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The Relationship Between Phonemic Awareness, Vocabulary and Musical Abilities in 5-6-year old Children in Kindergartens

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A B S T R A C T

Young children (5-6 years old) are building strong foundations in language and music. Their phonemic awareness is developing, allowing them to identify and manipulate sounds in words. Vocabulary is rapidly expanding, with children learning new words and their meanings. Musical abilities are blossoming, with many children enjoying singing, keeping rhythm, and exploring instruments. However, there can be variations in these skills, and even gender differences in performance on some tasks. This study investigated the phonemic awareness, vocabulary, and musical abilities of 5-6-year-old children. We explored potential correlations between these domains and any gender differences in performance. Forty children (20 girls and 20 boys) from three kindergartens (two urban, one rural) were tested in June 2022. Three assessments were employed: Eľkonin's test of phonemic awareness, COWAT speech fluency test (vocabulary), and Bentley's test of musical abilities. Pearson's correlation coefficient analyzed relationships between the tests. A positive correlation was found between all three tests, suggesting potential links between phonemic awareness, vocabulary, and musical abilities. Interestingly, girls outperformed boys significantly in both Eľkonin's and Bentley's tests. Within Eľkonin's test, children achieved the highest scores in syllable synthesis (subtest No. 4) and the lowest scores in syllable deletion (subtest No. 10). This study suggests a connection between phonemic awareness, vocabulary, and musical abilities in young children. Additionally, it highlights potential gender differences in specific aspects of these domains. Further research is needed to explore the cause of these findings and their implications for early childhood education.

1. Introduction

Music has a special position in the education of young children. It works on the development of children‘s thinking, imagination, memory, attention and feeling. It includes oromotor skills, important for children‘s speech development. Clausson et al., (1997) stated that music and speech depend on the same auditory processes and that their linked development is therefore important. This statement is also represented by studies that address the common functions of music and speech (Tallal et al., 2006) and their mutual influence (Jäncke, 2012). Chan et al., (1998) argued that musical training can make learning to read and count more effective and develop children‘s language skills overall. Several authors dealt with the relationship between music and speech, such as Douglas et al., (1994), Patel (2006), Pramling et al., (2009), Dahlbäcks (2011), Still (2011), Chen-Hafteck et al., (2012), Harms et al. (2014), Bačlija Sučić (2019) and others. Among the most fundamental research regarding the relationship of development of phonemic awareness through an intervention program is the research of Anvari et al. (2002), and a follow-up study by Moyeda et al., (2006). The similar research realised also Bolduc (2009). Moritz et al., (2012) investigated the effectiveness of implementing music training in preschool children. They concluded that sense of rhythm is a pre-cursor skill for language acquisition.

Very interesting findings were also reached by Patscheke et al., who experimentally investigated the effect of musical activities focused on pitch and rhythm.

The aim of the study is to highlight the importance of developing phonemic awareness and vocabulary through musical activities. The testing was aimed at determining the level of phonemic awareness, vocabulary and musical abilities in 5-6 year old children. The results will serve as a basis for the creation of a vocal-rhythmic stimulation methodology that will be applied in kindergartens. We set the objectives of the research as follows: To determine the dependence between the level of development of speech and musical abilities; To find out in which subtests of the Elkonin test the children achieved the best results, and in which the weakest and To compare the achieved results between girls and boys.

2. Literature Review

The development of speech as well as musical abilities is strongly influenced by external and internal factors, which were discussed in detail by Langmeier et al., (1998), Vágnerová (2000), Tafuri (2008), Weglichová (2010), McPherson et al., (2012), Sedlák et al., (2013), Holas (2013), Derevjaníková (2016), Kaščáková (2020) and others. Among the internal factors we recommend e.g. heredity, high-risk pregnancy, influence of gender, disorders of the CNS, hearing and vision. Among the external factors most influencing the development of speech and musical abilities, we recommend an unstimulating social environment, the negative impact of excessive use of modern technologies, insufficient communication in the family, the influence of the teacher and others. It was concluded that the teachers from the research sample observe an annual deterioration in the correct pronunciation of these children (Lipnická, 2016). Similar conclusions were reached by e.g. Lechta (2002), Neubauer (2011), Neubaueret al., (2016) and Kerekrétiová (2016). According to Buntová et al., (2016), speech sound disorders occur more often in boys than in girls (60% : 40%), and the same is true abroad. Over the past two decades, research has been conducted abroad focused on the impact of digital technologies on children‘s speech development. For example results of one of these research realised in the USA were published in study Mustafaoğlu et al. (2018). Gonca Özyurt et al. (2016) dealt with research focused on children‘s speech development disorders and the application of the triple P (Positive Parenting Program).

Leading psychologists Jean Piaget (Piaget et al., 1997) and Lev Semjonovič Vygotskij (2017) dealt with the relationship between a child‘s language development through learning and cognitive development, but each with a different theoretical approach. They are considered constructivist theories of children‘s learning (Průcha, 2011). Systematic research on children‘s speech in Slovakia is carried out by Professor Daniela Slančová. Her most important work is the collective monograph *Study of children‘s speech*, which was published in 2008. In addition to it, the language development of young children was investigated by Vužňáková (2009, 2018) and Kesselová (2008) and others. The basic knowledge base for the creation of a stimulation methodology with a focus on the prevention of impaired communication skills in preschool children will be the published works of Antušeková (1989), Kutálková (1996), Lechta (2002), Horňáková et al., (2005), Klenková (2006), Lipnická (2013, 2019) and other authors. We will be based on the results of research by Lechta (2001), Klenková et al., (2003), Kutálková (2009) and Kapalková (2016) also. Of the research in this area, the research of Cherednychenko (2021) is interesting for us, which investigated the peculiarities of the use of logopedic rhythms in the process of correcting the phonological side of speech and their impact on preschool children with general underdevelopment of speech. Well-known works in the musical field of pedagogical solutions to the problem are works by

Kantor (1969), Lysáková, et al., (1989), Kodejšek (1989), Baranová (2009), Sedlák et al., (2013) and Tichá (2014). Terentyeva et al., (2021) experimentally investigated the development and correction of intonation expressiveness in 5-6-year-old children through short fables and fairy tales. Gan and Chong (2006) published the results of the Expressive Language and Music (ELM) Project, which showed that the children involved in the project significantly improved language, music and social skills.

3. Methods

This quantitative research represents the basis for the creation of a vocal-rhythmic stimulation methodology and the subsequent verification of its effectiveness, as part of the evaluation research. In order to comply with the principle of triangulation, we used 3 standardized tests described below for testing children – Eľkonin‘s phonemic awareness test (Mikulajová et al., 2014), COWAT speech fluency test (1994) and Bentley‘s test for measuring musical abilities (1966). During the diagnosis, audio recordings were made, which were subsequently transcribed. We then subjected the obtained data to statistical processing and qualitative analysis. The research sample of children consisted of 40 children - 20 boys and 20 girls aged 5-6 years. The children came from different types of social backgrounds – foster care, single-parent families, marginalized communities. 1 child came from a family where both parents have a hearing impairment. It was an available choice. The testing was carried out in June 2022 in 3 kindergartens - 2 urban and 1 rural. It was followed by the transcription of audio recordings of children‘s communications in the summer of 2022. This was followed by statistical processing and evaluation of diagnostic data. In the months of November and December 2022, an additional survey method was also implemented in 2 kindergartens - 1 in the city in Banská Bystrica and 1 in the countryside in Smižany. It was subsequently evaluated in December.

In 1968, Benton created a set of Multilingual Aphasia Examination tests (later modified by Benton et al., 1994), whose subtest is COWAT (Controlled Oral Word Association Test). The test is aimed at measuring the fluency of speech and also the range of vocabulary. For evaluation, it uses a set of 3 sounds at the beginning of words F, A, S, which are the most common sounds in the English language. For our needs, we have adapted the set of sounds to P, K, M, L, which we perceive as the most frequently used sounds in the vocabulary of preschool children (Lipnická, 2021). The child has a limited time limit of 1 minute for each sound. In this time limit, he should list at least 11 words. However, he may not use proper nouns or variations of one word, e.g. *krátky – krátke* (short – short) (Preiss et al., 2007).

Russian psychologist prof. Daniil Borisovič Eľkonin created a program for developing phonemic awareness (Slovak translation: Mikulajová et al., 2001), Test of phonemic awareness according to D. B. Eľkonin. The diagnostic test consists of 11 subtests focused on rhyming words, synthesis and analysis of words into syllables and vowels, substitution of vowels, omission of vowels and syllables in a word, and isolation of the initial vowel and syllable of a word. Each subtest contains 5 items - a total of 55 items.

In 1966, Arnold Bentley created a test of musical abilities (Measures of Musical Abilities (MMA)) consisting of 4 subtests: pitch descrimination – 20 items; tonal memory – 10 items; chord analysis – 20 items and rhythmic memory – 10 items. The test was given to the children by means of a recording on a CD. The implementation of the testing in June 2022 was followed by the transcription of the audio recordings of the tested children in the months of July, August and September 2022. These transcripts were used for qualitative analysis and the subsequent creation of categories. Within this period, the individual tests were statistically evaluated and the results of the children‘s success were recorded in an Excel table.

The testing of the children and the making of the audio recordings were carried out with the informed consent of the parents of all the children and they were kept fully informed of the whole process.

4. Results and Discussion

As part of the quantitative processing of the test results, we looked for a positive correlation between the individual tests. We were interested in whether there is a relationship between phonemic awareness, vocabulary, and musical ability. Pearson's correlation coefficient showed a positive correlation between all tests (Figures 1, 2, and 3). Children with higher scores on the phonemic awareness test also scored higher on the musical ability test. It is also true that a child with a higher score on the musical ability test also has a wider vocabulary. It can also be argued that the child with a larger vocabulary has a more developed phonemic awareness. The correlation coefficient r is approximately the same for all 3 tests, hence this positive correlation (Table 1). We also determined the success of the tested children in the individual subtests of the Eľkonin's phonemic awareness test (figure 4). We found that the strength of phonemic awareness of 5-6-year-old children is the synthesis of syllables into words (success rate 89.52%), but also the opposite process - analysis of words into syllables. Children are also very aware of the sound similarity of words that rhyme. A weakness of these children is working with phonemes - sounds, namely their omission in words (success rate 20.48%) and analysis of words into sounds. Omitting syllables in words is also a big problem. If we were to sort the individual subtests according to the success of the children we tested in descending order, the order would be as follows: e4, e3, e7, e1, e11, e2, e8, e5, e9, e6, e10. Subtest 7 – The isolation of the initial sound of the word is similar to the tasks in the COWAT speech fluency test, which created a close connection between the two tests.

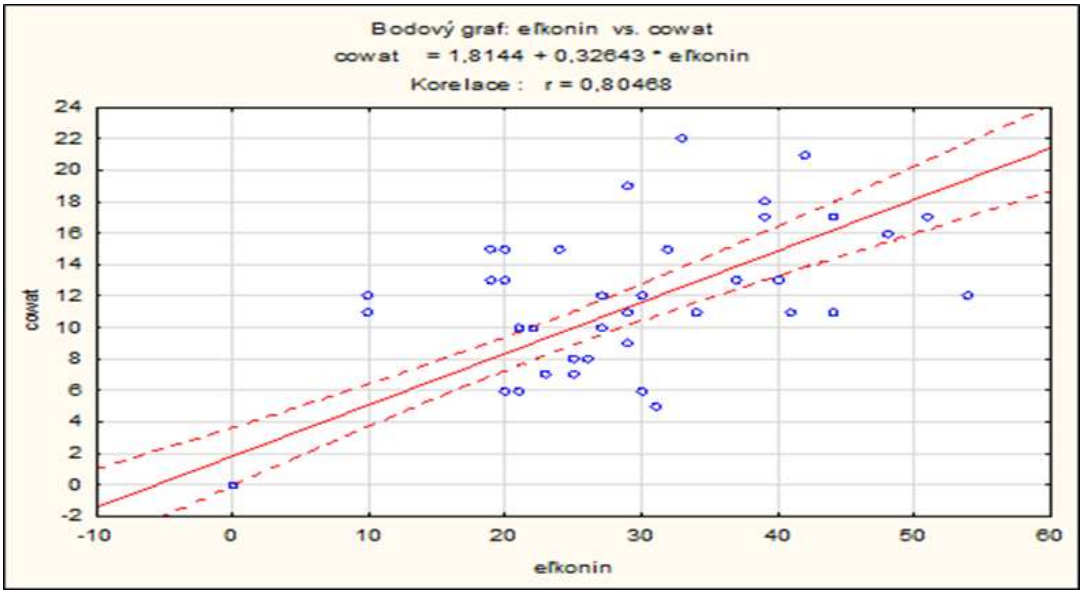

Figure 1. Correlation of Eľkonin's-Bentley's test results vocabulary has a more developed phonemic awareness.

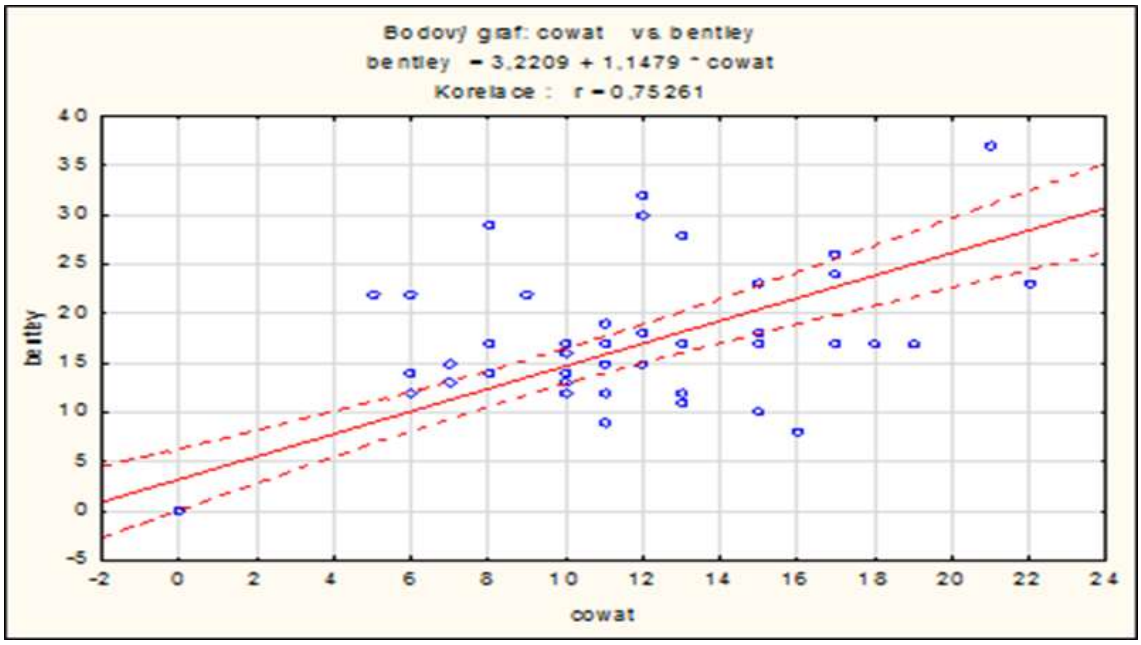

Figure 2. Correlation of Eľkonin‘s - COWAT test results.

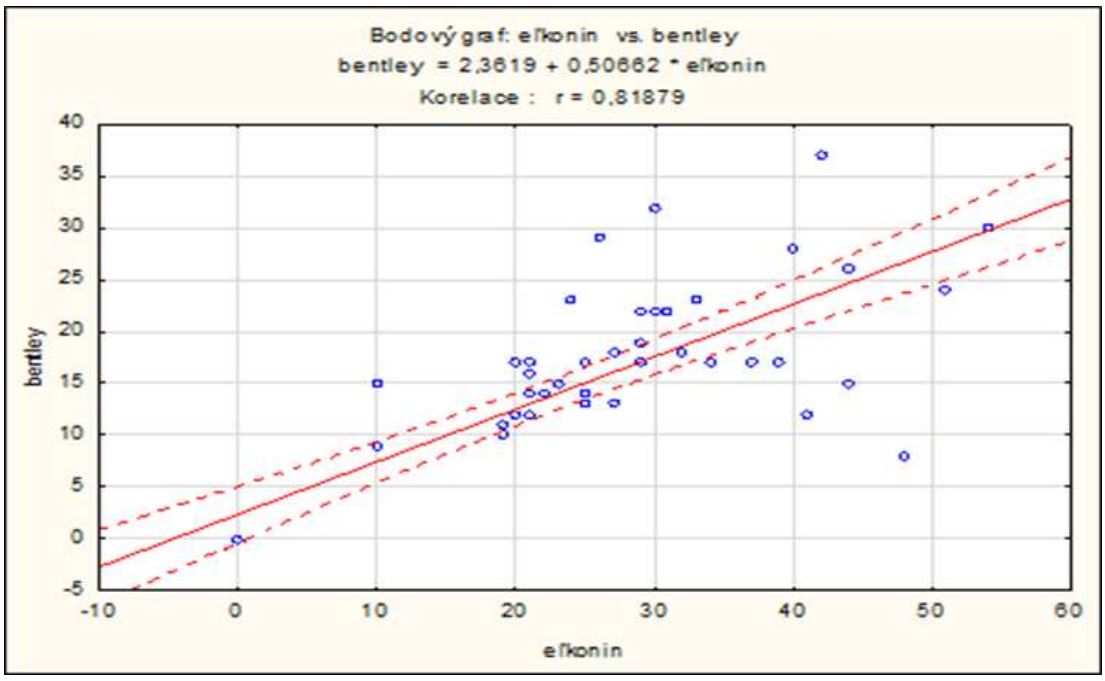

Figure 3. Correlation of COWAT – Bentley‘s test results.

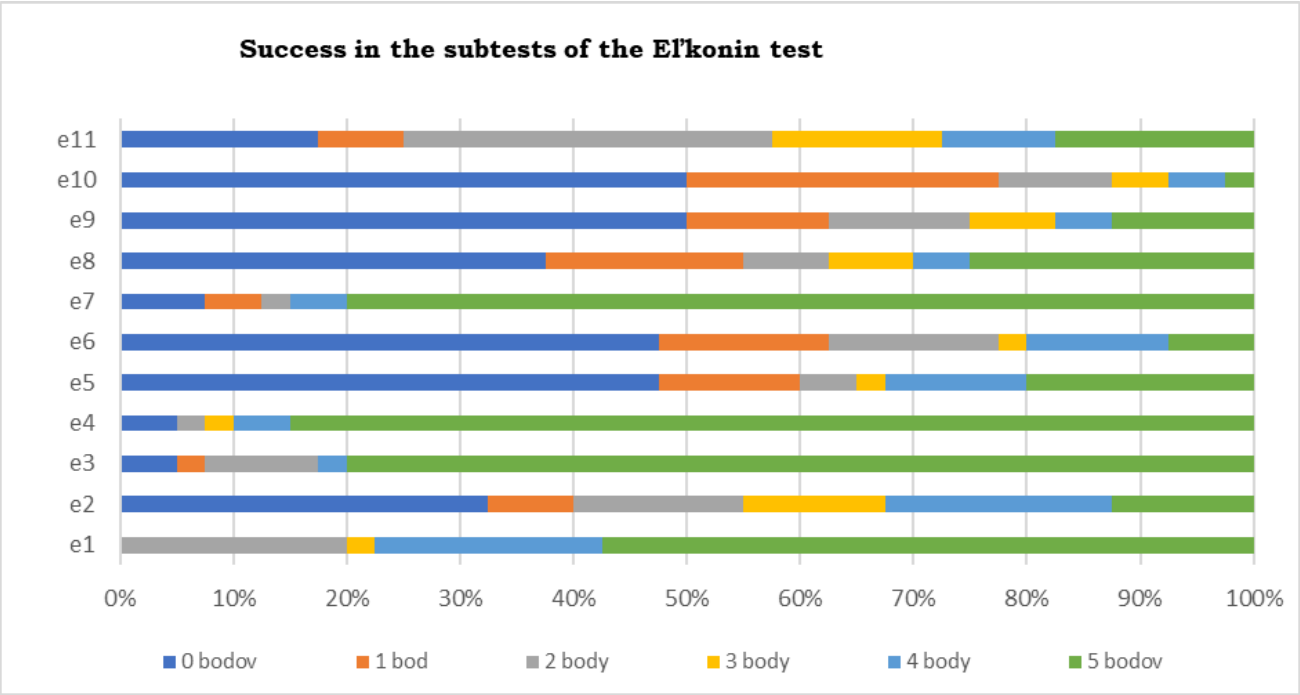

Figure 4. Success in individual subtests of the El'konin's test. e1 – awareness of rhymes,; e2 – production of rhymes; e3 – analysis of the word into syllables; e4 – synthesis of syllables into a word; e5 – isolation of the first syllable in a word; e6 – omitting a syllable in a word; e7 – isolation of the first sound of the word; e8 – synthesis of vowels into a word; e9 – analysis of the word into sounds; e10 – omitting a sound in a word; e11 – substitution of vowels in a word.

Table 1. Correlation of variable test.

	r (X, Y)	r^2	p
El'konin -Bentley	0,818794	0,670423	0,000000
El'koni - COWAT	0,804680	0,647509	0,000000
COWAT - Bentley	0,752607	0,566417	0,000000

Finally, we compared the success rate between girls and boys in individual tests (Figures 5, 6, and 7). We found that the girls scored statistically significantly better (provable) than the boys on the test of phonemic awareness and musical ability. The girls also achieved better results in the vocabulary test, but we did not find statistically significantly better results. This may be due to the small sample size. In principle, however, we do not assume that there are statistically significant differences. For this reason, we focused more closely on the results of the COWAT speech fluency test, where we came to the following findings: the girls used a total of 161 different words for all 4 sounds (table 2). Boys used 131 different words for all 4 sounds, which is up to 30 words less than girls. The tested children listed the most words for the sound p

with a number of 96, followed by words with the sound k with a number of 80 words, words with the sound m with a number of 59 words and finally words beginning with the sound l with a number of 57. according to these results, it follows that the selected sounds m and l are not suitable for their further use in this test and we will look for those sounds that will meet this criterion.

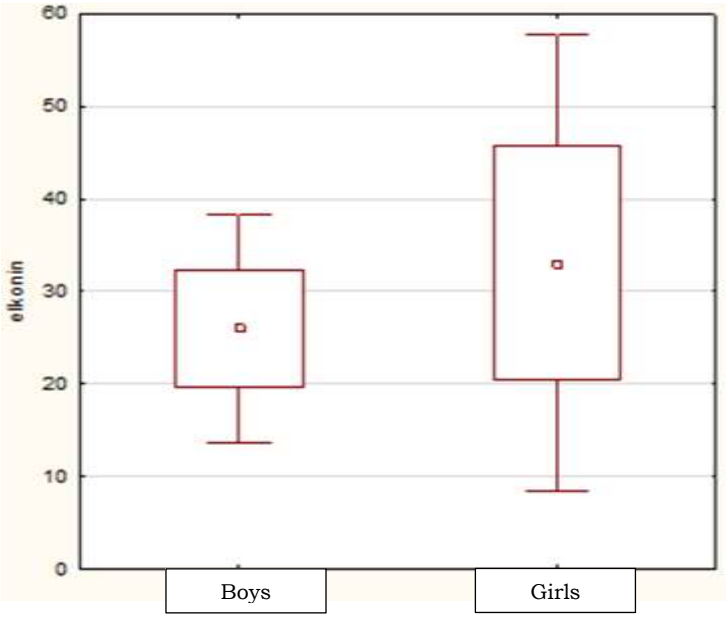

Figure 5. Comparison of the success rate of girls and boys – Elkonin's test.

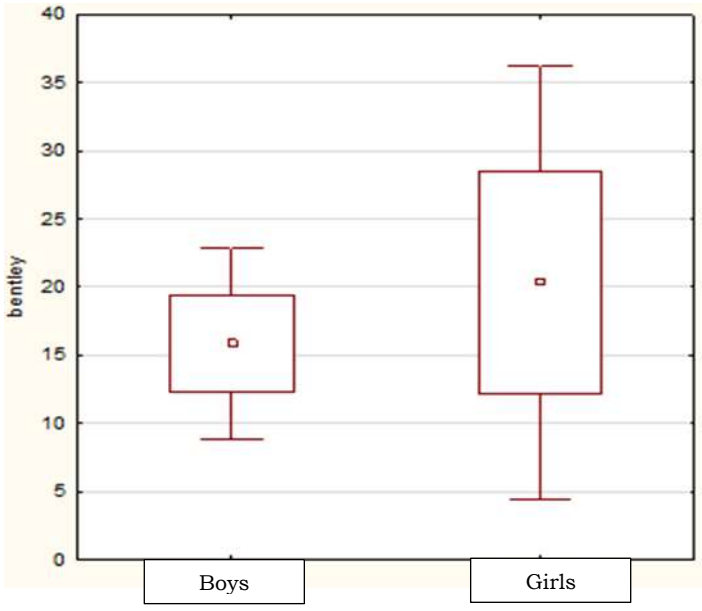

Figure 6. Comparison of the success rate of girls and boys – Bentley's test.

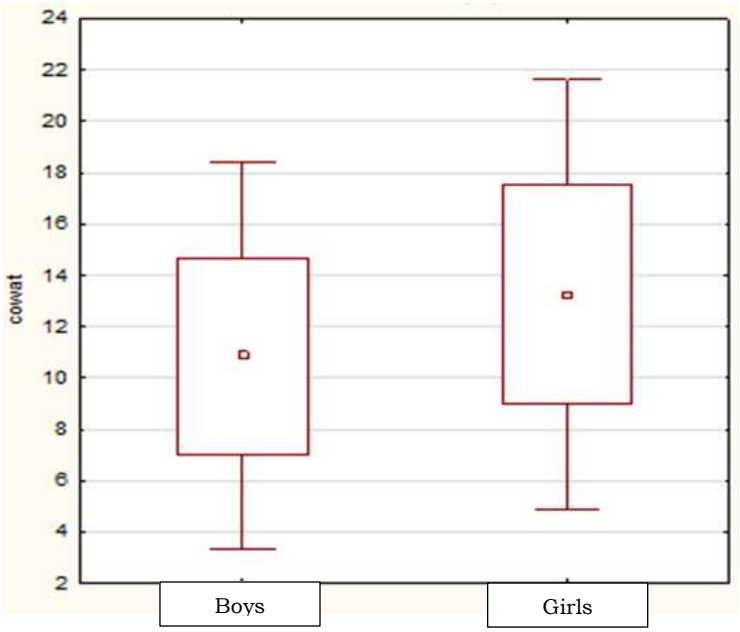

Figure 7. Comparison of girls‘ and boys‘ success - COWAT test.

Table 2. Number and frequency of words in children in the COWAT test

	P - girls	P - boys	K - girls	K - boys	M - girls	M - boys	L - girls	L - boys
The words used	53	43	46	34	32	27	30	27
Total words count	79	58	72	55	72	52	45	57
Together, the words used	96		80		59		57	

Table 3 presents the overall results of children in individual tests. The resulting score of the Phonemic Awareness Test and the Music Aptitude Test is given as a percentage, and the total number of words listed in the COWAT test is recorded. If we were to evaluate the success rate above 50%, 6 boys reached this threshold in Elkonin‘s test, while 2 were just below the threshold - 49.09%, and up to 14 girls. The best result in Elkonin‘s test was for the boy B3 - 74.55% and for the girl G10 - 98.18%, which represents only 1 incorrectly answered item from the entire test. On the contrary, the weakest result was for the boys, B17 - 34.55%, and for the girls, G17 and G18 - 18.18%. The average value is 47.27% for boys and 60.18% for girls. In Bentley‘s test, we recorded a success rate above 50% in only 3 girls, one of whom reached exactly the 50% mark, but none of the boys did. The best result was for the boy B15 - 38.33% and for the girl G1 - 61.66%. On the contrary, the weakest result was 16.66% for the boy B17 and 13.33% for the girl G13. The average value is 26.41% for boys and 33.91% for girls. It is interesting that boy B13 achieved the weakest results in both Elkonin‘s test and Bentley’s test.

Table 3. Children's percentage of success in the El'konin's and Bentley's tests and the number of words listened in the COWAT test (own processing).

	El'konin	Bentley	COWAT			El'konin	Bentley	COWAT
B1	38,18%	23,33%	6		**G1**	76,36%	**61,66%**	**21**
B2	61,82%	28,33%	11		**G2**	67,27%	28,33%	13
B3	**74,55%**	20%	11		**G3**	70,91%	28,33%	18
B4	45,45%	23,33%	8		**G4**	47,27%	48,33%	8
B5	38,18%	28,33%	10		**G5**	52,73%	31,66%	11
B6	52,72%	28,33%	19		**G6**	41,82%	25%	7
B7	56,36%	36,66%	**5**		**G7**	80%	25%	11
B8	45,45%	21,66%	7		**G8**	60%	38,33%	22
B9	52,73%	36,66%	9		**G9**	54,55%	36,66%	**6**
B10	36,36%	20%	6		**G10**	**98,18%**	50%	12
B11	36,36%	20%	6		**G11**	92,73%	40%	17
B12	45,45%	28,33%	8		**G12**	80%	43,33%	17
B13	49,09%	30%	12		**G13**	87,27%	**13,33%**	16
B14	49,09%	21,66%	10		**G14**	58,18%	30%	15
B15	43,64%	**38,33%**	15		**G15**	72,73%	46,66%	13
B16	70,91%	28,33%	**17**		**G16**	38,18%	20%	10
B17	**34,55%**	**16,66%**	15		**G17**	**18,18%**	25%	12
B18	40%	23,33%	10		**G18**	**18,18%**	15%	11
B19	38,18%	26,66%	10		**G19**	34,55%	18,33%	13
B20	36,36%	28,33%	15		**G20**	54,55%	53,33%	12
Average	47,27%	26,41%	10,5		**Average**	60,18%	33,91%	13,25

One of the limits of the research is the small sample size, which prevents us from generalizing the research results to the entire population. We can only assume that similar results would be obtained in other kindergartens. Another limitation of the research may be the choice of tests. For example, the Holas test (2013) could have been used to measure musical ability, but it is time-consuming. In the COWAT, children may have felt pressure due to the time limit, which may have resulted in a lower word count. We see the fact that children come from different demographic backgrounds as an important factor influencing not only speech development but also the overall development of the child. However, this factor is not necessarily considered to be a negative influence; as such, a child may be more motivated to learn. As an example, we can mention a boy whose parents are hearing impaired. This boy scored average on all the tests.

5. Conclusion

There is a positive correlation between all three areas. Compared to boys, girls achieved better results in all three tests, with statistically significantly better results in the Eľkonin‘s and Bentley‘s tests. Synthesis of syllables into words and analysis of words into syllables was the most developed among the tested children, which is based on the naturalness of speech.

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