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THE IMPORTANCE OF EARLY ESTIMATE OF SPEECH-LANGUAGE CAPACITIES IN PREVENTION OF DEVELOPMENTAL DYSGRAPHIA

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SUMMARY

Written speech is the last to develop and it represents a form of speech expression. It consists of two speech fields. These are coding and performing of a written speech act and decoding of written signs. The first field belongs to performance of willing acts and it belongs to experiential activities while decoding belongs to Gnostic functions. In the process of writing a phoneme is connected with a certain letter image. It is considered that the most common cause of substitution is the impossibility of adequate auditory voice discrimination. Subtle voice differentiation is more necessary for proper writing than for oral speech, which means that there is no writing without proper speech and language development.

Dysgraphia is a disability in learning to write or in the process of acquiring the ability to write although there are preserved intelligence, good sight and hearing, proper education and social conditions. Early detection of faults in development of motor and speech patterns and timely involvement of children in appropriate treatments would give a significant results and contribute to a significant reduction in number of children having a dysgraphia.

Our research was conducted on the population of young schoolchildren and included the sample of 482 children. The aim of the research was to study speech-language capacities and graphomotor abilities in order to detect writing difficulties among young schoolchildren in Belgrade schools. Based on the results obtained from the research and their statistic analysis, we can conclude that the existing capacities of speech and language pathology offer possibilities to detect difficulties in writing at young schoolchildren.

Key words: early detection, speech-language capacities, graphomotor abilities, developmental dysgraphia

INTRODUCTION

Human needs for continuous acquisition of knowledge, which lasts in time, led to expansion of the means system of verbal communication. The writing transmits the voice message and develops on the basis of speech. Deprived of the physical elements and transferred from acoustic to visual analyzer has received a durability that speech usually does not have (Bojanin, 1985; Adams, 1994; Sayeski, 2011; Snowling, 2013). The entire culture of the man's past became available to modern civilization thanks to letter. In spite of shaping characters and words written speech indicates several significant structures and functions involved in realizing the act of writing. It is defined through

the concept of space (the direction of the string), the rhythm of grafema placement in space, the game of tension and relaxation of muscles involved in this act and which is backed by the quality of personal emotions in a given time of writing (Destreri et al., 2000; Ouellette, Tims, 2014). Language system of man consists of three forms: speaking, reading and writing. Each of these form has a reciprocal relationship with others. That relationship is hierarchical and is reflected in the consistency of development. Researches in frequency of using forms of the language system, in the course of the day in high developed areas are shown in Table 1.

Table 1 *The frequency of using language forms*

Hearing	36%	
Language	28%	64%
Reading	20%	
Writing	16%	36%

The process of writing of adult man is automated and is different from the writing of a child which is just overcoming this skill. The act of writing involves very complex processes and elements of: motor, manipulative, kinesthetic, visual and auditory activities, the ability of reasoning and the ability to use linguistic and non-linguistic knowledge (Brunsdon et al., 2005; Fletcher-Flinn, 2014). Since the writing is highly complex and phylogenetic late developed functions, it is difficult to talk about a specific center in the brain that is responsible for the realization of writing. However, as writing disorders are usually occurred at lesions gyrus angularis, Eksner center (the bottom of the second frontal curve) and pars opercularis dominant hemisphere, these centers are considered as basic neuroanatomical system for writing function (Rinne et al., 2000; Bookheimer, 2002; Johnson, 2003). For developing the function of writing that engages the whole being (psychological, physiological, biological and motor functions), the most important is neuropsychological motor organization, that is the organization of the central nervous system. Disturbance and lack of neurologic maturity often do not allow necessary coordination for the speech, and that is manifested in the child's movements (Rapp, 2005; Pennington, 2009). Which means there is a need to create a deliberate, controlled movements, which will carry out a precise willing action. These activities at the very beginning are very simple, and later more complex (Smits-Engelsman et al., 1997, Govedarica, 2000).

Relation between handiness and speech skills has long been known. Neurological diagnosis are based precisely on evaluating the ability of hand movement, and the movement of hand and fingers. Sophisticated and coordinated hand movements effect on the sensory-motor development of CNS, and through this also on the development of written speech, which requires the highest degree of sensorimotor coordination (Rosenblum et al., 2010; Nicolson, Fawcett, 2011). Success of forming and unfolding of the manuscript implies harmonious psychomotor organization in whole. The process of writing depends on: the muscle tone, strength in carrying out the action, the possibilities of localization movements, and the speed of execution of the act itself. Between 5 and 6 years child spontaneously demands to draw better, that drawings are more like object in reality. In that way gradually occurs the representative level of

graphomotor act. In the period of 5-7 years the child learns to write, resting the whole body on the table when writing. Later, when writing, it holds a little away from the table and the body is kept upright and firmly. In this way, the body becomes a support to the upper limb which performs the action of writing (hand), i.e. muscle tone body matures. The intensity of pressuring the surface, i.e. the intensity of the power in action of writing changes over the action, which reflects on the line of the manuscript. In the year 7 when a child learns to write, muscles are strained and strength is directed and stiffens the muscles that perform the action of writing. In 11-12 year, the movements are soft, elastic, and each group of muscles has its own tension level. In early childhood is difficult to perform precise movements due to dis-gestures of other parts of the body, which follow them. Later it achieves full accuracy of the action which is carried out by that movement. Writing speed is determined by the maturing of graphomotor team. This development takes place until about 14 years when the certain automatism necessary for full communicative writing is achieved. Priority and intention is to look at writing as a function of communication, which means that we have to analyze it in its full oneness with gnostic ability, within the gnostic-practice (understanding of written) and / or practice-gnostic (write) organization (Raymer et al., 2003, McCloskey, 2006; Graham et al., 2006).

The aim of this study is to examine spoken-linguistic graphomotor capacities and capabilities, in the context of detection and prediction of difficulties in writing of young school age children at Belgrade schools.

The hypothesis of the research is: The predictive capacity of spoken-linguistic pathology make possible the revealing of the difficulties in writing in children at young school age.

METHOD

The research was transversal and was conducted in two elementary schools in the municipality of Voždovac, namely: Elementary school "Milan Đ. Milićević" and Primary School "Bora Stanković". Basic sample consisted of 482 children of the third and fourth grades of which 278 children in third grade and 204 children in the fourth grade. Among examined children were 262 boys and 241 girls. Subsample is selected from a basic sample population, while respecting the criteria of presence of dysgraphia, which is determined by applying the scale for the assessment of handwriting dysgraphia (Aziriagrera, Ozias). This sub-sample consisted of 30 disgraphical children. In our research, we looked at this as a sub-sample of the experimental group. Other sub-sample of children selected from the basic sample consisted of 30 children of harmonious handwriting. Equable by age (class) with the experimental group. This group we watched as the control group. For the experimental and control groups, an additional test criteria was defined by the absence of other disturbances and disorders in intelligence, motor skills and sensory perception.

Instruments

For this research, we applied the following instruments: Test for estimation of handwriting dysgraphia – a modified version of the scale for assessing dysgraphia authors Ozijas and Ažiriagera (Ćordić, Bojanin, 1997). The first set of characteristics used to assess the spatial organization. Another group to assess the performance of a series of letters, a third group of characteristics reveals errors in form and proportion of letters. Dysgraphia Assessment was carried out on the basis of analysis of ability to write from dictation, transcription and writing of free composition. A predictive test for dysgraphia (Lj. Budimirović and S. Vladislavljević), which examines graphomotor dexterity and visual perception. Follow the task of understanding, skill of execution and ability to focus attention. Test phonemes (letters) analysis and synthesis (V. Radičević), this test first examines the ability of phonemic hearing, memory phonemes and their synthesis of the group. In assessing the synthesis of words, the examiner pronounced the votes, a respondent is advised to listen to the voices of the examiner pronounced and finally says what he said (the examiner between each spoken voice pauses). Testing analysis consists of issues from how many letters consist of individual words, the letter of a word eg. on the second or third position and Fig. During testing, monitors possible participation in the articulation of words to sonic analysis. Similar to the above is the examination of the situation of the letters in the word. Testing sound synthesis consists in giving the entire style or words, letter by letter (voice after voice) where the subjects are required to say that it is a word or syllable. Good analysis and synthesis of words is the basis for the proper writing and reading, and therefore is the basis of good literacy and eliminating errors based on the structure of words. In order to examine the justification of the objectives and tasks of the collected empirical data we have processed using the statistical analysis by parametric algorithms SPSS v.17 for Windows. Data are presented in absolute and relative terms, tables and pictures.

RESULTS

Table 2 *Structure of respondents in relation to age (class)*

Class (age)	N	(%)
3	278	57.7
4	204	42.3
Total	482	100.0

Table 2. shows the distribution of respondents presented in relation to age. From the table it can be seen that the largest number of respondents were in the third grade of elementary school, 278 (57.7%), while in the fourth grade were 204 (42.3%).

Table 3 *Structure of respondents with respect to gender*

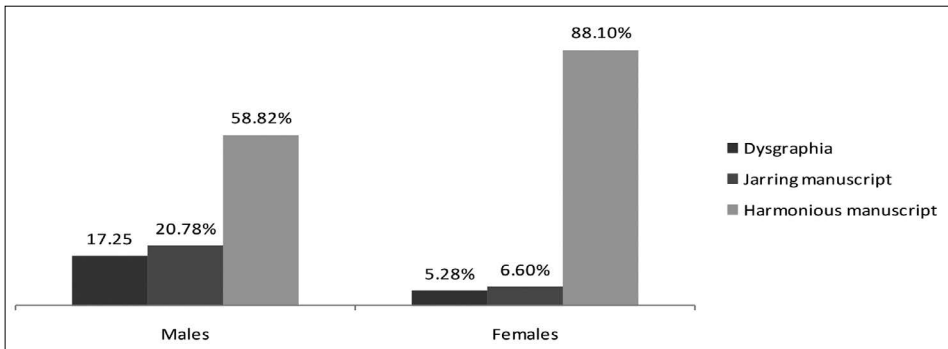
Class (age)	N	(%)
Males	255	52,9
Females	227	47,1
Total	482	100

Table 3. Shows the distribution of respondents presented in relation to gender. From the table it can be seen that the majority were male subjects them 255 (52.9%), while females were 227 (47.1%).

Table 4 Ability to write in younger school age children

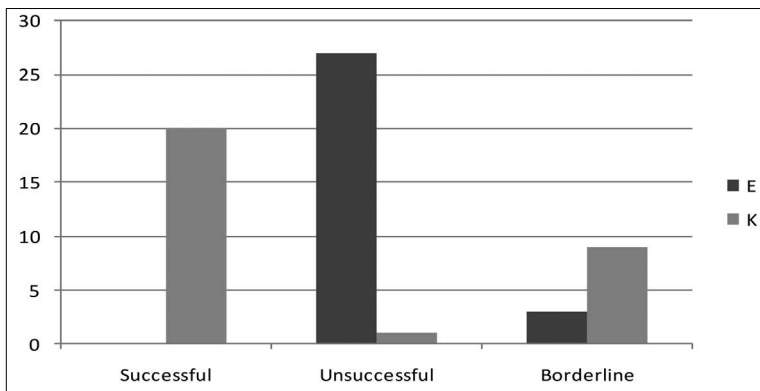
Handwriting	N	(%)
Dysgraphia	56	11,6
Jarring manuscript	68	14,1
Harmonious manuscript	358	74,3
Total	482	100

The results in the table 4 shows that dysgraphia occurs in 56 examinees (11.6%) in younger school children, while the jarring handwriting had 68 respondents (14.1%), a harmonious 358 respondents (74, 3%).



Picture 1 Distribution of respondents by writing abilities in relation to gender

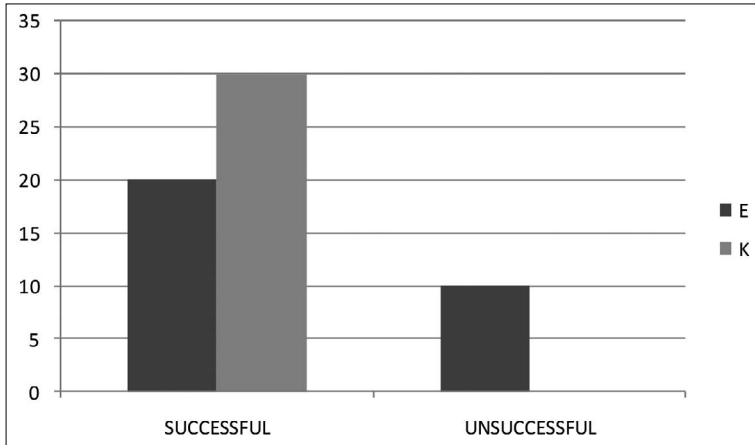
Picture 1. shows that in the sample were 44 male subjects with dysgraphia and 12 female subjects, with the jarring handwriting was them 53 males and 15 females, while with the harmonious handwriting was 158 male and 200 female subjects.



Picture 2 The distribution of examinees E and K group in relation to the results of a predictive test

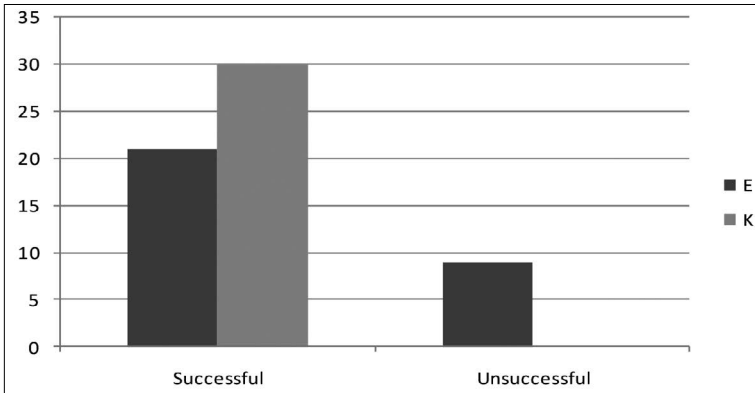
Picture 2. presents the results of E and K groups of examinees, the predictive test for dysgraphia. Respondents of E Group achieved significantly lower scores than subjects

K groups ($p=0.000$). In Group E of respondents in the category of unsuccessful there were 27 patients in the category of borderline 3, while there was no successful ones. In the K group in the category of unsuccessful was 1 respondent, border was 9, and 20 successful examinees.



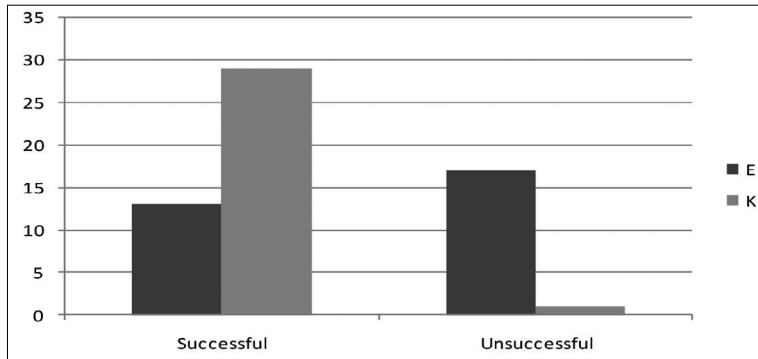
Picture 3 Distribution of respondents E and K groups in relation to the results of the task *The letter in front of...* (analysis of the letters in the sentence, test)

Picture 3. Shows that in E group was unsuccessful 10 respondents, while 20 of them were successful. Situation at K Group is as follows: no unsuccessful, and 30 have been successful. Statistical analysis found a statistically significant difference ($p=0.000$) between E and K group.



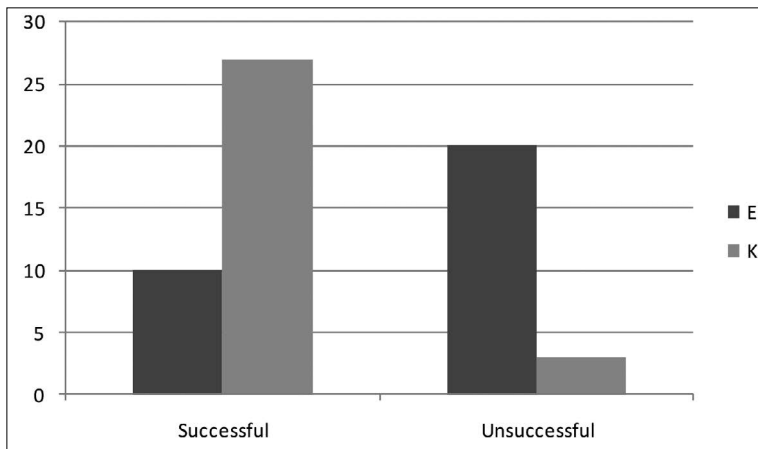
Picture 4 Distribution of respondents E and K groups in relation to the results of the task *The letter behind...* (analysis of the letters in the sentence, test)

Picture 4. Shows that in E group was unsuccessful 9 respondents, while 21 were successful. Situation at K Group is as follows: no failures, and 30 have been successful. Statistical analysis found a statistically significant difference ($p=0.001$) between E and K group.



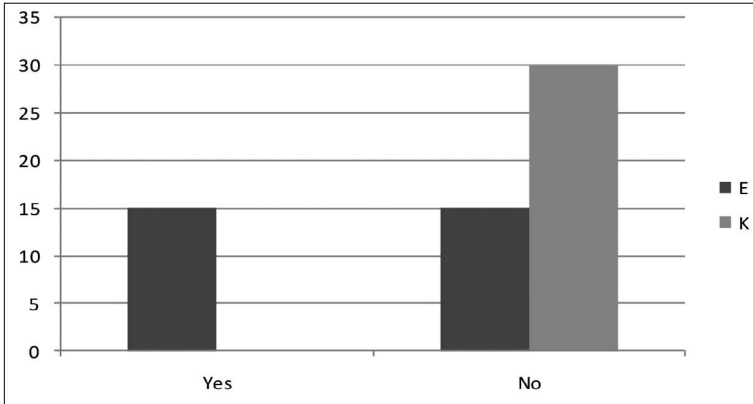
Picture 5 Distribution of respondents E and K groups in relation to the results of the task "RASKRSNICA" (synthesis of the letters in the sentence, test)

Picture. 5 shows that in E group was unsuccessful 17 respondents, while 13 of them were successful. Situation at K Group is as follows: 1 unsuccessful and 29 successful. Statistical analysis found a statistically significant difference ($p=0.000$) between E and K group.



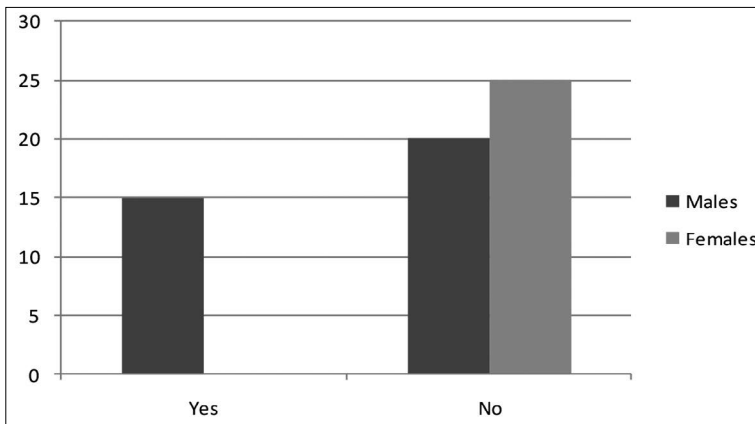
Picture 6 Distribution of respondents E and K groups in relation to the results of the task "PROSTRANSTVO" (synthesis of the letters in the sentence, test)

Picture 6. shows that in E group was unsuccessful 20 respondents, while 10 of them were successful. Situation at K Group is as follows: 3 unsuccessful, 27 successful. Statistical analysis found a statistically significant difference ($p=0.000$) between E and K group.



Picture 7 The distribution of subjects K and E group in relation to the presence of the dysgraphia with the linguistic pathology

In Picture 7. it is represented by E and K groups in accordance with the presence of the linguistic dysgraphia. From picture 8 we can see that the respondents Group E were significantly worse by the presence of dysgraphia with linguistic pathology of respondents in K groups ($p=0.000$). In Group E of respondents in the category no respondents was 15, and in the category were 15. In K group in the category no there were 30, while in the category yes, were not any.



Picture 8 Distribution of respondents by gender in relation to the presence of dysgraphia with linguistic pathology

Picture 8. shows the distribution of respondents by gender in relation to the presence of dysgraphia with linguistic pathology. From Table 30 shows that male gender, 20 of them have no dysgraphia with linguistic pathology, and 15 of them have. As for females, 25 of them have no dysgraphia with linguistic pathology, while there is no respondents who have it. Statistical analysis found a statistically significant difference ($p=0.000$) between gender and the presence of dysgraphia with linguistic pathology.

DISCUSSION

We wanted to determine what options we have for predicting outbursts in graphomotor expression on the basis of the present linguistic speech pathology in respondents. In this research in the basic sample, we got results on the frequency of occurrence of dysgraphia. The results shown in the table (3) and the picture (1) to dysgraphia occurs in 11.6% in cases of younger school age children, while the jarring handwriting had 14.1% of the children, and harmonious handwriting 74.3%. Analysis of writing skills in relation to gender showed that dysgraphia and jarring handwriting exhibit significantly higher in males than in females ($p=0.000$). In group of dysgraphia handwriting were (44) males and (12) females, and in the group of jarring handwriting (53) males and (15) females. We established incidence of dysgraphia at younger school age in line with our expectations and confirms the results of earlier studies (Golubovic, 2003, Stevović-Otasević, 2010). As we, except the basic, also had a sub-sample, which consisted of children with dysgraphia determined by the presence of 30 of them, compared to the achievements of children with harmonious handwriting. All respondents to the achievement tests are analyzed collectively for both groups. Results of respondents with dysgraphia in relation to the results of respondents with a harmonious handwriting on the test analysis of the letters in the sentence, analysis and synthesis are given in picture (3, 4, 5, 6). With this test, we examined the ability of acoustic analysis and synthesis of respondents, from simple to the more complex task. Test gives us insight into the predisposition to adopt a function of reading and writing. We started from the assumption that the respondents with harmonious handwriting were better on the test analysis and synthesis than respondents with dysgraphia. From the tables above we can see that the individual tasks, analysis and synthesis of respondents with dysgraphia were significantly worse than respondents with harmonious handwriting. The results of the analysis of the letters in the sentence test, on a subtest "The letter in front of" are given in the picture number (3). Unsuccessful respondents with dysgraphia reflected in the growing number of respondents in the category of unsuccessful (10), while in groups of harmonious handwriting there were no unsuccessful. In the category successful in subjects with dysgraphia was (20), while respondents with harmonious handwriting, all of them were successful (30). Results of subjects with dysgraphia on the part of the analysis of the letters in the sentence test on a subtest "The letter behind..." significantly were worse than those with harmonious handwriting ($p=0.001$). This indicates a poorer ability of subjects with dysgraphia in analysis of the situation in a letter "behind" than respondents with harmonious handwriting. The results of the test subjects letter analysis in the sentences on a subtest, "a letter behind" are given in the picture number (4). Failure respondents with dysgraphia reflected in the growing number of respondents in the category of unsuccessful (9), while there were not respondents with harmonious handwriting. In the category successfully in respondents with dysgraphia was (21), while respondents with harmonious handwriting that is successful, all of them (30). Results of subjects with dysgraphia on the part of the test letter analysis on a subtest, "a letter behind" were significantly inferior compared to those respondents with harmonious handwriting

($p=0.001$). This indicates a poorer ability of respondents with dysgraphia in analysis of the subtest a letter "behind" compared to respondents with harmonious handwriting.

On assignment (intersection), picture 5, 6 on the part of the test results of a word synthesis respondents with dysgraphia were significantly worse than patients with harmonious handwriting ($p=0.000$). Unsuccessful of respondents with dysgraphia is reflected in the growing number of children in the group unsuccessfully (17) in this task as compared to respondents with a harmonious handwriting (1). In the group of respondents successfully with dysgraphia was (13), with a harmonious handwriting (29). The test results of respondents with dysgraphia and respondents with harmonious handwriting on the part of the test letter synthesis task (raskrsnica) are given in picture (5). Review of result of respondents per group to test synthesis of the subtest "prostranstvo" are given in a picture 6. Unsuccessful of respondents with dysgraphia reflected in the growing number of respondents in the group unsuccessful them (20) while (3) in respondents with harmonious handwriting. The group successfully in respondents with dysgraphia was (10) subjects and in respondents with harmonious handwriting them (27). Results of respondents with dysgraphia are significantly worse than the same harmonious handwriting, on a subtest letter synthesis task (prostranstvo) ($p=0.000$). Similar results in the research were obtained by other researchers (Hoefst et al., 2006; Booth et al., 2004; Miceli et al., 2006; Kohnen et al., 2008). Their results suggest that children who have outbursts in the function of writing have phonological deficits and problems with spelling, as well as problems with the analysis and synthesis of less frequent and polysyllabic words. Results of children with dysgraphia presence compared to the results of children with harmonious handwriting on a predictive test are given in pictures (1). With this test, we examined graphomotor dexterity and visual perception. We believe that the test is of great importance because it is the prediction of character and provides the possibility of failure in graphomotor expression, if timely applied. The survey started from the assumption that the graphomotor capability and better visual perception in children with harmonious handwriting in relation to children with dysgraphia. From the above picture we can see that the predictive test subjects with harmonious handwriting were statistically significantly better compared to those with dysgraphia ($p=0.000$). Success of respondents with harmonious handwriting reflected in the growing number of subjects in the group of successful (20) in this test compared to subjects with dysgraphia, where there was not successful ones. In the group of bordering respondents with dysgraphia was (9) subjects, and in respondents with harmonious handwriting (3). While the group unsuccessful in respondents with harmonious handwriting was (1) respondent, while respondents with dysgraphia were (27). Results of the respondents with harmonious handwriting on a predictive test indicates that these respondents have better graphomotor ability and visual perception. Results of respondents with dysgraphia in relation to the results of subjects with a harmonious handwriting, and in relation to the presence of dysgraphia with linguistic pathology are given in the picture number (7, 8). From that picture it can be seen that the subjects with dysgraphia compared to subjects with harmonious handwriting was significantly worse ($p=0.000$).

CONCLUSION

Based on the results of tests writing skills in children of younger school age we can conclude the following:

1. Dysgraphia occurs in 11.6% of cases. Characteristics of jarring handwriting had 14.1% of the children, while the harmonious handwriting had 74.3% of children.
2. Dysgraphia and jarring handwriting statistically significantly are more often manifested in males compared with females. (78.6% in males and 21.4% females)
3. Graphomotor dexterity and visual perception is worse in children with dysgraphia compared to children with harmonious handwriting.
4. The voice analysis of words is better in respondents with harmonious handwriting compared to respondents with dysgraphia.
5. Voice synthesis of words is worse in respondents with dysgraphia in relation to those with harmonious handwriting.

Upon observation of the results was carried out general conclusion: The existing capacities of speech – language pathology provide opportunities for discovering difficulties in writing in children of younger school age.

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