sampling from each child. The duration of the interaction was 20 - 30 minutes depending on the child's willingness, and the obtained data were recorded in one session. If the child stopped cooperating, the entire session would be repeated at a different time. The context of the interaction was free play, and the SLPs did not force the children to talk although they were allowed to provide stimuli while following the child's lead (2).

Two other SLPs (one with 16 years of clinical experience and the other as a master's degree student in SLP) who had an adequate knowledge of the Persian grammar and were qualified to use the LARSP transcribed the interaction. After the elimination of the first three minutes due to the potential warm-up effect, the middle 10 minutes of the intervention were analyzed. The transcriptions were segmented based on the rules proposed by Fletcher and Garman (14). Finally, 82 transcriptions were eliminated due to the number of the utterances (< 50). Another SLT who was blinded to the study transcribed and segmented 12 samples again (10%) for reliability assessment. The reliability of the samples was compared through a point-by-point procedure. Discrepancies were discussed in terms of the segmentation, identification, labeling, and allocation of the structures as unanalyzable units, and 100% agreement was achieved on all the transcripts.

To save time, avoid the disturbance of the parents, and confirm the health of the children, the parents of the remaining 96 children completed a questionnaire to provide data on their children's language and developmental history, maternal education levels, and parental ethnic and racial background.

3.2. Materials and Procedure

Age-appropriate toys (e.g., dolls, dollhouses, furniture, animals, and cars) were used in the interaction. For a consistent context, similar toy sets were also applied. The child started the play and was free to choose any set of the provided toys. The toys were placed on the floor, and the children were allowed to switch to another toy set during the interaction. The SLPs did not remove the previous toy sets in case the child wanted to retrieve or combine the toys. The entire session was audio-recorded for transcription and further analysis.

3.3. Language Sample Transcription and Processing

Fletcher and Garman (14) recognized the distinct elements that constitute a text, which are known as text units. They also adapted minimal terminable utterance, known as a t-unit, into the analysis unit or a-unit for longer utterances (14, 15). As a result, all the connectives (except 'and') could be used to mark the boundaries between the clausal text units within their a-units. The constraints of this procedure have been explained below in the text units numbered five. In addition, the transcriptions have been segmented into text units (14), as follows:

1) Minor elements, such as the filled pause 'mmm';

2) Lexical elements consisting of only a single word, which were not part of a larger phrase or clause pattern ('bishtar' as 'more');

3) Phrasal elements consisting of a phrase pattern such as determiner + noun, which cannot be construed as part of a larger phrasal or clausal pattern;

4) Clausal elements such as subject + object + verb in 'Baba miveh kharid' as 'Daddy bought fruits'.

5) Each occurrence of 'and' marks a new a-unit; If 'and' marked a boundary of a new a-unit, it would be considered an independent unit. However, the ellipsis of an element in the first clause and/or the presence of a pronoun in the second clause with an anaphoric relation to a prior phrase or lexical item in the first clause would render both clauses as one unit. For instance, "Rafteh budam bazaro kafsh kharidam." as "I went to the mall and bought a pair of shoes." would be considered as one text unit. In another example, "Khune ro jam konid o man lebas bepusham o ghaza ro bardaram, rah mioftim." would be segmented into three text units or a-units, as follows:

"khune ro jam kanid" as "you clean up the house";

"o man lebas bepusham o ghaza ro bardaram" as "and I put on my cloths and pack the food";

"rah mioftim" as "we will move";

6) Notably, the intonation boundaries have also been considered in the LARSP to segment a language sample.

The SLPs followed the rules of section A of the LASRP to recognize the utterances that were unanalyzed and problematic in language samples (10-12).

1) Unintelligible: Some or all of an utterance could not be fully retrieved after three times of listening.

2) Symbolic Noise: The child imitated the noises from the real world, such as animals' sounds, whistles, and sirens.

3) Deviant: Any utterance falling outside the typical patterns of the child or adult language in terms of the morpheme order, morpheme addition, morpheme omission, or morpheme substitution. Such an example is "Tu chaqush jib dare", as "In his knife has pocket".

4) Incomplete: An unfinished sentence marked by its prosody, such as "Man mikhastam begam ke …" as "I wanted to say …".

5) Ambiguous: An utterance could not be assigned to a specific grammatical analysis even when the SLPs considered the context. Such an example would be "Yesterday I lunch in the garden", which is ambiguous since the client might attempt to convey one of these utterances as "yesterday I lunched in the garden" or "yesterday I had lunch in the garden". In this case, the SLP would be undecided in choosing either the grammatical structure adverb-subject-verb-adverb or adverb-subject-verb-object-adverb (11).

6) Stereotyped: The utterances that had been partially or completely learned as single units, such as "Salam, chetorin?", as "Hi, how are you?"

The remaining utterances from section A were analyzed further and considered normal, abnormal, and problematic in sections B and C. The abnormal utterances included structural abnormality and zero responses. Structural abnormality occurs where the grammatical pattern of the client's response does not match the one required by the SLP's stimulus, as in SLP 'what're you making! Child 'yes!'. Therefore, a decision should be made concerning structural abnormality regardless of semantic considerations. For instance, a client replied Spaghetti to the stimulus 'where in your house does your mummy cook?' The client's response was semantically relevant to the SLP's stimulus, while it did not match the syntactic requirements of the stimulus, which were to have a form of adverbial phrase for places as a response.

The P-LARSP has one column to report repetitions. If the client repeats the entire or part of the SLP's stimulus, they are recorded as repetitions. Notably, repetitions of the

speaker's utterance do not represent a complete thought of the client and might increase the chance of misinterpretation if SLPs do not report the number of the repetitions in their notes. Considering repetitions and structurally abnormal utterances as unanalyzable utterances reduces numerous risks in the LSA.

3.4. Computation and Statistical Analysis

We computed the analyzable text units, unanalyzable text units, and MLUs (morphemes/analyzable text units) for each sample based on the P-LARSP. Mean and standard deviation were reported as descriptive indices, and we attempted to use analytical calculations as well. The results of the Shapiro-Wilks test indicated that the data did not have normal distribution; therefore, we used nonparametric tests such as Kruskal-Wallis analysis of variance (ANOVA) to compare the age groups, multiple comparisons Bonferroni to determine the actual differences between the age groups, Spearman's Rho to assess the correlations between age and some of the variables, and Mann-Whitney U-test to compare the gender differences.

4. Results

With respect to language background, the mothers in our study claimed that their children were monolingual (i.e., native speakers of Persian). In addition, all the children had a typical history of general and language development. Socioeconomic status was determined based on maternal education level, with 40% having an academic degree, 40% having a high school diploma, and 20% being below high school diploma.

The sample population of this study included both males and females. Table 1 shows the gender distribution of each age group. The researchers evaluated the effects of gender on the target measures. The results of Mann-Whitney U-test indicated that the girls and boys had no significant differences in terms of the investigated variables ($P > 0.5$). Therefore, the data of both genders were combined in the analyses.

Our findings demonstrated no significant differences between the age groups regarding the total number of the text units. However, the follow-up analysis showed significant differences in terms of the percentages of the analyzable and unanalyzable text units (Table 2). Moreover, the results of Bonferroni test confirmed the significant differences between the youngest age group and the elder age groups only in terms of the percentage of the a-units (Table 3). An ascending trend was also observed in the MLU (r_s = 0.377; $P < 0.001$), along with a descending trend in the percentage of the unanalyzable text units (r_s = -0.283; P =

Table 1. The Participants' Age and Gender

	Sex		Total
	Male	**Female**	
Age in months			
18 - 24	3	6	9
25 - 36	9	16	25
37 - 48	18	18	36
49 - 60	17	9	26
Total	47	49	96

0.005) and an ascending trend in the a-units (r_s = 0.30; P = 0.003). While the Kruskal-Wallis ANOVA revealed a significant difference between the age groups in terms of the MLU, Bonferroni confirmed the significant difference between the eldest group and the first two younger age groups in this regard (Table 3).

The descriptive results suggested the increasing trends of the incomplete and stereotyped utterances across the age groups (Table 4). However, Spearman's Rho revealed poor correlations between age and the percentage of the incomplete utterances (r_s = 0.24; $P = 0.02$), as well as age and the stereotyped utterances (r_s = 0.23; $P = 0.02$). Table 3 shows the pattern of the percentage of the unintelligible utterances across different age groups. The obtained results also demonstrated a downward trend from the age of 18 months to 48 months, as well as a sharp increase at the age of 60 months.

With the exception of the percentage of repetitions that had a fluctuating pattern, the percentages of the other unanalyzable utterances experienced a downward trend across the age groups. On the other hand, the results of Kruskal-Wallis ANOVA indicated that the difference between the age groups was only significant for the percentage of the incomplete utterances. The follow-up Bonferroni multiple comparisons confirmed the significant difference between the age groups in terms of the percentage of the incomplete utterances (Table 3).

5. Discussion

The present study aimed to investigate the extent of unanalyzable text units in the LSA based on the P-LARSP using a time-based cut approach. As a result, the number of the text units within the 10-minute cut had an increasing trend based on the children's age (from 83 to 96 text units). This is consistent with the previous data reported in the English studies of 91 C-units (an independent clause with its modifiers)(16) or 100 utterances(2). On the other hand, 10%

Table 2. Analyzable Versus Unanalyzable Text-units

	18 - 24 (N = 9), Mean ± SD	25 - 36 (N = 25), Mean ± SD	37 - 48 (N = 36), Mean ± SD	49 - 60 (N = 26), Mean ± SD	P-Value
Total number of child's text-unit	83.89 ± 25.92	92.92 ± 12.91	95.00 ± 11.70	96.74 ± 7.62	0.71
Total number of un-analyzable text-unit	13.89 ± 10.14	13.54 ± 8.31	11.39 ± 9.08	8.89 ± 5.95	0.08
Total number of analyzable text-unit	62.11 ± 26.20	72.92 ± 14.97	78.94 ± 13.59	83.33 ± 11.79	0.008
Percentage of un-analyzable utterances	17.47 ± 10.41	14.59 ± 9.62	11.85 ± 9.50	9.16 ± 5.94	0.03
Percentage of analyzable utterances	71.97 ± 15.74	78.42 ± 12.35	83.17 ± 10.14	86.01 ± 9.24	0.01
MLU	2.87 ± 1.37	3.49 ± 0.82	3.87 ± 1.00	4.45 ± 1.29	0.004

Table 3. Bonferroni Multiple Comparisons on Different Variables[a]

Dependent Variable	(I) Agecod	(J) Agecod	Mean Difference (I-J) ± SD	Sig.
Analyzable utterances	18 - 24	25 - 36	-10.81 ± 5.87	0.41
		37 - 48	-16.83* ± 5.59	0.02
		49 - 60	-21.22* ± 5.78	0.002
MLU	49 - 60	18 - 24	1.58* ± 0.42	0.002
		25 - 36	0.95* ± 0.31	0.02
		37 - 48	0.57 ± 0.28	0.25
Percentage of Incomplete	18 - 24	25 - 36	-13.64 ± 7.75	0.49
		37 - 48	-22.26* ± 7.39	0.02
		49 - 60	-21.53* ± 7.63	0.04

[a] *, significant.

Table 4. Different Kinds of Unanalyzable Text-units

Unanalyzable Utterances	18 - 24 (N = 9), Mean ± SD	25 - 36 (N = 25), Mean ± SD	37 - 48 (N = 36), Mean ± SD	49 - 60 (N = 26), Mean ± SD	P-Value
Unintelligible	27.00 ± 21.53	23.31 ± 26.02	16.76 ± 18.46	27.36 ± 28.88	0.38
Structurally abnormal	23.51 ± 21.75	13.77 ± 16.61	11.91 ± 17.18	10.83 ± 14.89	0.28
Ambiguous	20.75 ± 34.47	10.88 ± 14.97	7.47 ± 13.32	8.26 ± 15.70	0.43
Repetition	9.74 ± 8.50	16.85 ± 17.43	16.20 ± 17.70	6.78 ± 10.12	0.18
Stereotyped	8.83 ± 14.96	11.63 ± 18.46	20.18 ± 20.08	18.37 ± 16.90	0.11
Deviant	7.04 ± 9.67	7.70 ± 10.48	4.76 ± 9.70	6.25 ± 13.19	0.48
Symbolic noise	2.21 ± 4.89	0.92 ± 3.25	0.33 ± 1.20	0.23 ± 1.15	0.37
Incomplete	0.93 ± 2.78	14.57 ± 15.56	23.19 ± 22.02	21.94 ± 23.16	0.002

- 15% of the text units did not require further morphosyntactic analysis since they were considered unanalyzable. According to our findings, the youngest group had the lowest number of text units and the highest percentage of the unanalyzable text units. This finding is in line with the previous studies, indicating that younger children produce fewer utterances and a smaller number of different words within eight minutes of free play with examiners compared to their mothers (17).

In the present study, the participants had a significant difference only in terms of the percentage of the incomplete utterances. We did not investigate the reason behind the occurrence of the incomplete utterances although it is speculated that interruptions by the partner, noises, and starting a new subject may be some of the possible reasons.

According to our findings, the number of the stereo-

typed text units was high in the elder children since they sang their kindergarten songs and rhymes to the SLPs or the dolls. In addition, unintelligibility was one of the main reasons to stop the further analyses of the text units. This finding is in line with the results obtained in English studies. For instance, Hustad et al. (18) reported that approximately 85% of the words were intelligible in the typical children aged 55 months. Furthermore, the mentioned study demonstrated that the mean percentage of the correctly recognized words changed across the utterances length, and an upward trend was observed for 1 - 4 words utterances, followed by a descending trend. This finding could explain the pattern observed in the percentage of the unintelligible utterances across the age groups.

According to the literature, utterances with grammatical errors, which are categorized as deviants in the P-LARSP, are a common phenomenon when children acquire language (1, 19, 20). Due to the differences in the language grammars, our findings were only compared with Persian studies. Our participants aged 37 - 48 months had similar percentage of utterances with grammatical errors to those reported by Kazemi (1) for typical children aged 48 months. In the mentioned research, the participants produced 4% of the utterances with grammatical errors.

The ascending trend of the MLU in the present study is consistent with the previous studies in this regard (4-6) although the reported MLU values are mostly higher than the MLU obtained in our study. The discrepancy may be due to the differences in procedures to collect language samples, and to segment and include utterances. Utterances have often been excluded with one word, and studies merged two contexts to collect the language samples. In the current research, the MLU of the eldest age group was similar to the findings of Ghaderniya et al. (9). Furthermore, the MLU of the children in the youngest age group was close to the values reported by Ghelmani Pour (13) in children aged 18 - 21 (MLU = 1.6) and 21-24 months (MLU = 3.1). The discrepancy in this regard could be attributed to age allocations. We considered children aged 18 - 24 months as one group, while the age ranges in the mentioned study were 18 - 21 and 21 - 24 months. The MLU of the third age group (37 - 48 months) in the present study was also similar to the study by Kazemi (1) in children aged 48 months (mean: 3.83 ± 0.64 months) with the inclusion of one-word utterances.

In summary, applying the first and second sections of the P-LARSP for the analysis of language samples could provide a similar platform for SLPs in research and clinical fields, as well as proper numbers of analyzable utterances for language analysis. However, the settings and partners should be selected more carefully to reach a more representative language sample.

5.1. Limitations and Research Implications

We investigated the unanalyzable utterances in 10-minute examiner-elicited conversational samples during free play in a small group of typical children. Therefore, the results may not be generalizable to other sampling contexts. In addition, the effects of the communication partner, types of speaking tasks, and contexts/settings on the LSA measures have been documented by some studies, and our findings in this regard may apply to the LSA with similar procedures.

Acknowledgments

Footnotes

References

1. Kazemi Najafabadi Y. *Clinical assessment of Persian-speaking children with language impairment in Iran: exploring the potential of language sample measures.* UK: Newcastle University; 2013.
2. Paul R, Norbury CF. *Language disorders from infancy through adolescence.* USA: Elsevier Health Sciences; 2012.
3. Oryadi Zanjani MM, Bakhtiari BM, Vahab M, Jafari S. Efficiency of picture description and storytelling methods in language sampling according to the mean length of utterance index. *Audiology.* 2012;**21**(3).

4. Jalilevand N, Kamali M, Modarresi Y, Kazemi Y. The Persian developmental sentence scoring as a clinical measure of morphosyntax in children. *Med J Islam Republ Iran*. 2016;**30**:435.

5. Kazemi Y, Taheri A, Kianfar F, Shafiei M, Eslamifard R, Pirmoraian M, et al. Mean length of utterance (MLU) in typically-developing 2; 6-5; 6 year-old Farsi-speaking children in Iran. *J Res Rehabil Sci*. 2012;**8**(5):928–37.

6. Jalilevand N. *Speech & language development in Farsi-speaking children*. Thehran: Dangeh; 2012.

7. Finestack LH, Payesteh B, Disher JR, Julien HM. Reporting child language sampling procedures. *J Speech Lang Hear Res*. 2014;**57**(6):2274–9. doi: 10.1044/2014_JSLHR-L-14-0093. [PubMed: 25399013]. [PubMed Central: PMC4346310].

8. Afkhami I, Sharifi P. Comparison of Conversation, Freeplay, and Story Generation as Methods of Language Sample Elicitation in Persian Language Children. *Educ Psychol*. 2011;**7**(20):51–68.

9. Ghaderniya N, Alizadeh M, Jalilevand N, Jalaei S, MollaAghajani S. Language Sample Length Effect on Mean Length of Utterance in Morpheme in Normal Persian Children. *J Paramed Sci Rehabil*. 2019;**8**(1):17–25.

10. Crystal D. *Profiling linguistic disability*. 2nd ed. London, UK: Whurr Publishers Ltd; 1992.

11. Crystal D. *Working with LARSP*. London, UK: Edward Arnold Ltd; 1979.

12. Samadi H, Perkins M. 10 Persian: Devising the P-LARSP. In: Ball MJ, Crystal D, Fletcher P, editors. *Assessing Grammar*. Bristol, United Kingdom: Multilingual Matter; 2012. p. 167–88. doi: 10.21832/9781847696397-012.

13. Ghelmani Pour M. *The study of some of the morphosyntactical features of Persian typical children aged 1;6- 2;6 based on LARSP in Tehran*. Tehran: University of Social Welfare and Rehabilitation Sciences; 2006.

14. Fletcher P, Garman M. Larsping by numbers. *Int J Lang Commun Disord*. 1988;**23**(3):309–21. doi: 10.3109/13682828809011940.

15. Hunt KW. *Differences in grammatical structures written at three grade levels, the structures to be analyzed by transformational methods*. USA: Florida State University; 1964.

16. Guo LY, Eisenberg S. Sample length affects the reliability of language sample measures in 3-year-olds: evidence from parent-elicited conversational samples. *Lang Speech Hear Serv Sch*. 2015;**46**(2):141–53. doi: 10.1044/2015_LSHSS-14-0052. [PubMed: 25615272]. [PubMed Central: PMC4610271].

17. Bornstein MH, Haynes OM, Painter KM, Genevro JL. Child language with mother and with stranger at home and in the laboratory: a methodological study. *J Child Lang*. 2000;**27**(2):407–20. doi: 10.1017/s0305000900004165. [PubMed: 10967894].

18. Hustad KC, Schueler B, Schultz L, DuHadway C. Intelligibility of 4-Year-Old Children With and Without Cerebral Palsy. *J Speech Lang Hear Res*. 2012;**55**(4):1177–89. doi: 10.1044/1092-4388(2011/11-0083).

19. Eisenberg SL, Guo LY, Germezia M. How grammatical are 3-year-olds? *Lang Speech Hear Serv Sch*. 2012;**43**(1):36–52. doi: 10.1044/0161-1461(2011/10-0093). [PubMed: 22215529].

20. Guo LY, Eisenberg S, Schneider P, Spencer L. Percent Grammatical Utterances Between 4 and 9 Years of Age for the Edmonton Narrative Norms Instrument: Reference Data and Psychometric Properties. *Am J Speech Lang Pathol*. 2019;**28**(4):1448–62. doi: 10.1044/2019_AJSLP-18-0228. [PubMed: 31433664].