SOME OF THE PREDICTORS OF THE VOCABULARY SCOPE OF DEAF AND HARD-OF-HEARING STUDENTS

NEKI OD PREDIKTORA OBIMA RJEČNIKA GLUHIH I NAGLUHIH UČENIKA

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ABSTRACT

The main aim of the research is to examine the characteristics of the development of vocabulary of hearing impaired children of primary school age, the structure of vocabulary of certain word classes, and to determine whether the degree of hearing impairment, time of emergence of hearing impairment, chronological age, gender and school achievement (grade) in the subject of respondent's native language affect the vocabulary scope of deaf and hard-of-hearing students. The sample consisted of 65 hearing-impaired children of primary school age (grades 3rd to 8th). In accordance with the general objectives/aims, hypotheses, sample structure of respondents and analyzed variables, in the statistical processing of collected data, the following was applied: the method of descriptive statistics, variance analysis, discriminant analysis, and regression analysis. Based on the conducted research, we conclude that: there is a statistically significant difference in the vocabulary scope of certain word classes in respondents with hearing impairment. We also found that chronological age and school achievement (grade) in the subject of respondent's native language are relevant predictors of vocabulary scope and structure, while no statistically significant difference in the vocabulary scope of word classes in hearing impaired respondents was found in relation to gender, time of emergence of hearing impairment, and degree of hearing impairment

Key words: deafness, hard-of-hearing, vocabulary, predictors

SAŽETAK

Glavni cilj istraživanja je da se ispitaju karakteristike razvoja rječnika djece oštećena sluha osnovnoškolske dobi, struktura rječnika pojedinih vrsta riječi, te da se utvrdi da li stepen i vrijeme nastanka oštećenja sluha, hronološka dob, spol i uspjeh ispitanika iz maternjeg jezika, utiču na obim rječnika gluhih i nagluhih učenika. Uzorak je činilo 65 djece oštećena sluha osnovnoškolske dobi (od 3. do 8. razreda).

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U skladu sa opštim ciljevima, hipotezama, strukturom uzorka ispitanika i analiziranim varijablama, u statističkoj obradi prikupljenih podataka primjenjene su: metoda deskriptivne statistike, analiza varijance, diskriminativna analiza, te regresijska analiza. Na osnovu provedenog istraživanja, utvrdili smo da: postoji statistički značajna razlika u obimu rječnika pojedinih vrsta riječi u ispitanika oštećena sluha. Utvrdili smo da su hronološka dob i uspjeh iz maternjeg jezika relevantni prediktori obima i strukture rječnika, dok nije utvrđena statistički značajna razlika, u obimu rječnika vrsta riječi u ispitanika oštećenog sluha u odnosu na spol, vrijeme nastanka oštećenja sluha, stupanj oštećenja sluha.,

Ključne riječi: gluhoća, nagluhost, rječnik, prediktori.

INTRODUCTION

Hearing impairment is mostly reflected in the area of speech-language communication, given the fact that speech and language are spontaneously acquired through the sense of hearing (Avdić, 2015). At birth, a hearing-impaired child does not differ much from a non-hearing-impaired child. However, the consequences of hearing impairment are those that determine different trajectories in later development. The impossibility of complete perception of speech through the remnants of hearing and through "reading" speech from the face and lips is only one of many obstacles to the educability of a child with hearing impairment (Huremović, 2020). This is directly reflected in the quantity of concepts mastered by hearing-impaired children. Hearing impairment also has consequences for a person's bio-psycho-social structure. These consequences are conditioned by several factors. The literature most often mentions the degree of hearing impairment, the time of emergence of hearing impairment, the chronological age when the impairment occurred, the time of detection of impairment, the beginning of education and rehabilitation, the level of education of the environment in which a person with hearing impairment develops, and many other factors. This gives a very different picture of the difficulties that leave consequences in the psychological, emotional, social and cultural life of the person who has suffered the impairment. Within each of these groups, there are large individual differences, both in the character of the predictor and in the consequences it leaves on the overall development of the person. Moeller (1986; according to Wake, Poulakis, Hughes, Carey-Sargeant, & Rickards, 2004) considers that the time of diagnosis of the impairment is one of the most important factors that are reflected on the vocabulary scope: if hearing impairment is diagnosed before the 6th month of the child's age, on average, such children later are 3 years ahead of hearing impaired children in whom the impairment was diagnosed after the 6th month of the child's age in regard to language skills. Contradictory results were obtained by Wake et al. (2004). They examined 88 children, ages 7-8 years, who had been wearing a hearing aid for 4.5 years and had no additional intellectual or major physical disabilities. The time of diagnosis of hearing impairment and average hearing impairment on the better-hearing ear were set as predictors (21% of respondents had mild hearing impairment, 34% of respondents had moderate hearing impairment, 21% of respondents had severe hearing impairment and 24% of respondents were practically deaf).

The authors concluded that the time of diagnosis of the impairment is not statistically significant in correlation with language achievement, while the degree of hearing impairment is highly but negatively correlated with vocabulary scope, i.e. the higher the degree of hearing impairment the smaller the vocabulary scope. However, it is not uncommon for children who we would expect to achieve better results during the educational process, in relation to these factors, to surprise us with their achievements and lead to the conclusion that it is necessary to examine the level of influence of individual factors or predictors.

AIM OF THE RESEARCH

The main aim of the research was to determine whether and to what extent some of the predictors affect the vocabulary scope of deaf and hard-of-hearing children. In accordance with the aim defined in this way, at the beginning of the research the hypothesis was set:

H_1 – The degree of hearing impairment, the time of emergence of hearing impairment, chronological age, gender, and school achievement (grade) in the subject of respondent's native language are predictors of the vocabulary scope of deaf and hard-of-hearing children.

RESEARCH METHODS
Sample of respondents

The research sample consisted of 65 hearing-impaired respondents, who were attending primary school at the time of the research. The eliminatory control characteristics of the respondents were: diagnosed additional difficulties of the respondents. Respondents were classified into several groups according to the following criteria: chronological age, gender, degree of hearing impairment, time of emergence of hearing impairment, and school achievement (grade) in the subject of respondent's native language. According to chronological age, the respondents were classified into 7 groups. The first group consisted of 6 respondents aged 9. The second group consisted of 5 respondents aged 10. The third group consisted of 11 respondents aged 11. The fourth group consisted of 8 respondents aged 12. The fifth group consisted of 9 respondents aged 13. The sixth group consisted of 20 respondents aged 14. The seventh group consisted of 6 respondents aged 15. According to the gender criterion, the respondents were classified into two groups. The first group consisted of 35 male respondents, and the second group consisted of 30 female respondents. According to the criterion of the degree of hearing impairment, the respondents were classified into 4 groups. The first group consisted of 10 respondents with moderate hearing loss. The second group consisted of 34 respondents with severe hearing loss. The third group consisted of 17 respondents who were practically deaf, while the fourth group consisted of 4 respondents with an implanted cochlear implant. According to the criterion of the time of emergence of hearing impairment, the respondents were classified into two groups.

The first group consisted of 62 respondents whose impairment emerged in the prelingual period, and the second group consisted of three respondents whose impairment emerged in the postlingual period. According to the criterion of school achievement (grade) in the subject of respondent's native language, the respondents were classified into three groups. Since only two respondents achieved a "D" grade in the subject of native language, together with respondents who achieved a "C" grade, they were classified in the first group. The first group consisted of a total of 18 respondents. The second group consisted of 21 respondents who achieved a "B" grade. The third group consisted of 26 respondents who achieved an "A" grade.

Measuring instrument

To assess the scope of the vocabulary, we used the Diagnostic Material for Oral Speech Examination - Vocabulary Development Examination Area (Bjelica and Posokhova, 2001). The main reason why we opted for this instrument is that it allows us to accurately identify areas that create difficulties for hearing-impaired children. It consists of several areas: vocabulary of nouns, vocabulary of adjectives, vocabulary of verbs, vocabulary of adverbs, vocabulary of prepositions, and vocabulary of pronouns. Data such as the degree of hearing impairment, time of emergence of hearing impairment, chronological age, gender, and school achievement (grade) in the subject of respondent's native language were taken from the Anamnestic data of the respondents

Method of conducting research

The data collection procedure was preceded by preparation, a "Research Notice" was sent to institutions where hearing-impaired children are educated, which contained information about the research itself, the aim of the research, the manner of conducting the research, and the conditions necessary for conducting the research. Data collection was conducted individually, in optimal conditions. During the examination, respondents with hearing impairment were wearing an individual hearing amplifier. The method of conducting the examination was adapted to the respondents, taking into account the very nature of the impairment. Instructions for performing tasks and explanations were given orally and by using sign language. The profiles of the respondents also include the Anamnestic data, which contains information gathered by interviewing informants or by analyzing documentation.

Data processing methods

In accordance with the general aims, hypotheses, the structure of the sample of respondents and the analyzed variables, appropriate statistical procedures were applied in the statistical processing of the collected data. We used the method of descriptive statistics, i.e. the calculation of basic statistics: mean values, standard deviations, variances, standard errors, and minimum and maximum values; to examine variations between groups and within groups. The examining of the significance of variations was performed using the method of variance analysis. The examining of the significance of the model set up, in order to predict the development of vocabulary in respondents with intact hearing, was performed using the method of regression analysis.

RESULTS AND DISCUSSION

Respondents with hearing impairment wrote a total of 14080 words on the "Vocabulary Development Examination" test. 7204 words were nouns, 3885 were adjectives, 1065 were verbs, 954 were adverbs, 439 were prepositions and 533 were pronouns (Table 1). Since the data on the development of the vocabulary were collected by writing, in addition to correctly spelled words, we accepted those words that have been changed, regardless of whether it is a metathesis, addition, substitution, omission or citation of the changed word form, as long as it does not interfere with understanding. Regardless if the words are given/written in a grammatical case or wrong gender or grammatical number - if they don't interfere with the understanding, we have classified them as acceptable. Words that were altered/changed, and could not be correlated to anything, were not accepted, such as e.g. (Bosnian) „todo", „nedi", „žado", „dapo". The highest maximum and minimum results, as well as the highest mean values, but also the values of standard deviations, were achieved in the area of vocabulary of nouns, then in the area of vocabulary of adjectives and further as follows: verbs, adverbs, prepositions and pronouns (Table 1).

Table 1. Descriptive statistics of respondents' vocabulary development

	Arithmetic mean	Standard deviation	Minimum	Maximum	Total
Nouns	110,83	59,67	6,00	221,00	7204
Adjectives	59,78	28,68	1,00	102,00	3885
Verbs	16,38	12,06	,00	36,00	1065
Adverbs	14,67	9,46	,00	31,00	954
Pronouns	8,20	4,56	3,00	15,00	533
Prepositions	6,75	3,98	2,00	12,00	439
Total	216,63	112,12	12,00	412,00	14080

Impact of respondent's chronological age on the vocabulary scope and structure

The chronological age of the respondents ranged from 9 to 15 years. Respondents aged 9 years wrote a total of 189 words, of which as many as 110 were nouns, followed by adjectives (32), pronouns (18), prepositions (18), verbs (10) and adverbs (7). Respondents aged 10 years wrote a total of 612 words. Regarding these words, 316 of them were nouns, 180 were adjectives, 35 were adverbs, 32 were verbs, 27 were pronouns and 22 written words were prepositions. Respondents aged 11 years wrote a total of 2,045 words. Regarding these words, 1006 of them were nouns, 633 were adjectives, 146 were verbs, 137 were adverbs, 67 were pronouns and 55 words were prepositions. Respondents aged 12 years wrote a total of 2167 words, of which as many as 1079 were nouns, then followed by adjectives (592), verbs (179), adverbs (149), pronouns (90) and prepositions (78). Respondents aged 13 years wrote a total of 2343 words. Regarding these words, 1185 of them were nouns, 654 were adjectives, 176 were verbs, 170 were adverbs, 87 were pronouns and 71 words were prepositions. Respondents aged 14 years wrote a total of 5,325 words. Regarding these words, 2752 of them were nouns, 1410 were adjectives, 454 were verbs, 356 were adverbs, 194 were pronouns and 159 words were prepositions.

Respondents aged 15 years wrote a total of 1,400 words. Regrading these words, 755 of them were nouns, 385 were adjectives, 100 of them were adverbs, 58 were verbs, 50 were pronouns and 42 words were prepositions. Based on the results of descriptive statistics, mean values and values of standard deviations (Table 2), we can conclude that the vocabulary scope of all word classes increases through the function of chronological age.

Table 2. Descriptive statistics of vocabulary development in relation to chronological age

		Maximum	Minimum	Arithmetic mean	Standard deviation	N
9	Nouns	35,00	7,00	18,33	10,74	6
	Adjectives	10,00	2,00	5,33	2,87	6
	Verbs	3,00	1,00	1,67	,81	6
	Adverbs	2,00	,00	1,17	,98	6
	Prepositions	2,00	2,00	2,00	,00	6
	Pronouns	3,00	3,00	3,00	,00	6
10	Nouns	136,00	6,00	63,20	49,57	5
	Adjectives	72,00	1,00	36,00	29,62	5
	Verbs	18,00	,00	6,40	6,87	5
	Adverbs	28,00	,00	7,00	11,78	5
	Prepositions	8,00	2,00	4,40	2,60	5
	Pronouns	9,00	3,00	5,40	2,61	5
11	Nouns	191,00	11,00	91,45	54,32	11
	Adjectives	88,00	6,00	57,54	23,74	11
	Verbs	33,00	1,00	13,27	11,73	11
	Adverbs	28,00	2,00	12,45	8,98	11
	Prepositions	11,00	2,00	5,00	3,32	11
	Pronouns	13,00	3,00	6,09	3,51	11
12	Nouns	221,00	91,00	134,87	44,13	8
	Adjectives	100,00	55,00	74,00	15,52	8
	Verbs	34,00	10,00	22,38	10,01	8
	Adverbs	30,00	8,00	18,62	7,44	8
	Prepositions	12,00	6,00	9,75	1,91	8
	Pronouns	15,00	7,00	11,25	2,49	8
13	Nouns	211,00	54,00	131,66	59,09	9
	Adjectives	98,00	17,00	72,66	23,35	9
	Verbs	36,00	3,00	19,55	11,64	9
	Adverbs	30,00	2,00	18,88	9,07	9
	Prepositions	12,00	2,00	7,88	4,01	9
	Pronouns	15,00	3,00	9,67	4,8990	9
14	Nouns	220,00	60,00	137,60	51,52	20
	Adjectives	102,00	17,00	70,50	21,89	20
	Verbs	36,00	4,00	22,70	10,49	20
	Adverbs	31,00	8,00	17,80	7,37	20
	Prepositions	12,00	2,00	7,95	4,15	20
	Pronouns	15,00	3,00	9,70	4,91	20
15	Nouns	176,00	85,00	126,00	31,30	6
	Adjectives	85,00	25,00	64, 00	20,73	6
	Verbs	31,00	0,00	11,33	11,21	6

Adverbs	24,00	5,00	16,67	8,19	6
Prepositions	11,00	2,00	7,00	4,10	6
Pronouns	13,00	3,00	8,33	4,50	6

In order to examine the significance of differences in the arithmetic means of groups of respondents, classified by chronological age, the method of variance analysis was applied in the development of vocabulary. Given the results of the analysis (Table 3), we can conclude that there is a statistically significant difference in the development of the vocabulary of all word classes in hearing-impaired respondents in relation to chronological age.

Table 3. Variance analysis of the vocabulary development in relation to chronological age

Source of variation		Sum of squares	df	Centre of square	F	sig.
Nouns	Between groups	91052,60	6	15175,43	6,43	0,00
	Within groups	136814,54	58	2358,87		
	Total	227867,14	64			
Adjectives	Between groups	26186,48	6	4364,41	9,56	0,00
	Within groups	26491,06	58	456,74		
	Total	52677,54	64			
Verbs	Between groups	3233,04	6	538,84	5,14	0,00
	Within groups	6076,35	58	104,76		
	Total	9309,38	64			
Adverbs	Between groups	1947,36	6	324,56	4,98	0,00
	Within groups	3780,86	58	65,19		
	Total	5728,22	64			
Prepositions	Between groups	309,52	6	51,59	4,26	0,00
	Within groups	702,54	58	12,11		
	Total	1012,06	64			
Pronouns	Between groups	389,26	6	64,88	3,98	0,00
	Within groups	945,14	58	16,30		
	Total	1334,40	64			
Total	Between groups	352063,57	6	58677,26	7,52	0,00
	Within groups	452525,57	58	7802,16		
	Total	804589,14	64			

Shafiei & Nemat Zadeh (2004) found that hearing-impaired children at the age of 10 achieve poorer results in the ability to process and associate words, primarily antonyms and synonyms. The same authors point out that the ability to learn these concepts develops with the increase of chronological age, which is related to the quantity of language experiences. These results suggest that chronological age is a significant predictor of vocabulary development in hearing-impaired children, but they also indicate that there are other equally significant predictors that have led to this redistribution of results.According to the results of regression analysis (Table 4), the correlation coefficient (0.553) leads us to the conclusion that this is a moderate degree of correlation between the results of the respondents in relation to the chronological age. Based on the coefficient of determination (0.306), we conclude that the chronological age with a percentage of 30.60% determines the number of points achieved

on the test, and the rest is the influence of other factors. We found that the chronological age of the respondents as a predictor was significant in the model.

Table 4. Regression analysis of the vocabulary development results in relation to age

PREDICTOR		CRITERION
Age		Total points achieved
R		,553
R^2		,306
df_1		1
df_2		63
F		27,77
Sig. F		0,00
const.		0,00
b		-203,10
b_1		33,76
β		,553
t	Age	-2,523
	Age **2	5,27
sig. t	age	,014
	Age **2	,000

Impact of respondent's gender on the vocabulary scope and structure

According to the results of descriptive statistics, male and female respondents achieved approximately equal average values, with equally approximate values of standard deviations, and minimum and maximum results on all test variables of the Vocabulary Development Examination Test (Table 5).

Table 5. Descriptive statistics of respondents' vocabulary development in relation to gender

		Max.	Min.	Arithmetic mean	Standard deviation	Total
Female	Nouns	221,00	6,00	114,87	60,09	3446
	Adjectives	102,00	1,00	58,80	29,68	1764
	Verbs	36,00	,00	16,07	12,20	482
	Adverbs	31,00	,00	13,00	9,18	390
	Prepositions	12,00	2,00	6,43	4,04	193
	Pronouns	15,00	3,00	7,8667	4,66	236
	Total	-	-	217,03	113,42	6511
Male	Nouns	220,00	10,00	107,37	59,96	3758
	Adjectives	98,00	3,00	60,60	28,2189	2121
	Verbs	36,00	1,00	16,65	12,1145	583
	Adverbs	30,00	,00	16,11	9,5971	564
	Prepositions	12,00	2,00	7,03	3,9592	246
	Pronouns	15,00	3,00	8,49	4,5333	297
	Total	-	-	216,2857	112,6600	7570

In order to examine the significance of differences in the arithmetic means of groups of respondents, classified by gender, the method of variance analysis was applied in the development of the vocabulary. Given the results of the analysis (Table 6), we can conclude that there is no statistically significant difference in the vocabulary scope of certain word classes in hearing-impaired respondents in relation to gender.

Table 6. Variance analysis of respondents' vocabulary development in relation to gender

Source of variation		Sum of squares	df	Centre of square	F	sig.
Nouns	Between groups	907,50	1	907,500	,252	,617
	Within groups	226959,63	63	3602,534		
	Total	227867,13	64			
Adjectives	Between groups	52,33	1	52,338	,063	,803
	Within groups	52625,20	63	835,321		
	Total	52677,53	64			
Verbs	Between groups	5,63	1	5,632	,038	,846
	Within groups	9303,75	63	147,679		
	Total	9309,38	64			
Adverbs	Between groups	156,67	1	156,673	1,772	,188
	Within groups	5571,54	63	88,437		
	Total	5728,21	64			
Prepositions	Between groups	5,72	1	5,723	,358	,552
	Within groups	1006,33	63	15,974		
	Total	1012,06	64			
Pronouns	Between groups	6,19	1	6,190	,294	,590
	Within groups	1328,21	63	21,083		
	Total	1334,40	64			
Total	Between groups	9,02	1	9,029	,001	,979
	Within groups	804580,11	63	12771,113		
	Total	804589,13	64			

Impact of time of emergence of hearing impairment on the vocabulary scope and structure

A large number of researches point out that children who lost their hearing in a later period remember sound performances and use them. These sound performances are further reinforced through visual, tactile, and other extra-auditory pathways. The consequences of hearing impairment on speech and language development are more pronounced in those individuals in whom hearing loss occurred earlier. However, in our study, according to the results of descriptive statistics, respondents classified into groups according to the criterion of whether hearing impairment emerged prelingually or postlingually, achieved approximately equal average values, with equally approximate values of standard deviations, and minimum and maximum results on all test variables on the Vocabulary Development Examination Test (Table 7). The reason for such results is the insufficient differentiation of the sample in relation to this criterion, which should be kept in mind when interpreting the results and which should be taken into account in future tests.

Table 7. Descriptive statistics of respondents' vocabulary development in relation to the time of emergence of hearing impairment

		Maximum	Minimum	Arithmetic mean	Standard deviation
Prelingual	Nouns	221,00	6,00	107,80	58,64
	Adjectives	100,00	1,00	59,24	28,35
	Verbs	36,00	,00	16,12	11,83
	Adverbs	30,00	,00	14,38	9,35
	Prepositions	12,00	2,00	6,69	3,99
	Pronouns	15,00	3,00	8,12	4,57
	Total	-	-	212,40	110,75
Postlingual	Nouns	216,00	113,00	173,33	53,72
	Adjectives	102,00	25,00	70,66	40,45
	Verbs	36,00	1,00	21,66	18,33
	Adverbs	31,00	8,00	20,66	11,67
	Prepositions	12,00	4,00	8,00	4,00
	Pronouns	15,00	5,00	9,66	5,03
	Total	-	-	304,00	127,05

In order to examine the significance of differences in the arithmetic means of groups of respondents, classified according to the time of emergence of hearing impairment in the development of vocabulary, the method of variance analysis was applied. According to the results shown in Table 8, we conclude that there is no statistically significant difference in the vocabulary scope of word classes in hearing-impaired respondents, in relation to the time of emergence of hearing impairment.

Table 8. Variance analysis of vocabulary development in relation to the time of emergence of hearing impairment

Source of variation		Sum of squares	df	Centre of square	F	sig.
Nouns	Between groups	12286,79	1	12286,79	3,591	,063
	Within groups	215580,34	63	3421,910		
	Total	227867,14	64			
Adjectives	Between groups	373,50	1	373,50	,450	,505
	Within groups	52304,04	63	830,23		
	Total	52677,54	64			
Verbs	Between groups	87,75	1	87,75	,599	,442
	Within groups	9221,63	63	146,37		
	Total	9309,38	64			
Adverbs	Between groups	112,84	1	112,83	1,266	,265
	Within groups	5615,37	63	89,13		
	Total	5728,21	64			
Prepositions	Between	4,88	1	4,88	,306	,582

	groups					
	Within groups	1007,17	63	15,98		
	Total	1012,06	64			
Pronouns	Between groups	6,766	1	6,76	,321	,573
	Within groups	1327,63	63	21,07		
	Total	1334,40	64			
Total	Between groups	24008,22	1	24008,22	1,938	,169
	Within groups	780580,92	63	12390,17		
	Total	804589,14	64			

Discriminant analysis produced one discriminant function that did not prove statistically significant. Similar results are obtained by Wake et al. (2004). The authors concluded that the time of emergence of hearing impairment and diagnosis of impairment is not statistically significant in correlation with language and vocabulary achievement. Moeler (1986; according to Wake et al., 2004), however, prefers the time of diagnosis of impairment, as a factor that reflects on the volume of vocabulary: if hearing impairment is diagnosed before 6 months of age, on average, such children later in language skills were 3 years in front of hearing-impaired children in whom the impairment was diagnosed after 6 months of age of the child.

Impact of the degree of hearing impairment on the respondents' vocabulary scope and structure

According to the results of descriptive statistics, respondents with moderate hearing loss achieved better average results compared to other groups. It was observed that respondents with severe hearing loss achieved on average the weakest average results compared to the remaining groups of respondents, on all variables of the Test (Table 9).

Table 9. Descriptive statistics of vocabulary development in relation to the degree of hearing impairment

		Max	Min	Arithmetic mean	Standard deviation	Total
Moderate hearing loss	Nouns	216	65	133,40	53,42	1334
	Adjectives	102	25	66,50	23,77	665
	Verbs	36	1	19,50	13,58	195
	Adverbs	31	2	16,20	10,54	162
	Prepositions	12	4	8,70	3,20	87
	Pronouns	15	5	10,40	4,01	104
	Total	-	-	254,70	100,16	2547
Severe hearing loss	Nouns	221	6	97,79	61,68	3325
	Adjectives	100	1	52,79	30,53	1795
	Verbs	36	0	13,41	11,84	456
	Adverbs	30	0	12,03	9,45	409
	Prepositions	12	2	5,71	3,99	194

	Pronouns	15	3	7,06	4,55	240
	Total	-	-	188,82	115,55	6420
Total deafness	Nouns	220	11	120,35	54,41	2046
	Adjectives	98	6	69,41	22,94	1180
	Verbs	36	1	20,71	10,79	352
	Adverbs	30	2	18,41	7,48	313
	Prepositions	12	2	7,24	3,85	123
	Pronouns	15	3	8,65	4,37	147
	Total	-	-	244,76	98,58	4161
Children with implanted cochlear implant	Nouns	186	20	124,75	73,24	499
	Adjectives	90	5	61,25	39,61	245
	Verbs	29	1	15,5	12,15	62
	Adverbs	26	2	17,5	10,88	70
	Prepositions	12	2	8,75	4,57	35
	Pronouns	15	3	10,5	5,26	42
	Total	-	-	238,25	143,90	953

In order to examine the significance of differences in the arithmetic means of groups of respondents, classified according to the degree of impairment in vocabulary development, the method of variance analysis was applied. Given the results of the analysis (Table 10), we can conclude that there is no statistically significant difference in the vocabulary scope of all word classes in hearing-impaired respondents in relation to the degree of hearing impairment. This is supported by the results of Mayne (1999), where the degree of hearing impairment also did not prove to be a significant predictor of vocabulary scope in hearing-impaired children. However, Wake, et al. (2004) point out that the degree of hearing impairment is highly but negatively correlated with the vocabulary scope, i.e. the higher the degree of hearing impairment the smaller the vocabulary scope/volume. Kovačević (2006) points out that the degree of hearing impairment has an impact on the degree of vocabulary acquisition. Frisch & Pisoni (1998) conclude that better results on the vocabulary test are achieved by hearing-impaired respondents who use a cochlear implant, and who have undergone, as the authors themselves call a "total communication program," compared to those respondents who have undergone an "oral communication program". Eisenberg, Kirk, Martinez, Ying, & Miyamoto (2004) examined language abilities/skills in children with implanted cochlear implants and children who used standard hearing aids. Respondents with standard hearing aids achieved significantly higher scores than respondents with cochlear implants. According to the authors, the reason for this is that the group of respondents with a cochlear implant is significantly lower in chronological age than the group of respondents with hearing aids, and that they had slightly less experience with their new aids during the examination.

Table 10. Variance analysis of vocabulary development in relation to the degree of hearing impairment

Source of variation		Sum of squares	df	Centre of square	F	sig.
Nouns	Between groups	13188,55	3	4396,18	1,25	0,30
	Within groups	214678,59	61	3519,32		
	Total	227867,14	64			
Adjectives	Between groups	3696,61	3	1232,20	1,53	0,21
	Within groups	48980,93	61	802,97		
	Total	52677,54	64			
Verbs	Between groups	718,12	3	239,37	1,70	0,18
	Within groups	8591,26	61	140,84		
	Total	9309,38	64			
Adverbs	Between groups	530,53	3	176,84	2,08	0,11
	Within groups	5197,69	61	85,21		
	Total	5728,22	64			
Prepositions	Between groups	95,09	3	31,70	2,11	0,11
	Within groups	916,97	61	15,03		
	Total	1012,06	64			
Pronouns	Between groups	117,24	3	39,08	1,96	0,13
	Within groups	1217,16	61	19,95		
	Total	1334,40	64			
Total	Between groups	56108,29	3	18702,76	1,52	0,22
	Within groups	748480,85	61	12270,18		
	Total	804589,14	64			

Discriminant analysis produced three functions, none of which were statistically significant. Based on the analysis, we conclude that the degree of hearing impairment did not prove to be a relevant predictor of the vocabulary scope of the hearing-impaired respondents.

The impact of school achievement (grade) in the school subject of respondent's native language on respondents' vocabulary scope and structure

The results of descriptive statistics indicate that the vocabulary scope of all word classes in hearing-impaired respondents increases linearly with an increase in the achievement/grade from the respondent's native language school subject. Thus, respondents who achieved "A" grades in their native language school subject wrote on average the largest number of words regardless of the word class, with the lowest values of standard deviations.

Table 11. Descriptive statistics of vocabulary development in relation to school achievement (grade) in the school subject of respondent's native language

		N	Arithmetic mean	Standard deviation	Min	Max
Nouns	Grade "C"	18	35,47	25,05	6,00	132,00
	Grade "B"	21	106,71	50,24	11,00	202,00
	Grade "A"	26	148,08	52,15	35,00	221,00
	Total	65	110,83	59,66	-	-
Adjectives	Grade "C"	18	20,20	14,82	1,00	72,00
	Grade "B"	21	62,76	20,06	6,00	91,00
	Grade "A"	26	75,61	22,37	10,00	102,00
	Ukupno	65	59,76	28,68	-	-
Verbs	Grade "C"	18	3,25	2,68	0,00	14,00
	Grade "B"	21	17,71	10,35	1,00	36,00
	Grade "A"	26	22,92	11,76	,00	36,00
	Ukupno	65	16,38	12,06	-	-
Adverbs	Grade "C"	18	8,56	6,58	,00	18,00
	Grade "B"	21	14,33	8,44	2,00	30,00
	Grade "A"	26	19,76	8,95	2,00	31,00
	Ukupno	65	14,67	9,46	-	-
Prepositions	Grade "C"	18	5,25	3,54	2,00	11,00
	Grade "B"	21	6,19	3,77	2,00	12,00
	Grade "A"	26	8,50	3,84	2,00	12,00
	Ukupno	65	6,75	3,97	-	-
Pronouns	Grade "C"	18	6,37	3,77	3,00	13,00
	Grade "B"	21	7,47	4,23	3,00	15,00
	Grade "A"	26	10,30	4,59	3,00	15,00
	Ukupno	65	8,20	4,56	-	-
Total	Grade "C"	18	131,37	78,43	12,00	247,00
	Grade "B"	21	215,19	90,00	25,00	383,00
	Grade "A"	26	285,19	97,19	55,00	412,00
	Total	65	216,63	112,12	-	-

Thus, students who achieved an "A" grade in the school subject of native language wrote on average from 8 words in the vocabulary area of pronouns to 148 words in the vocabulary area of nouns. There were minimal differences in the achieved maximum and minimum results in students with an "A" grade and a "B" grade in the school subject of native language. Students with an average grade of "B" in the school subject of native language wrote from 6 words in the vocabulary area of prepositions to 117 words in the vocabulary area of nouns. Students with a "C" grade and below wrote from 0 words in the vocabulary area of verbs to 68 words in the vocabulary area of nouns.

In order to examine the significance of differences in the arithmetic means of groups of respondents, classified according to school achievement (grade) in the school subject of native language in relation to the results of vocabulary development, the method of variance analysis was applied (Table 12).

We can conclude that there is a statistically significant difference in the vocabulary scope of all word classes in hearing-impaired respondents in relation to the school achievement (grade) in the school subject of native language.

Table 12. Variance analysis of vocabulary development in relation to school achievement (grade) in the school subject of native language

Source of variation		Sum of squares	df	Centre of square	F	sig.
Nouns	Between groups	85004,06	3	28334,69	12,09	,000
	Within groups	142863,06	61	2342,01		
	Total	227867,13	64			
Adjectives	Between groups	21321,13	3	7107,04	13,826	,000
	Within groups	31356,40	61	514,03		
	Total	52677,53	64			
Verbs	Between groups	3378,75	3	1126,25	11,584	,000
	Within groups	5930,63	61	97,22		
	Total	9309,38	64			
Adverbs	Between groups	1648,99	3	549,66	8,220	,000
	Within groups	4079,22	61	66,87		
	Total	5728,21	64			
Prepositions	Between groups	167,32	3	55,77	4,028	,011
	Within groups	844,73	61	13,84		
	Total	1012,06	64			
Pronouns	Between groups	233,87	3	77,95	4,321	,008
	Within groups	1100,52	61	18,04		
	Total	1334,40	64			
Total	Between groups	313931,61	3	104643,87	13,010	,000
	Within groups	490657,52	61	8043,56		
	Total	804589,13	64			

CONCLUSIONS

The results obtained during the research can be reduced to the following conclusions:

- Respondents with hearing impairment wrote a total of 14080 words on the Vocabulary Development Examination test. 7204 words were nouns, 3885 words were adjectives, 1065 words were verbs, 654 words were adverbs, 438 words were prepositions, and 893 words were pronouns. There is also a statistically significant difference in the vocabulary scope of certain word classes.
- The analysis of the volume and structure of the vocabulary of hearing-impaired respondents in relation to chronological age showed that the best results were achieved by respondents aged 12 , then by respondents aged 13, 15, 14, 10 and 9. Since the increase in chronological age can be related to the quantity of language experiences/skills, such results suggest that chronological age is a significant predictor of vocabulary development in hearing-impaired children, but also indicate that there are other equally significant predictors that led to this redistribution of results.

- Gender as a predictor did not show impact on the vocabulary scope and structure of hearing-impaired respondents.
- In our study, differences in the vocabulary scope and structure in relation to the time of emergence of hearing impairment did not prove statistically significant. The reason for such results is the insufficient differentiation of the sample in relation to this criterion, which should be kept in mind when interpreting the results and which should be taken into account in future examinations.
- According to our results, the scope and structure of the vocabulary of hearing-impaired respondents does not statistically significantly change in relation to the degree of hearing impairment.
- In conditions of hearing impairment, the scope and structure of the respondent's vocabulary increases proportionally with school achievement (grade) in the school subject of respondent's native language.

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