УДК 376.374

DIAGNOSTIC ASPECTS OF THE PROBLEM OF PREVENTION OF DYSCALCULIA WITH OLDER PRESCHOOL CHILDREN WITH SEVERE SPEECH DISORDERS

O.A. Naumenko, (BSPU named after M. Tank
IIO, Minsk), Candidate of Pedagogical Sciences, Associate Professor;
D.V. Petuh, (BSPU named after M. Tank, IIO, Minsk), master's student.

Annotation. The article substantiates the importance of timely identification of children at risk of dyscalculia among older preschool children with severe speech disorders. A description of the methodology for studying numerical quantitative representations in this category of children in comparison with normally speaking pupils is given, as well as an analysis of the results of the ascertaining experiment.

Currently, at the first stage of general secondary education, the number of students with difficulties in mastering counting skills is growing. Accordingly, there is a need for timely identification of a "risk group" among pupils of senior preschool age and preventive work to prevent dyscalculia. This is stated in the recommendations of the Ministry of Education of the Republic of Belarus, presented in the instructional and methodological letters of recent years.

Under dyscalculia in our study, we consider a partial violation of counting activity, manifested in persistent repetitive mathematical errors caused by insufficient formation, on the one hand, of the processes of receiving and processing sensorimotor information and, on the other, "mathematical speech", leading to a decrease in the level of culture of knowledge of mathematics [1]. From the point of view of speech therapy, prevention of dyscalculia is the prevention of possible deviations in the formation of counting activity associated with violations in mastering the lexical and grammatical structure of speech based on mathematical terminology, violations in mastering and understanding mathematical symbols, etc. [2].

A number of modern studies have proved the possibility of predicting dyscalculia in children through the study of representations of sets (L.B.Baryaeva, S.Y.Kondratieva, N.S.Tsyrulik, etc.). Operating with a variety of sets (objects, toys, pictures, geometric shapes), pupils learn to establish equality and inequality of sets, to call the number of words: "more", "less", "equally". Comparison of specific sets prepares for the assimilation of the concept of number in the future, since operations

with sets are the basis to which children turn when studying at school. The idea of the set forms the basis for students to understand the number, the laws of the natural series of numbers [1;3]. The concepts of a natural number, as well as a geometric figure, magnitude, part and whole reflect the connections and relationships of objects of the surrounding reality.

In the conditions of normal speech development, the consistent systematic formation of representations in pupils through practical tasks and actions contribute to the successful formation of the necessary numerical quantitative representations by the senior preschool age [3;4;5]. Numerical quantitative representations include: the isolation of a quantitative attribute from a number of others and the establishment of quantitative relations between sets; the assimilation of the elemental composition of a set and ways to change it; the ability to compare sets by quantity; creation of equal and unequal groups, equalization of them; possession of the operations of unification and separation of the set, assimilation of the concept of conservation in actions that do not change the quantitative attribute [5;6].

. A number of modern researchers (L.B.Baryaeva, R.I.Lalaeva, N.S.Tsyrulik, etc.) consider the deficit of numerical quantitative representations and elementary counting skills as a specific factor in the occurrence of counting disorders (dyscalculia).

As is known, pupils with severe speech disorders (SSU) have difficulties in forming mathematical representations [1;2;3]. For example, pupils may have insufficient knowledge of a mathematical dictionary, difficulties in mastering mathematical concepts, a low level of assimilation of the mathematical sign-symbolic system. There may be a mechanical reproduction of quantitative counting, often accompanied by the presence of omissions of numbers in the numerical series, insufficient representation of the composition of the number, there are also difficulties in performing elementary arithmetic operations, especially subtraction, even with the use of fingers or counting sticks. In the development of spatial representations, difficulties can manifest themselves in the splicing and splitting of words and numbers when writing, in the fused spelling of words with prepositions, in the replacement of letters and numbers by spatial similarity (c - e, b - d, 5 – 6, 1 - 7), the height of the digits may not correspond to the height of the cell, when writing off (reading) the letters are arranged (read) in reverse order (instead of "on" they write and read "an", instead of "nose" - "sleep", etc.), which makes it difficult to understand the conditions of tasks and assignments. When reading, there may be repeated reading of the same line, skipping a line, reading above the line located instead of the bottom - all this makes it difficult to understand these tasks and task texts. Difficulties in counting, errors when performing counting operations with a transition through a dozen, non-compliance with the working line, when writing off

the digital sequence, recording from the last element – all these mistakes of students with SSU can be observed in math lessons.

In order to identify the "risk group" among the pupils of senior preschool age with SSU, we selected a method for studying numerical quantitative representations [6]. We consider the use of this technique to be optimal, since one of the age normative indicators of the development of preschool children aged five years is the mastery of the following skills:

- comparison, grouping and classification of subjects by 1-3 signs;
- construction of seriation series of 5-10 elements;
- determination of the ratio in magnitude between objects;
- the designation in words of the dimensional relations by one or two parameters of the magnitude between the elements of the series in ascending and descending order;
- comparison, distinction of objects or their images by one or two signs of magnitude by practical techniques of superposition, applications;
- performing various actions with flat and three-dimensional geometric shapes (circle, square, triangle, oval, etc.): viewing, recognizing, finding among other shapes, showing, naming, etc. [5].

Our chosen methodology includes 8 blocks consisting of 20 tasks. The tasks of the first two blocks do not require oral detailed answers from the child, the operation of mathematical concepts is studied impressively. Starting from the third block, the child needs to verbally denote quantity, quantitative relations, actions with quantity and quantitative changes. The tasks of the first-third block are aimed at identifying the ability to estimate quantity, from the fourth to the seventh - at identifying the ability to operate with quantity.

The first block "Distinguishing a set by quality" consists of tasks aimed at identifying the ability to distinguish sets by shape (square, triangle, rectangle), size (wide/narrow, long/short) and size (large/small). The second block, "Distinguishing a multitude by quantitative attribute," includes tasks to identify the ability to distinguish between the concepts of "many", "few", "one" and to identify the ability to distinguish between the concepts of "all", "one", "each" on the material of drawings depicting geometric shapes. The third block "Grouping of items" includes tasks to identify the ability to group items by one and two attributes. The fourth block "Serialization of objects" contains tasks to identify the ability to make an ordered series in ascending and descending order of the attribute. The fifth block "Comparison of sets by quantity" includes tasks for comparing the number of two sets with homogeneous elements, aimed at identifying the ability to compare two sets by quantity in a practical way (using the method of "application" of elements), establishing relationships "as much", "more", "less", and comparing elements of sets

differing in size, aimed at identifying the ability to compare sets by the number of elements, abstracting from the attribute of the magnitude of elements and using the correlation method. The sixth block "Formation of sets" includes tasks to identify the ability to form a new set, quantitatively equal to the given one, by a method of direct correlation, and to identify the ability to form a new set, larger or smaller in number of elements than the given one, by a method of direct correlation on the material of a set of geometric shapes. The seventh block "Transformation of sets that change the number of elements" consists of the following tasks: changing the quantity in the set, aimed at identifying the ability to use practical ways to change the quantity in the set (adding and removing elements), and equalizing sets by quantity, aimed at identifying the ability to equalize sets by the number of elements by adding /removing elements on the material of two sets of geometric shapes. The eighth block "Establishing the conservation of quantity when changing the external features of the set" contains one task aimed at identifying the ability to establish the immutability of quantity when changing the external features of the set on the material of a set of geometric shapes.

In the process of conducting the ascertaining experiment, we proposed the use of the following types of assistance:

- stimulating (repetition of instructions, encouragement, introduction of additional guidelines, etc.);
- guiding (leading questions, additional specification of the task, providing the opportunity to correct the answer);
- training (direct attention to the solution path, showing a sample of execution, etc.).

The results of all tasks were recorded in the protocol using special designations: independently, correctly and fully completed task — "+", task completion with the help of a teacher - "±" task completion with errors, refusal to complete the task or incompleteness of the action (response) provided in the task — "–". Each correctly self-completed task was evaluated at 1 point, when performing the task with help of 0.5 points and if it was not completed or refused, 0 points. The maximum number of points is 20 (100%).

In the process of monitoring the progress of diagnostic tasks, the following qualitative indicators were recorded:

- the degree of interiorization of activity: the speech component (counts to himself, in a whisper, in terms of loud speech), the motor component (movement of objects, touching them, pointing at them with eyes)–

- consistency of speech and motor components;

- understanding of the independence of the quantitative result of the account from the direction of the counting action;

- recognition of the number of items available without counting them one by one;

- the ability to demonstrate in practical actions with subject sets the meaning of arithmetic operations of addition and subtraction, the composition of numbers, the actions of counting and counting, and others, the use of the "application" and "overlay" methods.

To identify the "risk group" of dyscalculia, a ascertaining experiment was conducted, in which 35 pupils with TNR and 35 pupils with normal speech development took part.

Generalization of the results of the tasks of the third, fifth, sixth and eighth blocks are presented in the diagram (Fig. 1). Comparative characteristics showed that when performing tasks of these blocks, there is a significant difference in success (more than 20%) among the two groups of pupils.

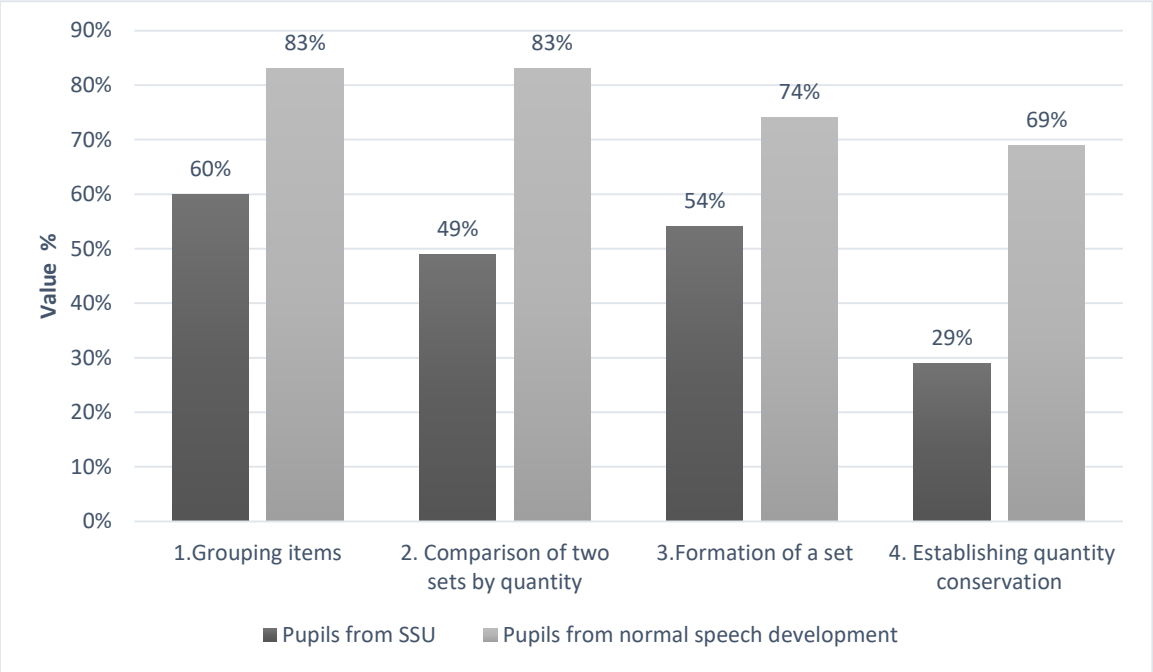

Figure 1. – Comparative characteristics of the performance of tasks of 3,5,6,8 blocks by pupils of both groups

The success rate of completing the tasks of the third block among children with normal speech development is 83%, while for children with SSU - 60%. When grouping objects according to two characteristics, the main difficulties consisted in the desire to divide objects according to one attribute, similar to the previous task, more often this feature was color, less often form. Actions with objects by pupils from SSU were carried out without oral explanations of their actions, and when asked to explain their actions, they answered in monosyllables. At the same time, pupils with normal speech development answered the question with a detailed answer.

The success rate of completing the tasks of the fifth block among children with normal speech development is 83%, while for children with SSU – 49%. Basically, the pupils from SSU tried to count the items in each group aloud using an index gesture and compare the numbers obtained, instead of using the "application" and "overlay" techniques that were required in the task, respectively, there was a need to provide training assistance. It was enough for their peers with normal speech development to provide stimulating assistance in the form of repeating the conditions of the task, also the children of this group were able to verbally explain their assumptions, the pupils with SSU managed it with difficulty, leading questions were required.

54% of pupils with SSU and 74% of pupils without speech disorders coped with the tasks of the sixth block for the education of a multitude independently. When performing the tasks of this block, both groups of pupils made mistakes in using the concepts "as much", "as much as", and, accordingly, they found it difficult to designate quantitative relations verbally. Children with SSU, as well as when performing the tasks of the previous block, found it difficult to use the techniques of practical correlation of objects, they tried to count them out loud.

When performing the task of the eighth block to establish the conservation of quantity when changing the external features of the set by changing the spatial arrangement of the elements of the set, 29% of pupils with SSU and 69% of pupils with normal speech development successfully coped with the task. The main difficulty for the two groups of pupils arose in understanding that the same number of geometric shapes remained on the table, despite the spatial movements made with them, and also when checking their guess, many children used counting, found it difficult to use the methods of "application" and "overlay".

The generalization of the results of the tasks of the first, second, fourth and seventh blocks by pupils of both groups is reflected in the diagram (Fig. 2). Comparative characteristics showed that when performing tasks of these blocks, there is a slight difference in success (less than 10%) among the two groups of pupils.

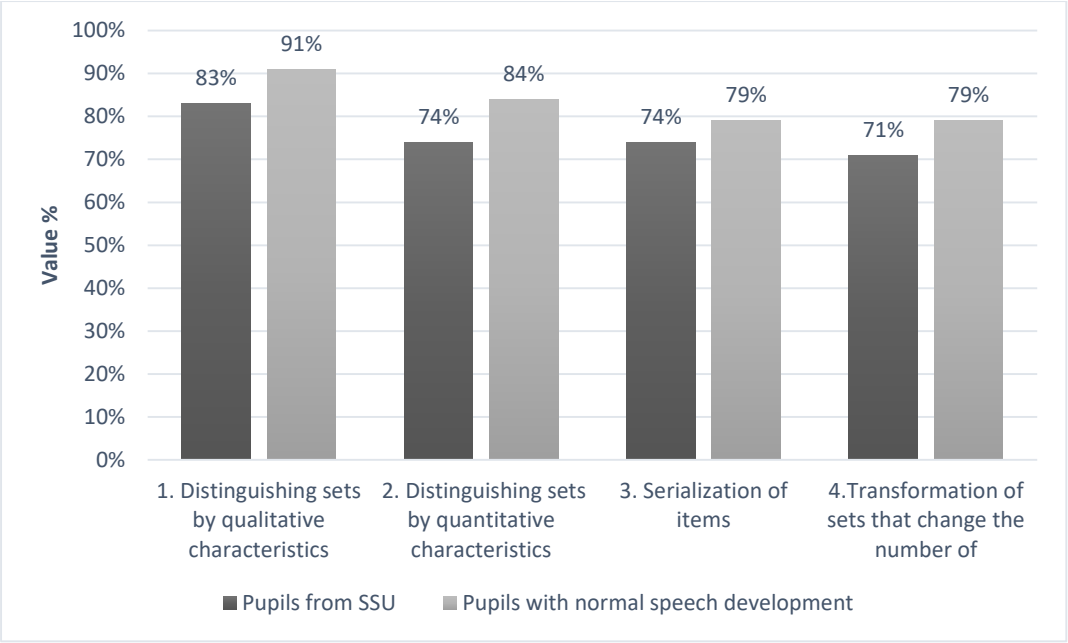

Figure 2. – Comparative characteristics of the performance of tasks of 1,2,4,7 blocks by pupils of both groups

The success rate of the tasks of the first block was 83% for pupils with SSU and, accordingly, 91% for pupils with normal speech development. The pupils of both groups completed this series of tasks with the least number of errors, the tasks of this block did not require oral explanations. It was necessary to provide stimulating assistance to children who had some difficulties associated with not knowing the names of the shapes of objects, with a mixture of length and width characteristics.

When completing the tasks of the second block, the success rate was 74% for pupils with speech disorders and 84% for their peers without speech disorders. The pupils of both groups showed a fairly high result when distinguishing the concepts of "many", "few", "one", and when distinguishing the categories of "all", "one", "each", it was difficult for some to show each item (they showed one of the items in a row in response to this request). The tasks of this block also did not require oral explanations from the children.

When performing the fourth block, 74% of pupils with SSU and 79% of pupils without speech disorders coped with the tasks independently. The main difficulties were recognized by the fact that the children tried to build a serial series by trial, while the mistakes were not eliminated, or the way to eliminate them was to re-build the entire series. Pupils with SSU could not independently determine the sequence of their actions, explain them, there was a need to provide training assistance.

The success rate of completing the tasks of the seventh block is 71% for pupils with SSU and 79% for the second group of pupils. Despite the rather high success

rate of completing tasks in this block, those who coped with the tasks did not understand the relationship between the actions performed and quantitative changes in the set, i.e. the children found it difficult to explain the tasks (added - more, the number increased, removed part - less, the number decreased). Pupils with SSU needed educational assistance, their peers without speech disorders – stimulating and guiding.

Thus, the results of the ascertaining experiment allowed us to conclude that the greatest difficulties for pupils with SSU are caused by tasks aimed at:

- identifying the ability to distinguish groups of subjects by qualitative characteristics;
- grouping of items;
- comparison of two groups of subjects and establishment of quantitative relations between them;
- establishing the conservation of quantity when changing the external features of the set by changing the spatial arrangement.

Tasks aimed at identifying skills turned out to be less difficult for pupils with SSU:

- to distinguish groups of subjects by qualitative characteristics;
- distinguish between the concepts of "all", "one", "each";
- make an ordered series in ascending and descending order of the attribute;
- use practical ways to change the quantity in the set;
- equalization of sets by quantity.

At the same time, the pupils of the studied category are characterized by: inconsistency of the speech and motor components of counting activity, a low level of its internalization, difficulties in understanding the independence of the quantitative result of counting from the direction of counting activity. It was also revealed that the most common errors in the performance of tasks are manifested in the difficulty of understanding mathematical concepts ("wide" - "narrow", "each", "all"), difficulties in spatial orientation and grouping of objects on two grounds, inability to use basic comparison techniques: "application" and "overlay".

According to the results of the experiment, the levels of formation of numerical quantitative representations were determined (Fig. 3). They were allocated based on the number of correctly, independently and fully performed actions and responses, taking into account the above-mentioned features of counting activities, from the maximum possible number: high (100% - 91%), above average

(90% - 76%), medium (75% - 51%), low (50% - 0%).

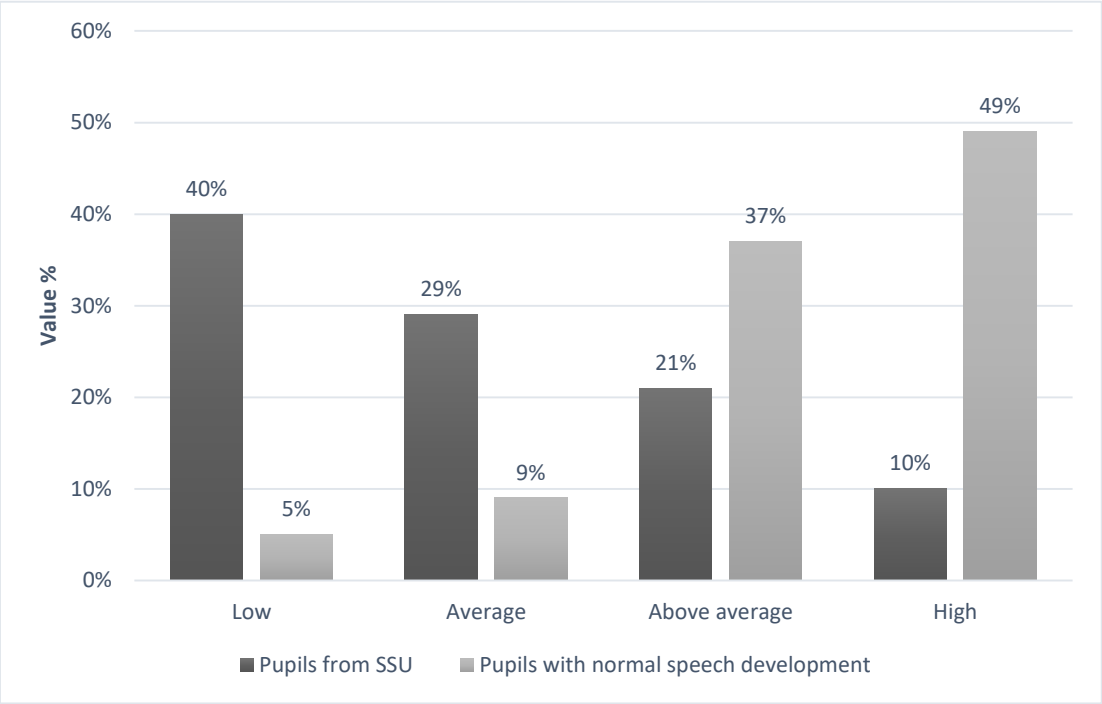

Figure 3. – Comparative characteristics of the levels of formation of numerical quantitative representations in pupils

So, the analysis and generalization of the data of the ascertaining experiment allows us to assert that for pupils with SSU, the most characteristic are low and average levels of formation of numerical quantitative representations, while for pupils with normal speech development - above average and high levels of formation of numerical quantitative representations. Consequently, in the majority of the examined pupils with SSU, quantitative ideas and ways of dealing with quantity in numerical activity remain insufficiently formed.

This allows us to assume that pupils of senior preschool age with SSU have a higher probability of difficulties in mastering counting skills during subsequent schooling than their peers without speech disorders, and in the absence of timely correctional and pedagogical work, the existing prerequisites can become persistent and lead to dyscalculia.

So, the need to identify a predisposition to dyscalculia in children with severe speech disorders is beyond doubt. Early identification of pupils with SSU who are in the "risk group" for the occurrence of dyscalculia in preschool age and carrying out appropriate work on its prevention in general will reduce the risk of dyscalculia, as well as increase the readiness of pupils of the designated category for subsequent systematic teaching of mathematics at school.

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