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Homogeneity of Variance of Content Understanding of the Written form of Expression of Deaf Children on the Basis of Measurement of Applied Language Constructions and Content within Linguistic Expression

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The study was conducted on a sample of 70 deaf children, chronologically aged from 10 to 18 years. Letters of deaf respondents on topics of their choice were used as a measurement instrument. The goals of the research are: To examine the homogeneity of variance of content understanding of written form of expression based on measurements of applied language constructions and content within language discourse, and to determine the statistical significance of content understanding of written form of expression using language constructions within language discourse. The second goal of the study was to examine the connection of language constructions in the applied measurement space of the number of used written expressions in the content understanding of written communication, and to determine the statistical significance of the connection of language constructions in the number of used written expressions in content understanding of written communication. The results of the research showed that the deaf population is characteristic and homogeneous in the way, style of writing and content understanding

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of the written text observed through linguistic discourse in written dialogue. In the written form of exchange of communication content, a significant degree of communication competence has been achieved, or the comprehensibility of the written form of expression in terms of content understanding. Deaf persons achieve very modest linguistic competence. The reduced ability of deaf children to achieve linguistic competence is reflected through the simplicity of statements in the substantive sense of preferring statements, as one of the characteristics of the linguistic competence of the deaf population.

Keywords: Deaf persons; communication competence; linguistic competence; homogeneity of variance.

1. INTRODUCTION

Language acquisition, or the formation of language competence occurs exclusively in the conditions of active speech communication which enables understanding and use of numerous speech-language constructions, or operations with meaningful language units phonemes, morphemes, words and sentences [1].

For deaf, communication problems arise from the nature of hearing loss, but also due to other factors arising from the personality of those who have suffered loss, as well as from the environment, or, willingness to communicate with these persons. The problem with children with prelingual hearing impairment does not lie in the foreground in the articulation and vocal elements of speech, but in the linguistic elements and meanings of words. Difficulties arise with the use of vocabulary, word meaning, grammar rules, syntax, reading, writing, difficulty memorizing words, understanding speech or expression [2]. Hearing provides access to acoustic information needed for oral communication [3]. Study has shown that most children with hearing impairment show significant delays in speech development and school achievement [4]. Children with hearing impairment also show lower scores in terms of motor skills and balance as opposed to children of normal development [5].

„Deaf children, from the impossibility of transforming the internal speech scheme into an expressive speech expression in mutual communication through letters, make maximum use of abbreviated speech schemes that determine the ability to communicate. The majority of deaf children (82.14%) have written communication competence, understand the messages from the received letters and respond adequately to the written content in accordance with the topic. A large percentage of deaf children (75.58%) do not have linguistic competence and in educational and in rehabilitation processes more should be done to improve the linguistic competence of deaf children. Agrammatic sentence structures, the presence of omissions, substitutions and lexical inversions, diminish the linguistic competence of the written form of communication of deaf children. About 24.42% of deaf children have linguistic competence in written communication. In written correspondence there is an intelligibility of short sentences composed of two or three words. Deaf children use language ideologies in their written communication, which they learn and use without any problems. Well-placed lexemes can be noticed in the content of sentences" [6].

„Most deaf children in their written form of communication of free choice of topics ask questions, which indicates the fact that in general the deaf population has a communicative interest in certain events or happenings. Deaf children in their written expression of free choice of topics ask questions that are not grammatically correct, but the recipients of the letter understand their essence and respond adequately to them, which indicates the communicative competence of deaf persons in written communication. Through an experimental program of applied free topics in the communication chain, it has been proven that although sentences are not linguistically correct, deaf children can use sentence structure in written communication. Deaf children are weaker in writing complex sentences compared to writing simple sentences, but there is the possibility of using complex sentences in written form of communication of free choice of topics. A large percentage of deaf children use complex sentences incorrectly in written communication of free choice of topics. Over 17% of deaf persons can use syntactically correctly written complex sentences in free writing style. Deaf children through written form can recognize and understand agrammatically and asyntactically constructed messages, and respond to written

content in the same way. Findings predominate in the free written form of deaf children, probably due to poorly developed vocabulary that hinders oral-voice, and thus written communication and forces hearing-impaired children to reduce in some way the information they send to the interlocutor„ [7].

Aims of the study:

- Test the homogeneity of variance of content understanding of written expression of deaf children based on measurements of applied language constructions and content within language discourse, and determine the existence of statistical significance of differences in content understanding of written expression using language constructions within language discourse.
- Examine the connection of language constructions in the applied measurement space of the number of used written expressions in the content understanding of written communication of deaf children, and determine the existence of statistical significance of the connection of language constructions of the number of used written expressions in content understanding of written communication.

2. METHODS

2.1 Sample of Respondents

The study was conducted on a sample of 70 respondents, deaf children aged 10 to 18, who attend primary and secondary school in educational and rehabilitation centers in Sarajevo, Tuzla and Banja Luka. All subjects had preserved intellectual status and hearing impairment above 75 dB.

2.2 Measurement Instrument and Method of Conducting Research

Letters of deaf respondents on topics of their choice were used as a measurement instrument. Deaf students were subjected to experimental conditions, which were provided by the method of subjecting respondents to communication exchange through writing. The experiment was conducted in such a way that the envelopes were distributed to the students and the postal delivery was improvised, so that at the recipient's own choice, the respondents sent a letter to the recipient. Letters were delivered to the written addresses, and the recipients were not informed that they would receive the letters. The letters were copied during the transport process, and the originals were delivered to the recipients. Based on the mail received, the respondents wrote answers to the written letter. The measurement instrument aimed to establish the number of simple and complex sentences, questions asked and answers to questions, as well as the scope of statements and messages used.

The applied variables of the measurement instrument are: Number of questions asked; Number of adequate answers to the questions asked; Number of simple sentences used; Number of complex sentences used; The number of correctly used sentences; Number of messages used and Number of statements used.

2.3 Data Processing Methods

Comparisons of arithmetic means by the One-way ANOVA method were used in the analysis, and the number of correctly used complex sentences was used as a general factor of linguistic competence. A linear one-way analysis model was used, and a Tukey test with a significance level of 0.05 was used for post-Hoc multiple variance compression. Basic statistical parameters with Random effect fixation and variance homogeneity test were calculated.

3. RESULTS AND DISCUSSION

3.1 Testing the Homogeneity of the Variance of the Applied Set of Variables

„Within the content understanding of written form of communication, there is a certain type of communication competence, because it is known that deaf children generally do not have linguistic competence, which is confirmed in all relevant studies, proves that deaf children have understanding of certain written content through some kind of communication competence. This implies that a word, although not grammatically correct, is a component of a sentence that is syntactically incorrect, and that the intention of the statement can be recognized through this construct. Which would mean that deaf children through written form can recognize certain messages agrammatically and asyntactically constructed, and respond to written content in the same way” [8]. To this end, a test of variance homogeneity was performed to determine

whether some of the entities have a distance from the arithmetic mean of the group within the group variance, and thus give a different picture of linguistic or communicative competence. The analysis was performed in the measurement areas of linguistic communication through the specified system of variables.

Testing the homogeneity of variance of the applied set of variables is important to determine the statistical significance of homogenization of linguistically used structures, to determine whether the subjects in the sample are homogeneous in a way that reflects the test results in relation to the population. Statistical significance was set at the significance level of p=0.05, ***and statistical significance at the level of p=0.00 was achieved on the variables „Number of used complex sentences" and „Number of messages used". This information is logical in justifying the communication competence of deaf children, because in their written discourse one can mostly notice the preference of messages as communication content,*** which is most likely the influence of children's presence on social networks, where they exchange messages in simple or short complex sentences.

3.2 Intergroup and Intragroup Analysis of the Variance of the Applied System of Linguistically Placed Structures

Table 2 shows the intergroup and intragroup analysis of variance of the applied system of linguistically set structures and calculated the statistical significance of variance in the subject measurement using the Fisher test. Based on arithmetic means, this variance indicates ***that the population is characterized by the way and style of writing, and content understanding of written text observed through this linguistic discourse, as indicated by the coefficients of statistical significance of intragroup and intergroup variance of applied variables.***

Table 1. Homogeneity test of variance

Variable	Coefficients (Tukey)	df1	df2	p
Number of asked questions	2.574	2	41	0.089
Number of adequate answers to the questions asked	3.523	2	41	0.039
Number of simple sentences used	1.870	2	41	0.167
Number of complex sentences used	10.760	2	41	0.000
Number of messages used	15.625	2	41	0.000
Number of statements used	1.627	2	41	0.209

Table 2. Analysis of variance

Variable	Variance	Sum	df	AS	F	p
Number of asked questions	Intergroup	56.35	3	18.78		
	Intragroup	936.23	41	22.83	0.82	0.49
Number of adequate answers	Intergroup	15.41	3	5.14		
to the questions asked	Intragroup	970.50	41	23.67	0.22	0.88
Number of simple sentences	Intergroup	147.70	3	49.23		
used	Intragroup	2012.88	41	49.10	1.00	0.40
Number of complex	Intergroup	36.92	3	12.31		
sentences used	Intragroup	655.52	41	15.99	0.80	0.52
Number of messages used	Intergroup	40.46	3	13.49		
	Intragroup	400.12	41	9.76	1.40	0.26
Number of statements used	Intergroup	34.22	3	11.41		
	Intragroup	938.23	41	22.88	0.50	0.69

Table 3. Intercorrelation relations in the space of applied variables

Variables	NoQ	NoAA	NoSS	NoCS	NoCCS	NoM	NoS
NoQ	1	**.555****	.141	.095	-.163	-.051	-.001
NoAA		1	-.162	.169	.024	-.017	.065
NoSS			1	-.148	-.200	.029	**.442****
NoCS				1	.171	-.004	.222
NoCCS					1	.275	-.073
NoM						1	.177
NoS							1

Legend: NoQ - Number of questions asked; NoAA- Number of adequate answers to the questions asked; NoSS- Number of simple sentences used; NoCS- Number of compound sentences used; NoCCS- Number of correctly used complex sentences; NoM - Number of messages used; NoS- Number of statements used.

3.3 The Connection of Language Constructions in the Applied Measurement Space of the Number of Used Written Expressions in the Content Understanding of the Written form of Communication

Table 3 shows the intercorrelation relations in the space of the applied variables of language constructions. Intercorrelation relations in the space of applied variables of language constructions were made due to confirmed homogeneous characteristics of the applied sample of respondents, in testing the comprehensibility of changed written contents in written expression among deaf children, based on which it was determined that in most communication competencies, with very modest linguistic competence of deaf children. The aim was to determine the quantity of questions asked in letters and the quantity of adequate answers to the question asked in conditions when words are written in agrammatic form, full of omissions, substitutions and metathesis. Also, the quantity of used simple and complex sentences was observed, then, the quantity of correctly used complex sentences, sent and received messages and statements.

Inspecting the table, it can be stated ***that a relatively high and statistically significant correlation was achieved between the quantity of questions asked and the quantity of adequate answers to questions, which points to the conclusion that a significant degree of communication competence was achieved between deaf respondents in written form of expression in terms of content understanding. Relatively moderate correlation was achieved on the variables of quantity of simple sentences used with the quantity of statements used, which confirms the reduced ability of deaf children to achieve linguistic competence, which in this experiment is reflected in the simplicity of statements in terms of content characterized as a statement, which is a characteristic of the linguistic competence of the deaf population.*** Other Pearson correlation coefficients are not statistically significant, but negative correlations can be seen that are present in the variables of use of complex sentences and the number of adequate answers to the questions asked.

Comparisons of arithmetic means by the One-way ANOVA method and the model of linear one-way analysis for the number of correctly used complex sentences as a general factor of linguistic competence were used to test the first goal of the research. On the test of homogeneity of variance, statistical significance was achieved at the level of p=0.05 for the number of used complex sentences and the number of used messages. ***Relatively high coefficients of the Tukey test indicate the present homogeneity of language discourse in relation to the tested population, which is evident from the intergroup and intragroup analysis of variance. The results of this test show that the population is characteristic and homogeneous in the way and style of writing and content understanding of the written text.***

In testing of the second research goal, a statistically significant association was found, which indicates „that deaf children have communication competence“. This correlation is reflected through the expressed statistically significant coefficients in the

correlation of the variables „number of questions asked“ and „number of adequate answers to questions“ (r=0.555), and variables „number of simple sentences used“ with „number of statements used“ (r=0.442). The correlation of Pearson correlation coefficients was tested at the level of statistical significance of p=0.00. ***This analysis confirms the second goal of the research that there is a connection between the linguistic constructions of the number of written expressions used in the content understanding of the written form of communication.***

3.4 Similar Studies

Achieving a systemic connection between oral voice and written text is of primary importance for deaf students and is considered the only causal rather than correlation variable in the development of literacy in deaf children. Difficulties in reading and writing and in hearing children can in many cases be attributed to deficits in phonological awareness [8].

There is a low level of literacy acquisition in students with severe hearing impairment due to differences between the underdeveloped speech-language system and the requirements for writing and reading in the speech environment of a deaf person [9].

Persons with hearing impairments have difficulty reading at the level of word recognition and progress in reading skills. Reading difficulties arise when the reader does not use contextual information to predict subsequent words and actions [10].

Persons with hearing impairment show difficulties and challenges in learning effective and fluent writing. About 50% of young deaf persons after high school read and write worse than a ten-year-old hearing child [11].

According to By Katherine (2008), research by Beck, McKeown and Kucan (2002), Biemiller and Boote (2006), Snow, Porche, Tabors and Harris (2007), showed that vocabulary development has a positive correlation with reading comprehension, and in order for a person to read with understanding he must know the meaning of the word, and therefore the development of vocabulary should begin as early as possible [12].

Rodriguez, Garcia, and Torres (1997), according to Herrera (2005), concluded that deaf persons analyze and process simple sentences in the same way as their hearing peers. Problems arise when faced with sentences of more complex structure, then the difficult syntactic abilities of the deaf come to the fore and then the deaf need extra help [13].

4. CONCLUSIONS

The population of deaf persons is characteristic and homogeneous in the way, style of writing and content understanding of written text observed through linguistic discourse in written dialogue, which is confirmed by the coefficients of statistical significance of intragroup and intergroup variance of applied variables. In the written form of exchange of communication content, a significant degree of communication competence has been achieved, or the comprehensibility of the written form of expression in terms of content understanding. Deaf persons achieve very modest linguistic competence. The reduced ability of deaf children to achieve linguistic competence is reflected through the simplicity of statements in the substantive sense of preferring statements, as one of the characteristics of the linguistic competence of the deaf population. In deaf persons, there is a negative correlation between the use of complex sentences and adequate answers to questions. A statistically significant correlation was found, which indicates that there is communication competence in deaf children. In deaf children, there is a connection between the linguistic constructions of the number of written expressions used in the content understanding of the written form of communication.

CONSENT

As per international standard, parental written consent has been collected and preserved by the author(s).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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