BRAIN. Broad Research in Artificial Intelligence and Neuroscience
ISSN: 2068-0473 | e-ISSN: 2067-3957
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2021, Volume 12, Issue 1, pages: 326-342 | https://doi.org/10.18662/brain/12.1/185

Results of the Examination of Primary School Students By Means of Speech Therapy Screening

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Abstract: *The number of senior preschoolers with speech development below the norm on the eve of school education is growing steadily annually. Updating the educational process organization, aiming at improving the efficiency and quality of primary school students education and, consequently, growing requirements for the level of their knowledge and skills, on the one hand, and the increase of the number of children with speech impairment, on the other, necessitate propedeutics of impairment and the development of special diagnostic tools.*

In this paper, we set an objective to analyze the reasons for which younger primary school students have difficulties in the process of written speech formation. The research is aimed at studying the level of the formation of basic processes and functions essential for literacy and writing skills acquisition.

240 primary school students were engaged in a pilot experiment aimed at assessing the efficiency of speech therapy screening. The traditional screening methods have always been the observation, conversation, but one of its modern methods is testing. The analysis of the results of the younger primary school students' frontal examination enables to state that in students from 1st to 4th grades there prevailed average level of formation of basic prerequisites and skills essential for writing skills teaching. According to the results of the study, we can affirm that the study of the degree of the formation of processes and functions essential for literacy and writing skills acquisition by means of speech therapy screening is an essential prerequisite of a comprehensive correction of the speech development of younger primary school students with dysgraphia, as it facilitates early identification of children from "risk groups" and those who have impairments of basic writing skills formation.

Keywords: *senior pre-schoolers; younger primary school students; speech impairment; propedeutics of impairments; special diagnostic tools; written speech; writing skills formation.*

How to cite: Zhuravlova, L., Sheremet, M., Suprun, D., Fedorenko, S., & Dubiaha, S. (2021). Results of the Examination of Primary School Students By Means of Speech Therapy Screening. *BRAIN. Broad Research in Artificial Intelligence and Neuroscience, 12*(1), 326-342. https://doi.org/10.18662/brain/12.1/185

Introduction

Modern education trends set high requirements for the quality of knowledge, the fundamentals of which are established already at the initial stage of school education. However, the level of speech development of primary school children does not always meet these requirements. Unfortunately, the number of senior preschoolers with a speech level below the norm on the eve of school education is growing steadily annually.

The success of education depends to a great extent on the patterns of children's development, in particular speech development, as with the increase in the study load, some difficulties may arise while mastering school subjects, including the acquisition of the written speech skills (Zhuravlova, 2020; Ahutina, 2008; Bezrukykh, 2005; Golub, 2014; Nerubasska, 2020). Specific writing impairments in schoolchildren are the most common evidence of difficulties of education and remain one of the most urgent problems of modern speech therapy. Thus, the renovation of the educational process organization, orientation at improving the efficiency and quality of young primary schools students' education and, accordingly, the growth of requirements for the level of their knowledge and skills, on the one hand, and the increase in the number of children with speech impairments, on the other, necessitate propedeutics of impairments and development of special diagnostic tools.

Complete acquisition of written skills by a child in the conditions of normal ontogenesis and dysontogenesis occurs differently. Thus, according to the researchers (Bezrukykh, 2005; Korniev, 2003; Sadovnikova, 1997; Melnyk, 2019; Sheremet, 2019), in the systemic underdevelopment of speech there are evident either only speech impairments, or a combination of underdevelopment of speech with a violation of the formation of a number of important non-speech processes and functions. This naturally results in the lack of the functional basis of writing formation and the occurrence of preconditions for the development of various forms of dysgraphia as one of the specific impairments (M. Bezrukyh, 2005; N. Golub, 2014; E. Danilavitchutie, 2012; O. Korniev, 2003; I. Sadovnikova, 1997; N. Cherednichenko, 2012 and others).

Speech therapy is the first stage of the system of corrective work with younger students with dysgraphia. However, unfortunately, the specified speech pathology is diagnosed even when the child has persistent difficulties in learning. Modern speech therapy practice reveals a great variety of mechanisms for disrupting the formation of writing skills in children and sets certain requirements for expansion of diagnostic tools. With this in

mind, it is necessary to organize the process of timely prophylaxy of writing skills impairments and their prevention while mastering written speech by younger students. We have suggested the approach based on prevention of manifestations of impairments, and not only on their discovery, in particular: timely diagnosis of the basic processes required for literacy acquisition and writing skills formation by means of speech therapy screening.

From a medical point of view, the main purpose of screening tests is to identify early diseases or risk factors of the disease in a large number of virtually healthy people. The purpose of the diagnostic test is to establish the presence (or absence) of the disease, in case of positive screening results (Ruf, Morgan, 2008; Onishchuk, 2020).

D. Creighton notes that the prognostic effect of screening (Creighton, Dewey, Sauve, 1997; Behas, 2019; Maksymchuk, 2018) techniques is noticeable while monitoring a child by a certain program, including screening techniques for basic examination, focal screening tests, and multi-purpose tests for thorough children's examination. However, work with most of them requires special training. Forecasting is necessary for the detection, timely correction or assistance in the development of children with high or moderate risk of impairments.

Thus, screening is aimed at the examination and detection of children who need further, more profound medical, psychological and pedagogical diagnostics.

It should be noted that today there is shortage of screening techniques in the domestic speech therapy practice and their use is rather limited. Therefore, in our opinion, the development and implementation of the screening methodology for determining the status of basic preconditions of writing is timely, since it may become an essential diagnostic tool in the work of both speech therapists and elementary school teachers.

The objective of this paper is to analyze the reasons for which younger students have difficulties in the process of written speech formation. The research is aimed at studying the level of the formation of basic processes and functions required for acquiring literacy and writing skills formation.

Materials & methods

The state of basic prerequisites for the formation of writing skills in younger primary school students was conducted by means of speech therapy in the period from 2016 to 2019 years. 240 younger primary school students (school # 249 in Kyiv and TEC # 16 in Melitopol) participated in a pilot

experiment to assess the efficiency of speech therapy screening. In the process of the experimental research there were examined 2534 pupils of 1-4th grades from schools in different cities of Ukraine (Sumy, Kyiv, Kolomyia, Sloviansk, Zaporizhzhya, Kamyanets-Podilsky, Melitopol, Lviv). The comparative analysis was employed to study predictive screening function.

The traditional screening methods have always been the observation, conversation, however one of the modern methods is testing.

In evaluating our achievement due to the specificity of our research, we studied the following testing characteristics: reliability, validity, discriminativity. **Reliability assessment** is based on the calculation of the correlation between two sets of results of the same test or of its two parallel forms. The higher the correlation is, the more reliable the test is. A good coefficient of test reliability is considered to be the one which changes in the range of $0.8 < r < 1$.

Since speech therapy screening performs chiefly a diagnostic function, we conducted it once without repetition on a certain number of pupils (240 people) to verify reliability. For this purpose, we employed the technique of splitting by Rulon's formula (Moroz, 2010) to assess reliability as internal consistency. The coefficient value is approximately equal to 0.99. This indicates that the test has a high degree of reliability. So, from this point of view, it is well-made. The reliability of the test is very high, that is, the methods used give correct (valid) results.

Validity characterizes the ability of methods to fulfil the tasks of assessment. It determines the degree in which the test reflects what it must evaluate. To assess the validity of the developed speech therapy screening methods, the correlation between test indices and certain external criteria was verified.

To determine the validity an independent external criterion was needed, i.e. expert assessment (speech therapist, elementary school teacher). For the validity factor there is taken correlation coefficient of the test parameters and criteria.

The validity of testing is checked by comparing test results of the examined students with expert — independent results of assessing the level of material assimilation by other methods: verbal survey, traditional test paper, examination or comparison of these results with assessment of current success.

To determine the validity there are most commonly employed in practice different types of correlation analysis, the relationship between individual estimates according to the methods and assessment on the

criterion of validation. If the criterion index is the result of other (reference) methods and the both sets of data are normally distributed and may be recognized interval, Pearson's correlation coefficient is used for the validity factor.

For our research, most suitable is a comparison of empirical distribution with theoretical one, that is, to test the technique of speech therapy screening for the validity we use Pierson's criterion, where the frequencies of these distribution series are compared, differences between them are distinguished and the probability of these differences is determined.

This criterion is not recommended for the evaluation of small samples, since the sample volume must have a quantity. The criterion is measured in approximate values. The accuracy of the criterion rises at large n.

Let's compile statistical hypotheses:

— experts' results and the total number of students' scores don't differ;

— experts' results and the total number of students' scores differ.

The number of degrees of freedom is the same. A variable value is $\chi^2_{\text{емп}}$, which equals $\chi^2_{\text{емп}} = 18{,}46$

$$\chi^2_{\text{емп}} < \chi^2_{\text{кр}}$$

On this condition, the hypothesis is accepted, that is, the experts' results and the total number of students' scores don't differ. This indicates that the validity of this test is high.

Discriminativity of the tasks is determined as the ability to separate the examinees with a high total number of scores for the test from those who received a low total number, or examinees with high scores from examinees with low scores.

We used the method of extreme groups to calculate the discriminativity: while calculating discriminativity of a test assignment the results of the most and least successful respondents are taken into account. (The proportion of extreme groups' members may vary widely depending on the sample size. The larger the sample, the less portion of the examinees suffices when selecting the groups with high and low results. The lower limit of "clipping groups" is 10% of the total number of examinees in the sample, the upper — 33%.) In our research we have employed 27% group, as with this percentage ratio the maximum accuracy in the discriminativity distinction is achieved. The discriminating index has been calculated by the formula:

$$D = \frac{Nn_{max}}{N_{max}} - \frac{Nn_{min}}{N_{min}}$$

where: N_{nmax} — the number of respondents in the group of the best, fulfilled the assignment correctly; N_{nmin} — the number of respondents in the group of the worst, fulfilled the assignment correctly; N_{max} — the total number of the examinees in the group of the best; N_{min} — the total number of the examinees tests in the group of the worst.

The value of the discrimination coefficient may vary from -1 to +1. High positive value of the assignment task discriminativity indicates the efficiency of the distribution of examinees, high negative value indicates the unsuitability of this assignment for the test, its mismatch in the total number of scores. The obtained result of mathematical processing, $D \geq 0.7$, (according to the results of each assignment's verification) is considered sufficient.

Thus, screening technique testing on the main test characteristics (reliability, validity, discriminativity) confirms the expediency of its application.

Results

The analysis of the younger primary school students' frontal examination results allows to state that students from 1st to 4th grades have revealed the predominance of the average level of **formation of basic prerequisites and skills necessary for teaching writing skills** (Fig. 1–5). In addition, in percentage value, its indicators gradually increase with the transition of the child to the following grades.

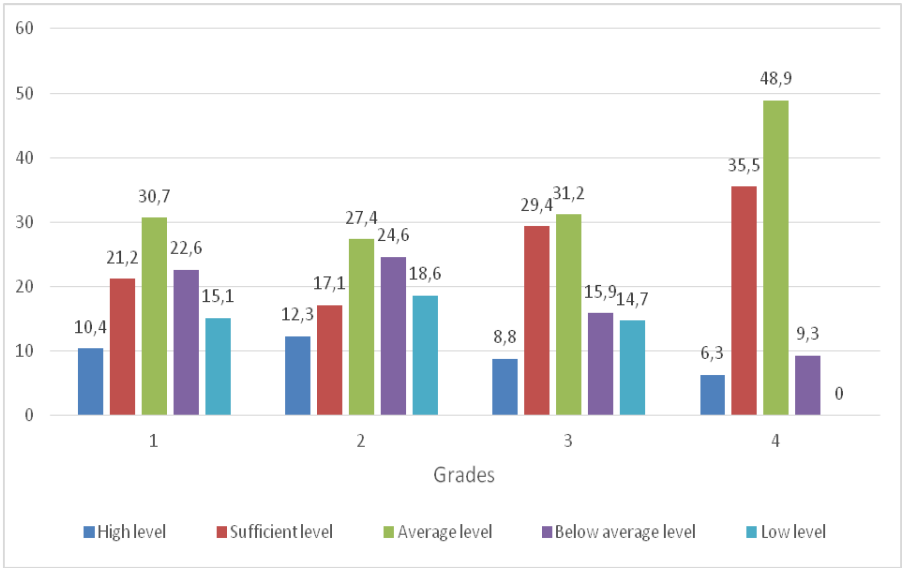

Figure 1. *Levels of formation of basic prerequisites and skills necessary for teaching writing skills*

Thus, in the 1st grade, the percentage of pupils of average level is 30.7%. It should be noted that the average level for the children of this age is considered acceptable. These pupils, though not in full extent, have coped with the tasks of speech therapy screening. The age norm for first-graders is a sufficient level of the development of basic mental processes and functions required for writing skills formation (about 21.2% of pupils had this level). And the figures corresponding to the high level (10.4%) illustrate that first-graders strictly followed the instructions, easily distinguished phonemes in words and differentiated them correctly, defined the number of sounds in the word, correlated the perception of phonetic with the visualization of the letter. They also had a high level of the formation of visual-motor and auditory-motor coordination, visual-spatial perception, spatial and visual-spatial orientation. They could analyze the sample without assistance and acted on the model. All this provides them with the possibility of successful training in the future and easy acquisition of skills in academic disciplines. However, we should note that among the first-graders, there occurred many children with difficulties in basic writing skills formation and writing impairments – 37.7% of the examinees (indicators below the average and the lowest levels). We believe that these children may have persistent typological errors in writing in the future. That is why we these children were included into the "risk group".

The greatest number of pupils with difficulties in basic writing skills formation and writing impairments are traced in the 2nd grade – 46% of the examinees had scores below the average (24.6%) and low levels (18.6%). They showed a low level of visual-motor coordination formation (inability to accurately reproduce the sample – a set of dots, difficulties in operating visual-spatial images (visual-spatial perception, spatial orientation), failure to adhere to instructions, inaptitude to analyze the sample and act on the model, as well as absence of phonetic processes formation. The examinees found it difficult to perceive and comprehend the linear sequence of sounds in words. That is the process of psychologically conditioned basic linguistic operations of writing in such students is carried out on the damaged and/or unformed basis. A little less number of students than in the 1st grade had an average level of scores (27%), however figures of the average level in the 2nd grade have revealed the imperfection of basic prerequisites of young primary school students writing skills formation. That is why we considered this group of children the "risk group". There were much fewer children who fulfilled all the assignments of speech therapy screening and had normative indexes of the formation of skills required for writing (sufficient level – 17.1% and high level – 12.3%).

In the third grade the percentage of pupils with low figures of the basic prerequisites of writing formation is 30.6% (indicators below the average and low levels) and 31.2% – students of the "risk group", who did not cope with the assignments of speech therapy screening or fulfilled them with errors. Quite a small number of younger pupils had scores corresponding to the high level (8.8%). The process of their written speech formation is carried out on the perfect basis. Finally, we recorded normative results in 29.4% of pupils who showed an adequate level of the basic mental processes and functions development required for writing skills formation.

As for the 4th grade pupils, there should be stated the absence of children with the low level of scores. It should also be taken into account that in the 4th grade there is observed the lowest percentage of pupils who have perfectly fulfilled all the assignments of speech therapy screening (6.3%). There were about 35.5% of the examinees with the sufficient level, the state of their basic writing skills formation corresponds to the age norm. However, the figures corresponding to the levels below the average (9.3%) and average (48.9%) revealed insufficient formation of the necessary prerequisites for teaching children of this age. This means that the younger primary school students' training is carried out on a deficient basis.

On the basis of the speech therapy screening results, there were selected pupils of 1st grades with the difficulty in writing skills formation

(those were the children from the "risk group") and pupils of the 2nd-4th grades with the insufficient level of writing skills formation and writing impairments for the more detailed empirical research.

The next year the re-examination of the 2nd grade pupils (ex-first-graders) and the 3rd grade pupils (ex-second-graders) was carried out.

The comparative analysis of the speech therapy screening results for younger primary school students of the 2nd grade (with their preliminary scores) reveals that the pupils either retained the same level of the skills essential for teaching writing, as in the previous year, or there was traced shift both for the higher and lower levels.

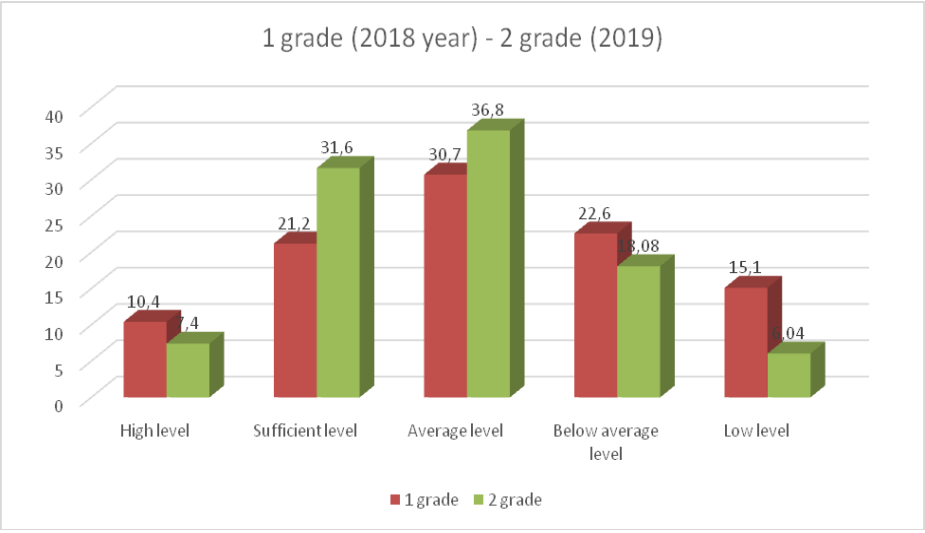

Figure 2. *Comparative analysis of the speech therapy screening results for younger primary school students of the 2nd grade*

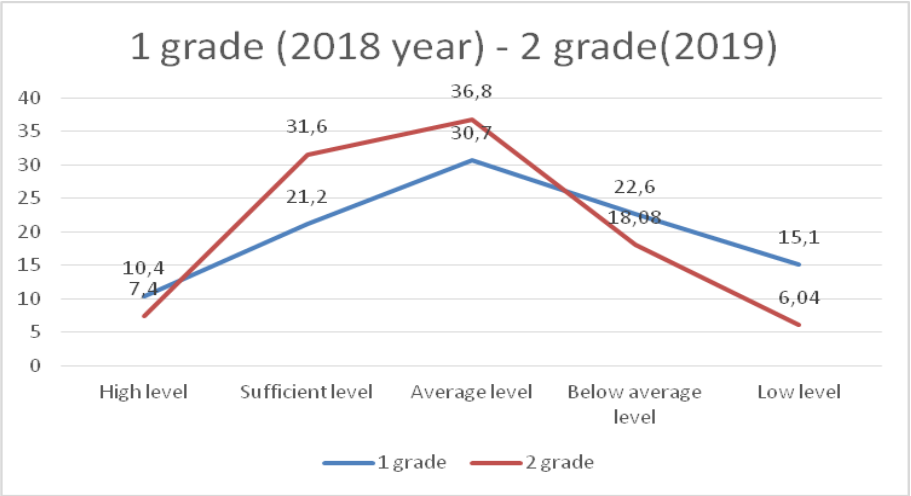

Figure 3. *Comparative analysis of the speech therapy screening results for younger primary school students of the 2nd grade*

We found out that the increase in teaching requirements resulted in the decrease of the percentage of children with high level (from 10.4% to 7.4%), there occurred certain increase in the number of children with sufficient (from 21.2% to 31.6%) and average level (from 30.7% to 36.8%). But, while in the first grade children with scores corresponding to the average level basic mental processes and functions formation were on the verge of acceptable, in the second grade they represent the "risk group" and constitute a significant percentage of pupils with difficulty in writing skills formation.

In addition, the number of children with low indexes of basic writing skills formation (low level – from 15.1% to 6.04% and below the average level – from 22.6% to 18.08%), has decreased. Still, the pupils who had difficulties in fulfilling all the assignments of speech therapy screening in the first grade are traced in the second grade as well.

So, the earlier assumption was confirmed that the students who had an average level of the formation of the basic functions and skills essential for teaching writing in the first grade, show a low level of writing skills in the second grade.

The comparative analysis of the speech therapy screening results for younger primary school students of the 3rd grade and their preliminary scores for the second grade showed similar changes in the indexes: increase in the sufficient (from 17.1% to 21.6%) and average levels (from 27.4% to

35.5%), and decrease in the high (from 7.8% to 12.3%) and low levels (from 18.6% to 14.2%).

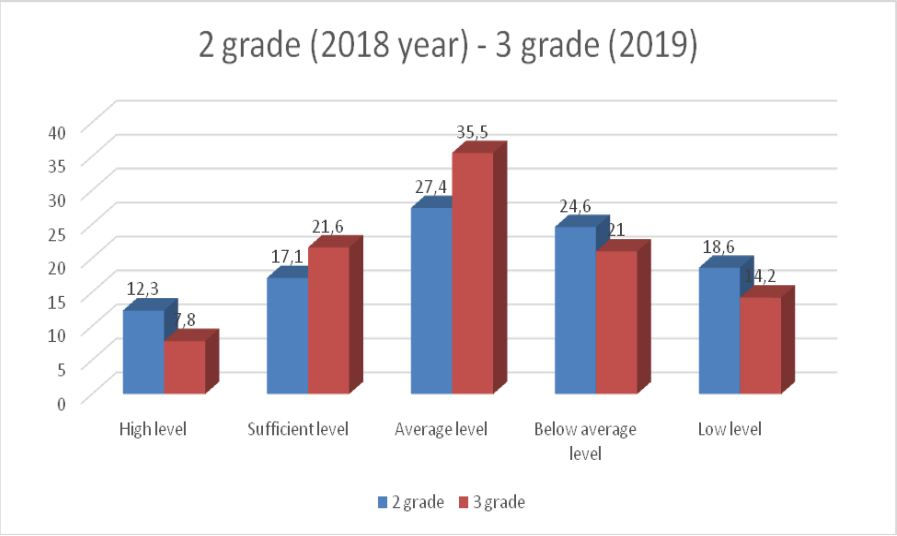

Figure 4. *Comparative analysis of the speech therapy screening results for younger primary school students of the 3d grade*

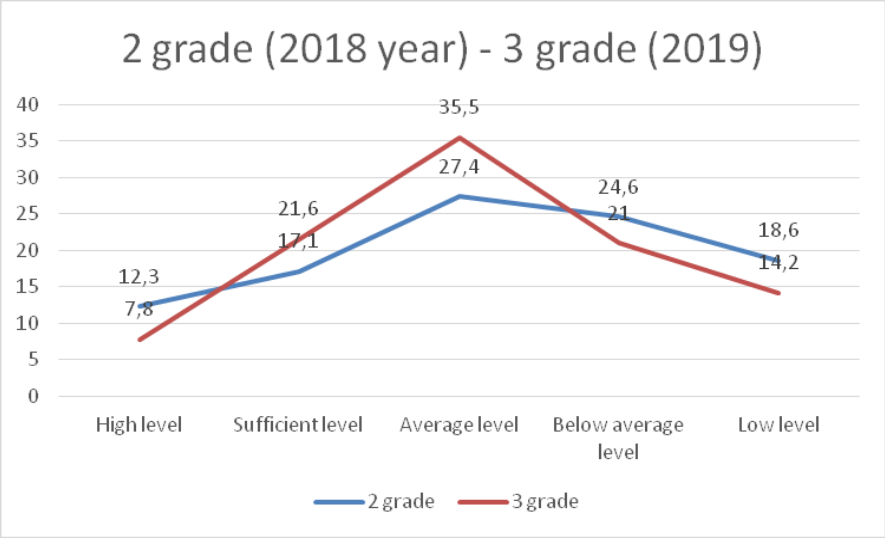

Figure 5. *Comparative analysis of the speech therapy screening results for younger primary school students of the 3d grade*

In the 3d grade there remains a significant percentage of children with the level below average (21%) and low level (14.2%), a slight decrease in their scores is traced. It should be noted that we have registered very few pupils of this age with normative indicators of basic writing skills formation (sufficient level – 21.6%, high level – 7.8%).

Consequently, the analysis of the speech therapy screening results has given us an opportunity to state in younger primary school students the imperfection of the functional and psychological basis of writing necessary for its formation. In the 1st grade there are a lot of children with nonformation of phonetic processes, motor function immaturity, reduced ability to automate and differentiate movements, immaturity of subtle movements kinesthetic control, absence of space perception and spatial orientation abilities, lack of coordination of development processes of visual and motor analyzers, insufficient development of self-control.

Discussion

We have suggested an approach based on the prevention of manifestations of impairments, not only their distinction, namely: the timely diagnostics of the level of basic processes and functions formation, which indirectly influence the violations of the written speech formation, in particular writing skills, and therefore the performance of the formation intensification in the sensitive period of the younger primary school students' speech development on the earliest stage.

We have grounded the speech therapy screening technique and determined the expediency of the introduction of the elaborated author's technique in comprehensive schools of Ukraine.

We have obtained new experimental data on the condition of basic prerequisites for writing skills formation for younger primary school students in comprehensive schools of Ukraine.

We have optimized the process of timely prevention of writing impairments while acquisition of writing skills by younger primary school students.

The screening technique is an important diagnostic tool in both speech therapist's and elementary school teacher's activity and is implemented on the basis of their interaction. It provides timely recognition of speech impairments in children of primary school age. It helps to predict the potential difficulties in writing skills formation and clarify the causes and character of these difficulties.

Conclusion

Thus, we have revealed that the main problem in first-graders is the absence of phonetic processes formation (starting with the touch level), remains and transforms into more complex mechanisms – immaturity of the analysis and synthesis mechanisms, traced in children up to the 4th grade. Children are experiencing difficulty in distinguishing the sounds from the words and their differentiation. It is especially difficult for them to perceive and realize the linear sequence of sounds in a word, to operate visual-spatial images and reproduce the spatial relationship. This means that for a long time children of younger primary school age are forming a necessary basic level instead of forming more complex processes and functions of a higher level. The compensation processes occur at a low level, and higher levels remain unreformed.

Thus, up to the 4th grade younger primary school students compensate for the reduced level of elementary mental processes and basic functions formation, but the skills of a higher level are not being formed. We believe that this results in a large number of common mistakes.

On the basis of the aforesaid, it is possible to draw conclusions, if pupils easily and independently perform speech therapy screening assignments, this proves their readiness to form the skills of writing and written speech. But, if children are experiencing difficulties with certain assignments phonetic processes formation, graphical-motor skills, visual-motor coordination and spatial orientation, as well as the development of the iconic thinking (necessary for mastering the symbolic designation of phonemes) and self-control, this indicates the insufficient formation of basic mental processes and functions, which indirectly influence the violation of the written speech formation, in particular writing skills. After all, any skill has its own specific spheres that must be in a state of readiness until its formation.

In the process of initial writing skills acquisition, pupils face various difficulties caused by individual peculiarities of the development. For many children, given their individual psychophysiological peculiarities, inadequate (compared to the average development at this age) or dysharmonic formation of certain psychological functions, which are important for the process of writing skills mastering.

We are conviced that, while studying in elementary school, it is necessary to take into account children's individual differences, especially their mental maturity and activity. In the case when there is no diagnostics of these individual characteristics, some pupils may first have difficulty in writing skills formation, and later – persistent dysgraphia may occur.

In school educational institutions speech therapy screening can be performed during the routine preventive examinations of children by teachers-speech therapists. It is performed with the employment of previous teachers' data based on the results of their observations of younger primary school students' speech. Screening diagnostics, implemented on the basis of interaction between elementary school teacher and teacher-speech therapist, provides timely recognition of speech impairments in children of primary school age. According to the screening results, the teacher is able to form a fairly complete picture of the imperfection basic prerequisites for writing formation or their violation, predicting the potential difficulties in writing skills formation, distinguishing the causes and character of these difficulties.

Organization of the process of timely prevention of writing impairments in the process of the acquisition of writing skills by younger primary school students, and therefore, the investigation of the condition of basic prerequisites for their writing skills is a prerequisite for successful teaching of primary school students.

According to the results of the study, we can state that the study of the underlying processes and functions required for literacy acquisition and writing skills formation by means of speech therapy screening is an essential prerequisite for a comprehensive correction of speech development for younger primary school students with dysgraphia, as it allows as early as possible to identify children as "risk groups" and select those who have basic writing skills formation impairments.

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