TECHNIUM
SOCIAL SCIENCES JOURNAL

Vol. 63/2024

A New Decade for Social Changes

PLUS COMMUNICATION
International Communication & PR

TECHNIUM SOCIAL SCIENCES JOURNAL

Technium Social Sciences Journal
Vol. 63, 47-55, November, 2024
ISSN: 2668-7798
www.techniumscience.com

K-mean cluster analysis of the use of prepositional phrases for location, writing, reading, and understanding words presented in a three-dimensional, puzzled, and distorted form

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Abstract. The primary objective of this study is to examine the statistically homogeneous clustering in the hierarchical arrangement of the use of adverbial clauses for location, recognition, and comprehension of words presented in three-dimensional, rebus, and distorted forms. The study was conducted on a sample of 140 participants. The first subset of participants constituted the experimental group, consisting of 70 deaf students, while the second subset formed the control group, comprising 70 hearing students of the same chronological age. A battery of tests was utilized as a measurement instrument, including the "Test of Writing and Comprehending Adverbial Clauses for Location," "Test of Reading, Writing, and Comprehending Words Presented in Three-Dimensional Form," "Test of Reading, Writing, and Comprehending Words Presented in Rebus Form," and "Test of Reading, Writing, and Comprehending Words Presented in Distorted Form." In the descriptive analysis, frequencies of the total words achieved by both deaf and hearing participants were computed for the different types of measurement instruments employed. To identify the most robust homogeneity of participants concerning the applied variables, non-hierarchical and hierarchical Cluster Analyses were employed. The research results indicate a significant lag in the use of adverbial clauses for location, writing, reading, and understanding words presented in three-dimensional, rebus, and distorted forms among deaf children in comparison to their hearing peers. The Cluster Analysis revealed the most significant linkage between the variable "Number of used adverbial clauses for location" and the variable "Number of recognized words presented in three-dimensional form." This link was clustered with the variable "Number of written words presented in rebus form" and the variable "Number of written words presented in three-dimensional form." An analysis of variance for isolated clusters identified a statistically significant difference in the entire measurement space of adverbial clauses for location, three-dimensional, rebus, and distorted forms of words, with a level of statistical significance at p=0.00.

Keywords. deaf children, reading, writing, comprehension, adverbial clauses, distorted form, rebus form, three-dimensional form

1. Introduction

Hearing impairment which occurred in early childhood has consequences for the child's cognitive, emotional and social development (Salkić, Hasanbegović, Švraka 2018). Hearing provides access to acoustic information needed for oral communication (Salkić, Švraka, Hadžiefendić-Povlakić 2018). Studies has shown that most children with hearing loss show significant delays in speech development and school achievements (Salkić, Švraka, Mahmutović, Avdić 2018).

nal speech scheme into an expressive speech in mutual written communication, deaf children maximally use abbreviated speech schemes that determine communication ability. 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. Well-placed lexemes are present in the content of the sentences (Salkić, Hasanbegović, Švraka 2018).

Deaf children can use dialogue in written communication. They are limited in writing complex sentences, but there is a possibility of using complex sentences. About 17% of deaf children can use syntactically correctly written complex sentences. Deaf children understand messages in written form of communication, they have communicative but not linguistic competence (Salkić, Hasanbegović, Švraka 2019).

Many serious studies in the world indicate that in order to become literate, a deaf child must learn the language of the community (Hasanbegović 2008). First, they must learn letters, learn to write. About 50% of young deaf people after finishing high school read and write worse than a ten-year-old hearing child states that (Traxler 2000). People with hearing loss have difficulties in reading at the level of word recognition and progress in reading skills (Stanovich 2000). Comprehension of related tasks in deaf people depends on the ability to recognize and understand key words and phrases in texts (Albertini, Mayer 2010).

The goal of this study is to examine the statistically homogeneous relation - clustering in the hierarchical arrangement in the use of adverbial clauses for place, recognition and understanding of words presented in three-dimensional, rebus and distorted form.

2. Methods

2.1. Sample

The survey was conducted on a sample of 140 respondents. The total sample of respondents consisted of two subsamples. The first subsample of respondents (N=70), the experimental group consisted of deaf children 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.

1.2 Measurement instrument and method of conducting a study

As a measurement instrument, a battery of tests was used: *"Test of writing and understanding adverbial clauses of place", "Test of reading, writing and understanding words presented in three-dimensional form", "Test of reading, writing and understanding words presented in puzzle form"* and *"Test of reading, writing and understanding words presented in distorted form"* (Hasanbegović 2013). Answers on the tests for reading, writing and understanding words presented in distorted, rebus and three-dimensional form were evaluated with grades from 1-5, and for the number of successfully used adverbial clauses of place with grades from 1-6. The children were given short instructions, and the task was to fill out the test material independently, without the help of the teacher. The applied variables of the measuring instruments are *"Number of used adverbs determining the place", "Number of written words presented in distorted form", "Number of recognized words presented in distorted form",*

in rebus form shape", "Number of written words presented in three-dimensional form" and "Number of recognized words presented in three-dimensional form".

2.3. Data processing methods

As part of the descriptive analysis, the frequencies of the total achieved words of deaf and hearing subjects were calculated by the types of measuring instruments used. In order to find the strongest homogeneity of respondents in the applied variables, non-hierarchical and hierarchical cluster analysis was used, as a statistical technique for determining relatively homogeneous groups of variables.

3. Results and discussion

3.1. Frequencies of total achieved words of deaf and hearing respondents by types of measuring instruments used

Table 1. Comparative overview of total words achieved by deaf and hearing respondents by types of measurement scales used

Variable (Word Count)	Number of adverbial clauses of place used		Number of written words represented in three-dimensional form		Number of recognized words represented in three-dimensional form		Number of written words presented in puzzle form		Number of recognized words presented in puzzle form		Number of written words presented in distorted form		Number of recognized words presented in distorted form	
	Deaf	Hearing	Deaf	Hearing	Deaf	Hearing	Deaf	Hearing	Deaf	Hearing	Deaf	Hearing	Deaf	Hearing
1.	13	0	1	0	3	0	11	0	12	0	2	0	5	0
2.	26	0	2	0	22	0	42	0	34	2	12	0	10	0
3.	57	0	33	0	42	3	39	3	45	3	60	0	42	0
4.	56	28	60	12	64	24	40	120	32	116	48	0	76	20
5.	20	140	210	335	110	315	65	195	60	195	125	350	120	325
6.	6	210	0	0	0	0	0	0	0	0	0	0	0	0
0.	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	178	378	306	347	241	342	197	318	183	316	247	350	253	345

Table 1 shows a comparative overview of the total words produced by types of measurement scales used between deaf and hearing respondents.

Most deaf children are completely successful in reading and writing words presented in ***three-dimensional form***, but they do worse than their hearing peers. From total, 60 % of deaf children fully read and write three-dimensionally presented words, and 40 % of deaf children partially succeed in reading and writing words presented in three-dimensional form. Deaf children in 31.40 % of cases understand read words presented in three-dimensional form. The majority of deaf children (62.90 %) partially understand words presented in three-dimensional form, and 5.70 % of deaf children do not understand words presented in three-dimensional form (Salkić 2022).

Deaf children do not understand all the words presented in the form of a puzzle, regardless of the fact that they successfully read and write them. From total, 18.60 % of deaf children completely read and write words presented in puzzle, and 17.10 % of deaf children understand and understand read and written words presented in puzzle form. Of the 14.30 % of deaf children who successfully read and write 80 % of the words presented in the puzzle, 11.40

written. About 2.90 % of deaf children cannot read and write words presented in puzzle form, and 8.60 % of deaf children do not understand words presented in puzzle form (Salkić 2022).

Words presented in distorted form are fully read and written by 35.70 % of deaf children, and 57.20 % manage to partially read and write words presented in ***distorted form***, while 7.10 % of deaf children cannot read and write words presented in distorted form. Words presented in distorted form are understood by 34.30 % of deaf children. The majority of deaf children (61.40 %) partially understand words presented in distorted form, and 4.30 % of deaf children do not understand words presented in distorted form (Salkić 2022).

The results showed that deaf children fully and correctly use adverbial ***clauses of place*** in a percentage of 1.40 %, and that most deaf children, 90 % of them, use adverbial clauses of place partially. The percentage of deaf children who do not use adverbial clauses for place in written expression is 8.60 %. The order of use of adverbial clauses for place by frequency is as follows: "in", "on", "under", "behind", "next to" and "between". The largest number of deaf children in written expression use the adverb clause "in", 65.70 % of them, followed by the adverb clause "on" 51.14 %, the adverb clause "below" 47.14 %, the adverb clause "behind" 31, 43 %, the adverbial clause "beside" 30 %, and the adverbial clause "between" 22.85 % (Salkić, Povlakić Hadžiefendić 2022).

On the basis of the above, looking at table 1, it can be concluded that the deaf respondents lag significantly behind their hearing peers in terms of the number of words they have achieved and the words they understand. Deaf children lag behind their hearing peers in the use of adverbial clauses of place, writing, reading and understanding of words presented in three-dimensional, rebus and distorted form. These data confirm the fact that the vocabulary of deaf children is much poorer compared to the vocabulary of hearing children.

3.2. K-mean Cluster analysis measuring the use of adverbial clauses for place, writing, reading and comprehension of words presented in three-dimensional, rebus and distorted form

Table 2. Initial solution of Cluster centroid in non-hierarchical Cluster analysis

Variable	Cluster	
	1	2
Number of adverbial clauses of place used	**7.00**	3.00
Number of written words represented in three-dimensional form	4.00	1.00
Number of recognized words represented in three-dimensional form	6.00	1.00
Number of written words presented in puzzle form	2.00	**6.00**
Number of recognized words presented in puzzle form	6.00	2.00
Number of written words presented in distorted form	2.00	3.00
Number of recognized words presented in distorted form	6.00	1.00

In the non-hierarchical cluster analysis or initial solution, two clusters were obtained that have their own hierarchical structure through the initial solution of the classification variables. The K-mean method begins with the construction of the center of the initial cluster, which is the data on the selected variables, and is done with the entity algorithm according to the distance criterion. As can be seen in Table 2. ***In the first cluster, the greatest distance is achieved in the first variable "Number of used adverbial clauses of place" which has the highest variable values (7.00) and then in the third "Number of recognized words presented in the three-dimensional form", the fifth "Number of recognized words presented in a rebus***

TECHNIUM SOCIAL SCIENCES JOURNAL
Technium Social Sciences Journal
Vol. 63, 47-55, November, 2024
ISSN: 2668-7798
www.techniumscience.com

d words presented in a distorted form" whose variable values are 6.00. The greatest distance in the second cluster was achieved in the fourth variable "Number of written words presented in the form of a puzzle" which has the highest variable values (6.00).

Table 3. Final solution of cluster centroid in non-hierarchical cluster analysis

Variable	Cluster	
	1	2
Number of adverbial clauses of place used	5.09	2.71
Number of written words represented in three-dimensional form	4.87	4.27
Number of recognized words represented in three-dimensional form	4.78	3.48
Number of written words presented in puzzle form	4.43	2.48
Number of recognized words presented in puzzle form	4.58	2.38
Number of written words presented in distorted form	4.85	3.77
Number of recognized words presented in distorted form	4.79	3.65

The final cluster centers were calculated as the mean of all variables within the cluster. ***The final cluster centers represent the characteristics of the entities (respondents) for each cluster***. As can be seen in Table 3, ***the arithmetic means of the first cluster are closer to the score of five, and the arithmetic means of the second cluster are closer to the score of three***.

Table 4. Analysis of variance of isolated clusters

Variable	**Cluster**		**Error**		**F**	**P**
	AS	**df**	**AS**	**df**		
Number of adverbial clauses of place used	178.47	1	1.66	138	107.44	0.000
Number of written words represented in three-dimensional form	11.31	1	0.43	138	26.05	0.000
Number of recognized words arranged in a three-dimensional form	53.60	1	0.85	138	62.87	0.000
Number of written words presented in puzzle form	120.63	1	0.93	138	129.46	0.000
Number of written words presented in puzzle form	152.82	1	0.82	138	185.45	0.000
Number of written words presented in distorted form	36.59	1	0.78	138	46.60	0.000
Number of recognized words presented in distorted form	41.55	1	0.841	138	49.40	0.000

Looking at Table 4, it can be concluded ***that the variables based on the arithmetic means of the isolated clusters are statistically significantly different in all characteristics of language naming, recognition and understanding.***

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Vol. 63, 47-55, November, 2024
ISSN: 2668-7798
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Classes	Number of adverbial clauses of place used	Number of written words presented in three-dimensional. form	Number of recognized words presented in three-dimensional form	Number of written words presented in puzzle form	Number of recognized words presented in puzzle form	Number of written words presented in distorted form	Number of recognized words presented in distorted form
Number of adverbial clauses of place used	**0.000**	0.190	0.387	0.000	0.143	0.196	0.134
Cumber of written words presented in three-dimensional form	0.190	**0.000**	0.920	0.259	0.348	0.938	0.851
Number of recognized words presented in three-dimensional form	0.387	0.920	**0.000**	0.479	0.539	0.830	0.851
Number of written words presented in puzzle form	**0.000**	0.259	0.479	**0.000**	0.830	0.527	0.571
Number of recognized words presented in puzzle form	0.143	0.348	0.539	0.830	**0.000**	0.473	0.482
Number of written words presented in distorted form	0.196	0.938	0.830	0.527	0.473	**0.000**	1.000
Number of recognized words presented in distorted form	0.134	0.851	0.851	0.571	0.482	1.000	**0.000**

Table 5 shows the results of the Hierarchical Cluster Analysis. The Agglomerative Hierarchy method was used in the analysis. Among the selected groups that were used in this research are linkage methods and the sum of squares error method or the variance method.

The successive formation of clusters is shown in a graphic diagram in the form of a tree (Dendogram). This graphical report presents the solution to the problem in such a manner that the variables are arranged along the left vertical axis, with the horizontal axis showing the distance between the variables and their sense of connection. ***Generally, the problem is solved by looking for large jumps between the connections on the horizontal axis, and in this graph we see that the biggest jump in the connection of variable number one "Number of adverbial clauses used" with variable number three "Number of recognized words presented in three-dimensional form", which is clustered linked with variable number four "Number of written words presented in puzzle form" with variable number two "Number of written words presented in three-dimensional form".*** Given that Cluster analysis does not define groups of respondents, but the isolation of problems by linking clusters of variables, it is necessary to discriminate between groups in connection with this measurement.

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Vol. 63, 47-55, November, 2024
ISSN: 2668-7798
www.techniumscience.com

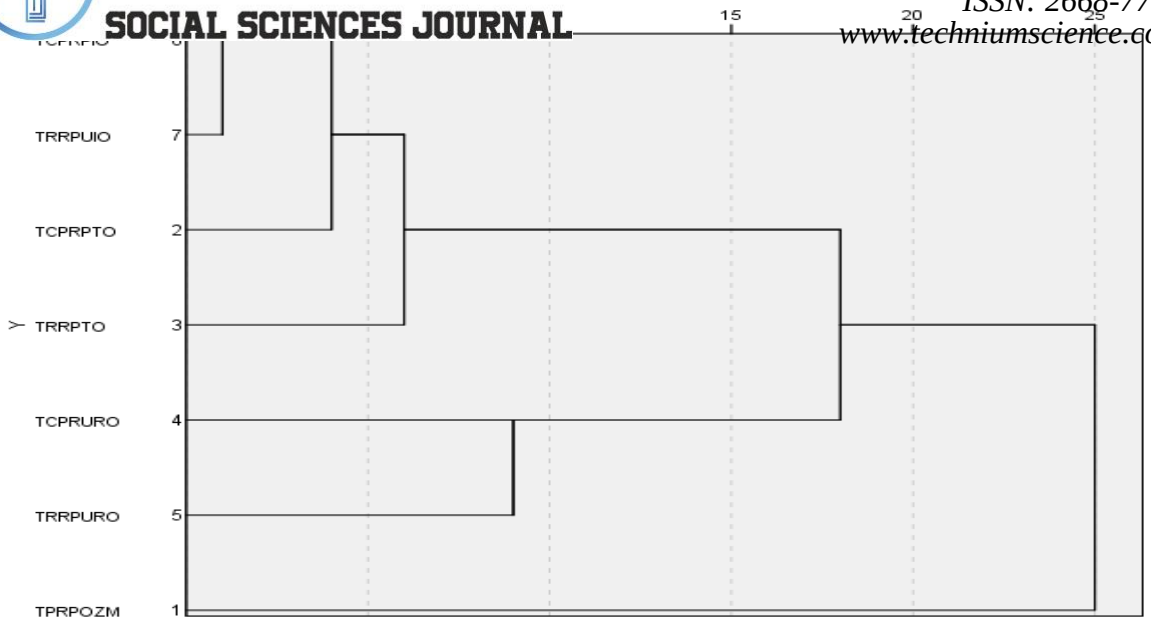

Figure 1. Successive formation of clusters, graphic diagram, Dendogram

Legend: TCPRPIO - Number of written words presented in distorted form, TRRPUIO - Number of recognized words presented in distorted form, TCPRPTO - Number of written words presented in three-dimensional form, TRRPTO - Number of recognized words presented in three-dimensional form, TCPRURO - Number of written words presented in rebus form, TRRPURO - Number of recognized words presented in rebus form, TPRPOZM - Number of used adverbial clauses of place.

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Vol. 63, 47-55, November, 2024
ISSN: 2668-7798
www.techniumscience.com

4. Conclusions

Deaf children significantly lag behind their hearing peers in the use of adverbial clauses of place, writing, reading and understanding of words presented in three-dimensional, rebus and distorted form. These data confirm the fact that the vocabulary of deaf children is much poorer compared to the vocabulary of hearing children.

Cluster analysis showed that the biggest jump is the connection of the variable "Number of used adverbial clauses for place" with the variable "Number of recognized words presented in three-dimensional form", which is clustered with the variable "Number of written words presented in puzzle form" with the variable "Number of written words presented in three-dimensional form".

Based on the variance analysis of isolated clusters, it was established that in the entire measurement space of adverbial clauses for place, three-dimensional, rebus and distorted word forms, there is a statistically significant difference at the level of statistical significance of p=0.00, whereby a certain type of classification can be observed on the basis of the method of agglomerative (accumulating) hierarchy, which starts from individual connection of variables into larger and larger clusters. This hierarchy is observed through the correlative coefficients in the correlation matrix whose diagonal contains zeros, and an insight into clusterization is visible in the dendogram, where the successive formation of clusters is observed.

References

[1] SALKIĆ, N., HASANBEGOVIĆ, H., ŠVRAKA, E. (2018). Content analysis of the written communication form of deaf children (Original scientific paper). Human Research in Rehabilitation The International Journal for interdisciplinary studies, Vol. 8 (2) 55-64 www.human.ba

[2] SALKIĆ, N., ŠVRAKA, E., HADŽIEFENDIĆ-POVLAKIĆ, M. (2018). Factor Analysis of Deaf Persons Communication Systems. World Journal of Research and Review Vol. -6, Issue-3

[3] SALKIĆ, N., ŠVRAKA, E., MAHMUTOVIĆ, I., AVDIĆ, A. (2018). Discriminant Analysis of Deaf Persons Communication Systems. World Journal of Research and Review (WJRR), Volume-6, Issue-2, p. 90-95 https://www.wjrr.org/

[4] SALKIĆ, N., HASANBEGOVIĆ, H., ŠVRAKA, E. (2019). The diAalogue structure in the written communication model of deaf children. Innovative Journal of Medical Health Science, Vol. 9. No.6. 2019. https://doi.org/10.15520/ijmhs.v9i6.2603,http://innovativejournal.in http://innovativejournal.in/index.php/ijmhs/article/view/2603/2159

[5] HASANBEGOVIĆ, H. (2008). Paradigmatično-pragmatična govorno-jezička metoda u edukaciji i rehabilitaciji slušno oštećene djece (orginalna metoda). Didaktički putokazi, časopis za nastavnu teoriju i praksu, 45, 50-55.

[6] TRAXLER, C. (2000). The Stanford Achievement Test, 9th Edition: National Norming and Performance Standards for Deaf and Hard-of-Hearing Students. Journal of Deaf Studies and Deaf Education, 5, 337-348. http://jdsde.oxfordjournals.org/content/5/4/337.full.pdf+html

[7] STANOVICH, K. (2000). Progress in Understanding Reading: Scientific Foundations and New Frontiers. The National Right to Read Foundation. http://www.nrrf.org/ivey_review_TCR.htm

[8] ALBERTINI, J., MAYER, C. (2010). Using Miscue Analysis to Assess Comprehension in Deaf College Readers. Journal of Deaf Studies and Deaf Education, 16 (1), 35-46. http://jdsde.oxfordjournals.org/content/16/1/35.full

Technium Social Sciences Journal
Vol. 63, 47-55, November, 2024
ISSN: 2668-7798
www.techniumscience.com

[9] HASANBEGOVIĆ, H., (2013). Test čitanja, pisanja i razumijevanja riječi predstavljenih u rebusnom obliku. Test čitanja, pisanja i razumijevanja riječi predstavljenih u trodimenzionalnom obliku. Test čitanja, pisanja i razumijevanja riječi predstavljenih u iskrivljenom obliku. Test pisanja i razumijevanja priloških odredbi za mjesto. https://human.ba/hasanbegovic/stvaranje/mi/BATERIJA%20TESTOVA%20ZA%20INTERNET_

[10] SALKIĆ, N. (2022). Reading, writing and understanding of words presented in threedimensional form in deaf children. KNOWLEDGE - International Journal, 52(2). https://ikm.mk/ojs/index.php/kij/article/view/5185

[11] SALKIĆ, N. (2022). Reading, writing and understanding of words presented in rebus form in deaf children. KNOWLEDGE - International Journal, 53(4), 627–633. ISSN: 1857-923X (Printed) ISSN: 2545-4439 (Online) Retrieved from https://ikm.mk/ojs/index.php/kij/article/view/5454

[12] SALKIĆ, N. (2022). Reading, writing and understanding of words presented in distorted form in deaf children. KNOWLEDGE - International Journal, 53(4), 635–641. ISSN: 1857-923X (Printed) ISSN: 2545-4439 (Online) Retrieved from https://ikm.mk/ojs/index.php/kij/article/view/5455

[13] SALKIĆ, N., POVLAKIĆ HADŽIEFENDIĆ, M. (2022). Reading, writing and comprehension in deaf children of the adverbial clause of place in written form. KNOWLEDGE - International Journal, 54(4), 719–724. ISSN: 1857- 923X (Printed) ISSN: 2545-4439 (Online) Retrieved from. https://ikm.mk/ojs/index.php/kij/article/view/5635