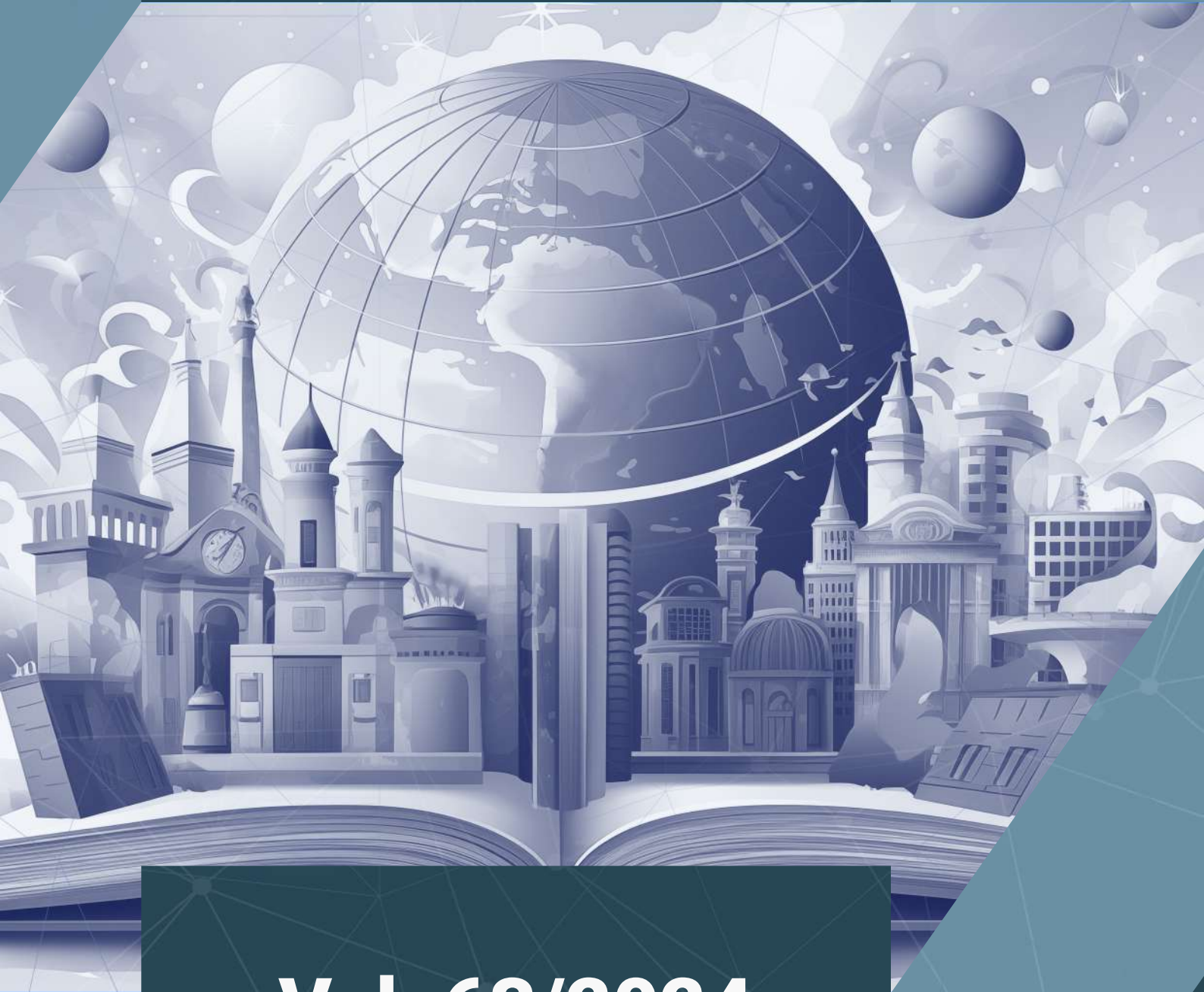




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Discrimination analysis of quantitative indicators of understanding the written form of deaf children's communication through the use of types of words

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Abstract. In deaf students, there is no contextual understanding and recognition of word types through linguistic competence testing compared to the hearing population, because 67.10% do not understand, and 10.00% of deaf children partially understand the contextual application of word types in a written text task. The aim of the study is to determine the distance of language discourse between deaf and hearing respondents and to establish a discrimination factor that can be used for practical purposes in a classification sense, with the aim of determining the priority of linguistic education and language elements of deaf children in relation to their lagging behind hearing children. The study was conducted on a sample of 140 respondents. The first subsample of respondents, the experimental group consisted of 70 deaf students, and the second subsample, the control group of 70 hearing students, of the same chronological age and gender. The measuring instrument "Test of comprehension of the written form of expression" was applied. The collected data were processed using the discriminant analysis method. The results of the study showed that the discrimination factor is in the sequence of the use of words, adjectives, exclamations and adverbs. Nouns and prepositions have a negative correlation, which points to the fact that these four types of words are in direct implication with nouns and prepositions, and represents information that these four types of words must be more represented in the educational materials of written expression of deaf children. The results of the study also open up a series of questions focused on the quality of the educational processes of deaf children, as well as the level of lag in written communication compared to hearing children. The results of the study can influence the raising of general rehabilitation procedures to a higher level of responsibility in education centers where deaf children are educated.

Keywords. deaf students, word types, written form of communication

1. Introduction

Language competence or language knowledge implies knowledge of the units of the language system at all levels: phonological, morphological, lexical, syntactic, semantic and textual level, and knowledge of the rules for combining language units and organizing them into higher order units (Jelaska, 2007). Language competences are linguistic and communicative competences. Linguistic competence includes theoretical knowledge of

language, and communicative competence includes practical knowledge of language, that is, practical use of theoretical knowledge (Aladrović, 2007).

The majority of deaf children (82.14 %) have written communication competence, they understand messages and respond adequately to the written content in accordance with the topic, but the majority of deaf children (75.58 %) do not have linguistic competence. Agrammatic sentence structures, the presence of omissions, substitutions and lexical inversions reduce 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, the comprehensibility of short sentences consisting of two or three words is present. Deaf children use language idioms in their written communication, which they learn and use without any problems. There are well-placed lexemes in the content of the sentences (Salkić, Hasanbegović, Švraka, 2018).

Deaf children can use dialogue in written communication, but in most cases, they use sentences that are not linguistically proper. They are weaker in writing complex sentences, but there is a possibility of using complex sentences. Over 17 % of deaf children can use syntactically proper complex sentences in written communication. Deaf children understand messages in the written form of communication, they have communicative but not linguistic competence (Salkić, Hasanbegović, Švraka 2019).

Deaf children have difficulty using pronouns, determiners, conjunctions, passives and conditional verbs such as: “may”, “can” and “should” (Wilbur, 2000). The four main omissions in the written expression of deaf and hard of hearing children are: prepositions, objects, verbs (especially auxiliary) and the strength of connections between words. In practice, deaf children who have mastered the phonological-morphological structure of the language can say and repeat a given sentence without understanding the meaning of the sentence and the message it carries, and have difficulty writing that sentence (Hasanbegović, 2009). With deaf students, there is no contextual understanding and recognition of word types through linguistic competence testing compared to the hearing population, because 67.10 % do not understand, and 10.00 % of deaf respondents partially understand the contextual application of word types in a written text task. In written communication, deaf students use nouns (65.70 %), pronouns (34.30 %), verbs (45.7 %), adjectives (28.60 %), adverbs (22.90 %), prepositions (54.30 %), exclamations (15.70 %), particles (12.90 %) and numbers (32.90 %) (Salkić, Mahmutović, 2023). When writing independently, hearing-impaired respondents, considering the type of word, mostly use nouns (51.61 %), followed by verbs (23.32 %), prepositions (8.10 %), then adjectives (4.70 %), pronouns (4.18 %), and conjunctions (3.22 %), numbers (1.91 %), adverbs (1.65 %) and particles (1.31 %) (Huremović, 2009). There are differences between deaf and hearing respondents in the quantitative use of word types in a written text task. Only 10% of deaf respondents understand and recognize the written form of expression in relation to the observed types of words. The majority of deaf respondents, 67.10 % of them, are not able to recognize and understand the contextual use of the observed types of words in the written form of the text task. Deaf respondents in the percentage of 22.90 % partially understand and recognize the contextual use of word types in the written text task. There are statistically significant differences between deaf and hearing respondents on all types of words except verbs (Salkić, Mahmutović, 2023). In speech, a deaf child usually uses only nouns and verbs, while omitting prepositions, pronouns and conjunctions (Kovačević, 2000). For deaf people to understand the read text, their ability to develop knowledge about the structure of the story and to use it properly is very important (Schirmer, 2003).

The aim of the study is to determine the distance of language discourse between deaf and hearing respondents and to establish a discrimination factor that can be used for practical purposes in a classification sense, with the aim of determining the priority of linguistic education and language elements of deaf children in relation to their lagging behind hearing children.

2. Methods

2.1. Sample

The study was conducted on a sample of 140 respondents. The total sample of respondents consisted of two subsamples. The first subsample of respondents (N=70), or the experimental group, consisted of deaf students chronologically aged from 10 to 18, who attend primary and secondary school in educational and rehabilitation centers in Sarajevo, Tuzla and Banja Luka. The second subsample of respondents (N=70), the control group consisted of hearing students of the same chronological age and gender, selected by random selection from the population of hearing students.

2.2. Measuring instrument and method of conducting the study

The vocabulary used by deaf children in their letters was used for the construction of a measuring instrument for assessing the linguistic competence of the written form of communication in deaf children (Salkić, Hasanbegović and Švraka, 2018. Content analysis of the written communication from of deaf children). The constructed test “*Test of understanding the written form of expression*” was modulated in such a manner that pictures were not described as suggested by Vladislavljević (1993), but based on the frequency representation of vocabulary in deaf children, a “text” was constructed, not a “comic” story for assessment of semantic levels of written communication of deaf children. For adequate measurement in the data processing process, the text was constructed in such a manner that each of the used types of words was numerically represented in a quantitative sequence. The study was conducted in such a manner that the respondents did not know that they were in an experimental situation, and it was organized in such a way as to simulate a regular school knowledge test in order to achieve the interest and motivation of students in the research process. The applied variables of the measuring instrument are: *Number of properly used nouns; Number of properly used pronouns; Number of properly used verbs; Number of properly used adjectives; Number of properly used adverbs; Number of properly used prepositions; Number of properly used exclamation points; Number of properly used particles and Number of properly used numbers.* Examination of conjunctions as a type of word was not done in this research, because the text task was constructed in such a way that the conjunctions in the task were a guide for recognizing other types of words and writing them on the empty lines to make it easier for the respondents to complete the tasks.

2.3. Data processing methods

Collected research data for determining the distance of language discourse between deaf and hearing respondents and determining the discrimination factor that can be used for practical purposes in the classification sense, with the aim of determining the priority of linguistic education and language elements of deaf children in relation to their lagging behind hearing children, were processed using the method of discrimination analysis.

3. Results and discussion

In the article “*Congruency of factor solutions of quantitative indicators of understanding of the written form of communication of deaf children through the use of types of words*” (Salkić, Povlakić Hadžiefendić 2024), factor analysis isolated three main factors linking types of words to the contextual relations of the written form of expression. In the first isolated factor, the hierarchical structure of tying types of words into the contextual relationships of the written form of expression goes in the direction of the proper use of verbs, prepositions, numbers and nouns. Orthogonal projections show a slight change towards the saturation of the coefficients, and include the proper use of prepositions, numbers, verbs and nouns. Another isolated factor shows a negative correlation between the proper use of adjectives and adverbs, indicating that deaf children are least taught these types of words. The third isolated factor goes in the direction of the proper use of exclamation points, particles and pronouns. In the hearing population, four main factors were singled out. In the first factor, the hierarchical structure of tying types of words into the contextual relationships of the written form of expression goes in the direction of the proper use of nouns, prepositions, verbs and pronouns, and in the second, in the direction of the proper use of exclamation points, adverbs and numbers. Particles are isolated in the third factor, and adjectives in the fourth. Considering such saturation of variability, it is possible to accurately determine in practice the direction of teaching deaf children the types of words in their native language. Isolated factors are part of separate, statistically unrelated entities in both deaf and hearing subjects and confirm the justification of successive teaching of the deaf according to the types of words that are present in the comparative analysis of hearing subjects.

After the correlative relationships were examined using the method of factor analysis, in which the intercorrelative relationships in the common space of the matrix assembly were isolated, and an insight into the factor solutions based on parallel and orthogonal projections of the variables was carried out, it was necessary to establish the distance of language discourse between the deaf and hearing respondents in order to a discrimination factor was established, which in a classification sense can be used for practical purposes, with the aim of determining the priority of linguistic education and linguistic elements of deaf children in relation to their lagging behind hearing respondents.

In this analysis, the Step-By-Step method was used, in order to extract, based on the logarithm of determinism and the Rank of the matrix assembly, the results on the applied variables that exactly show the F values of the discriminative characteristics between the two populations. For this purpose, determinization logarithms were calculated based on the separated group ranks of the covariance matrix, where for the experimental group it is - 0.187, and for the control group - 5.993. This calculation of the logarithm of determinism has a useful value in testing the covariance between populations, that is, checking whether the populations are the same in their covariances on the applied measuring instrument. To test the covariance between populations, the Box's M test was used, which is 234,822. Based on Box's results, it was established that the populations are not the same in their covariances on the applied measuring instrument, which can be seen in the table of equality of arithmetic means between the experimental and control groups.

Table 1. Test of equality of arithmetic means between applied groups

Variable	Wilks' Lambda	F	df1	df2	P
Properly used nouns	0.844	25.500	1	138	0.000
Properly used pronouns	0.896	16.103	1	138	0.000
Properly used verbs	0.995	0.645	1	138	0.423
Properly used adjectives	0.634	79.809	1	138	0.000
Properly used adverbs	0.677	65.721	1	138	0.000
Properly used prepositions	0.941	8.701	1	138	0.004
Properly used exclamations	0.669	68.361	1	138	0.000
Properly used particles	0.519	127.812	1	138	0.000
Properly used numbers	0.942	8.494	1	138	0.004

By observing the Table 1, the differences between the arithmetic means between the groups can be observed using the F test of the differences between the isolated first main measurements (WL) on all the applied word types. The F test reflects the significance of the differences and the higher it is, the more expressive the significance. In relation to the set criterion significance of $p=0.05$, it can be established that *only on the use of verbs as a type of word between the subsamples of respondents there is no statistically significant difference.*

Table 2. Isolated variables by the step-by-step method using the exact F test

Step	Variable	Wilks' Lambda							
		Lambda	df1	df2	df3	Exact F			
						Statistic	df1	df2	P
1	Proper use of particles	0.519	1	1	138	127.81	1	138	0.000
2	Proper use of adjectives	0.443	2	1	138	86.21	2	137	0.000
3	Proper use of nouns	0.383	3	1	138	73.11	3	136	0.000
4	Proper use of exclamations	0.349	4	1	138	62.96	4	135	0.000
5	Proper use of prepositions	0.328	5	1	138	54.90	5	134	0.000
6	Proper use of adverbs	0.311	6	1	138	49.11	6	133	0.000

Table 2 shows the isolated variables by the step-by-step method using the exact F test. By using this method, a maximum of 18 steps were used at the given values of the maximum F test of 3.84 and the minimum of 2.71. Based on the extraction of the coefficients of the exact F test from the nine applied types of words, the samples differ in statistical significance into six types of words, and the coefficients of the isolated variables in the statistical significances are classified through: proper use of particles, proper use of adjectives, proper use of nouns, proper use of exclamation points, proper use of prepositions and proper use of adverbs. The canonical correlation of the isolated function is 0.830, and the statistical significance of Wilks Lambda with H^2 score of 157.684 is $p=0.00$.

Table 3. Structure matrix

Variable	Function
Proper use of particles	0.647
Proper use of adjectives	0.511
Proper use of exclamations	0.473

Proper use of adverbs	0.464
Proper use of nouns	-0.289
Proper use of pronouns^x	0.231
Proper use of prepositions	-0.169
Proper use of verbs^x	-0.084
Proper use of numbers^x	-0.042

Legend: *x* = using the exact *F* test method excluded from the analysis

Table 3 shows the matrix of the structure. By examining the equality of group correlations between discriminating variables and standardized canonical functions, projections of variables that make up the discriminating factor and variables that were excluded from the analysis using the exact *F* test method were obtained. According to the logic of the discrimination method, the discrimination functions that arise from the relationship, the number of samples minus one, are isolated. ***In this comparison of results, one discrimination function was isolated. According to the magnitude of the correlation of the isolated discrimination function, the discrimination factor is in the order of the use of particles, adjectives, exclamations and adverbs. Nouns and prepositions have a negative correlation, which points to the fact that these four types of words are in direct implication with nouns and prepositions, and represents information that these four types of words isolated through the discrimination factor must be more represented in the educational materials of written expression of deaf children.*** By looking at the centroids between the groups, it can be seen that on the isolated discrimination function, the experimental group has a centroid of 1.478, and the control group -1.478, which represents a sufficient distance for the statistical significance of the use of word types between the groups to be maximally reflected through isolated analyzes of discrimination characteristics.

Conclusions

Discrimination analysis isolated one discriminating factor of language discourse between deaf and hearing children. According to the magnitude of the correlation of the isolated discrimination function, the discrimination factor is in the order of the use of particles, adjectives, exclamations and adverbs. Nouns and prepositions have a negative correlation, which points to the fact that these four types of words are in direct implication with nouns and prepositions, and represents information that these four types of words must be more represented in the educational materials of written expression of deaf children. The distance of the centroid on the isolated discriminant function shows a sufficient distance for the statistical significance of the use of word types between groups to be maximally reflected through isolated analyzes of discriminant characteristics.

The results of the research open up a series of questions focused on the quality of the educational processes of deaf children, as well as the level of lag in written communication compared to the hearing population of children. The results of the research can influence the raising of general rehabilitation procedures to a higher level of responsibility in education centers where deaf children are educated.

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