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Phenomenology of the Development of Mnemic Abilities of Junior Schoolchildren

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Abstract: The article presents a comparative analysis of the study of the mnemic abilities of younger schoolchildren with delayed mental development (100 students) and younger schoolchildren with a normal rate of mental development (105 students). The research methodology is based on the method of unfolding mnemonic activity (V. D. Shadrikova, L. V. Cheremoshkina). Experimental study included a pilot study, an ascertaining experiment and a longitudinal study, analysis of gender differences in mnemonic abilities of younger schoolchildren with different rates of mental development. It is revealed that the structure of mnemonic abilities of younger schoolchildren with delayed mental development is underdeveloped, in which the operating mechanisms are in an early stage of formation. The effect of inability to copy the previously memorized material by children with delayed mental development is also discussed in the paper.

1. Introduction

The study of factors and causes of learning difficulties remains relevant despite improvements in the quality and standard of living of the population and ongoing changes in the education system. In various countries of the world, the problem of rendering assistance to under-performing children has been relevant for many years both in pedagogy and in psychology. The younger school age is a sensitive period for the development of the ability to memorize, for the formation of the ability to learn.

The delayed mental development (DMD) (the term introduced into the domestic psychology of G. E. Sukhareva) is one of the reasons for the difficulties of mastering educational material by younger schoolchildren. Interest in the problem of delayed mental development has not decreased since the 60-70s of the last century. Russian and foreign scientists use different terminology in the description of this problem: “pseudonormal”, “children of the borderline”, “subnormal”, “poorly presented”. The following terminology can often be found in the English-language literature: global developmental delay, delayed mental development, developmental disability, speech / language delay, “minimal brain dysfunction”. And it is more often used to denote problems of an earlier age of 5-7 years [10-16]. In Russian psychology, V.V. Kovalev proposed the most complete classification, which covers various pathogenetic mechanisms, describing various clinical manifestations. K. S. Lebedinskaya, Yu. V. Mikadze, N. K. Korsakova, and other Russian scientists continued this classification [1, 2]. We followed this classification in our study.

2. Methods

The study of mnemonic abilities of younger schoolchildren was carried out by the method of unfolding mnemonic activity (Shadrikov & Cheremoshkina, 1990).

The applied method of diagnosing mnemonic activity includes 10 cards with the figures of increasing complexity depicted on them, consisting of straight intersecting lines. Non-verbal meaningless material and a certain order of its presentation allow to “expand” mnemonic activity and isolate the productivity of the mechanisms implementing it: functional, operational and regulatory [3,9].

We evaluated two indicators:

- Memory productivity based on functional mechanisms – the card No. 2 (simple non-verbal meaningless material);
- Memorization efficiency due to functional and operational mechanisms – the card No. 3 (complicated non-

verbal nonsense material).

As an indicator was considered the time of memorizing the cards No. 2 and No. 3 (Fig. 1).

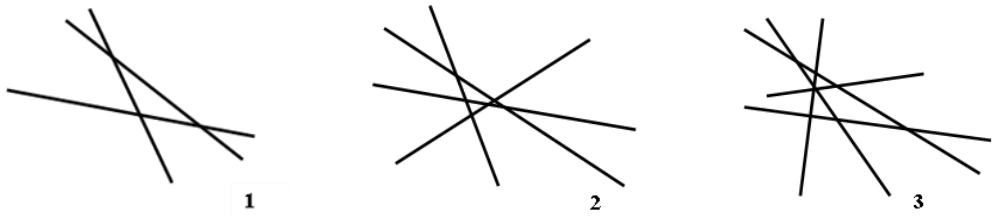


Fig. 1. Experimental material.

3. Research

100 junior schoolchildren with delayed mental development formed an experimental sample, and 105 junior schoolchildren with a normal rate of mental development were included in a control sample. Also, 25 people participated in a longitudinal study [3, 9].

In our sample, 51% of students have DMD of constitutional origin, 3% are of somatogenic origin, 12% are of psychogenic origin, and 34% of students are of cerebral organic origin. The children were trained according to a special correctional program of the type VII, which eas intended for correctional classes of general education schools. It was developed (1996) on the basis of methodological and didactic materials of the Institute of Correctional Pedagogics of the Russian Academy of Education and adapted to the peculiarities of the psychophysical development of a child with DMD (type VII program, 2006) [4].

Analysis of the research results

The distribution of the results of memorization based on the functional mechanisms of mnemonic abilities according to the average time of reproduction of non-verbal nonsense material in children with delayed mental developmen is as follows: 26 sec. in 7-8-year-olds, 27 sec. 9-year-olds, and 23 sec. in 10-12-year-olds. Memorization time corresponds to an average productivity. In particular, 56%, 66%, 83% coped with the task in each age group, respectively. The number of those who did not cope with the task decreases with age from 44% in 7-8 years old to 17% at the age of 10-12 years.

Of the group of subjects who coped with simple non-verbal material, only 6% of children with delayed mental development at the age of 9 - 12 years old were able to reproduce complicated non-verbal material (Card No. 3). That is, only 6% of children of 9-12 years with MR have developed functional and operational mechanisms of mnemic abilities.

Analyzing the results of schoolchildren who did not cope with the card No. 2, the variants of the CRA, we saw the following trend. For children with DMD of cerebral-organic origin, the impossibility of memorizing card No. 2 was 32% in 7-8-year olds, 24% in 9-year-olds, 11% in 10-12-years-olds.

The number of children with DMD who failed in their assignment (44% in the group of 7-8-year-olds, 34% among 9-year-olds; 19% among 10-12-year-olds) indicates significant differences in the structural organization of functional systems that implement their mnemonic abilities.

The results of the study of the level of development of mnemic abilities:

Level 1 in the development of mnemic abilities (MA) tends to change with age. And the predominance of level 1 is also observed in 7-8 year-olds, 9-year-olds, and 10-12-year-olds with delayed mental development.

Level 2 of mnemonic abilities begins to manifest at approximately 9.5 years.

This is another proof of the delayed (impaired) formation of mnemonic abilities compared with the control group of students, who, on the contrary, have an increase in level 2 in 9.5 years and a decrease in level 1 of mnemic abilities.

Analysis of the results showed that the structure of mnemic abilities of schoolchildren of 7–12 years with DMD and the structure of mnemic abilities of schoolchildren of 7–12 years of the control group have different qualitative expression and productivity [5,6,7] (Table 1).

TABLE 1. COMPARISON OF INDICATORS OF PRODUCTIVITY OF MEMORIZATION WITH SUPPORT TO FM MA OF SCHOOLCHILDREN OF 7-12 YEARS IN EXPERIMENTAL AND CONTROL GROUPS.

Productivity of functional mechanisms of mnemic abilities	Age						Sample 7-12 years, %	
	7-8 years, %		9 years, %		10-12 years, %			
	DMD	Control group.	DMD	Control group	DMD	Control group	DMD	Control group
Very high	7	35	11	29	16	40	13	35
High	29	35	21	15	13	23	18	25
Above the average	14	12	5	15	26	25	20	18
Average	7	9	21	17	8	6	11	11
Below the average	29	3	26	15	29	3	25	7
Low	14	6	16	9	8	3	13	6

Figure 2 graphically presents the mean values of memorization based on the functional mechanisms of mnemonic abilities among schoolchildren of 7–8 years, as well as 9-year-olds and 10-12-year-olds in a sample of CRA (71 people) and the control group (people).

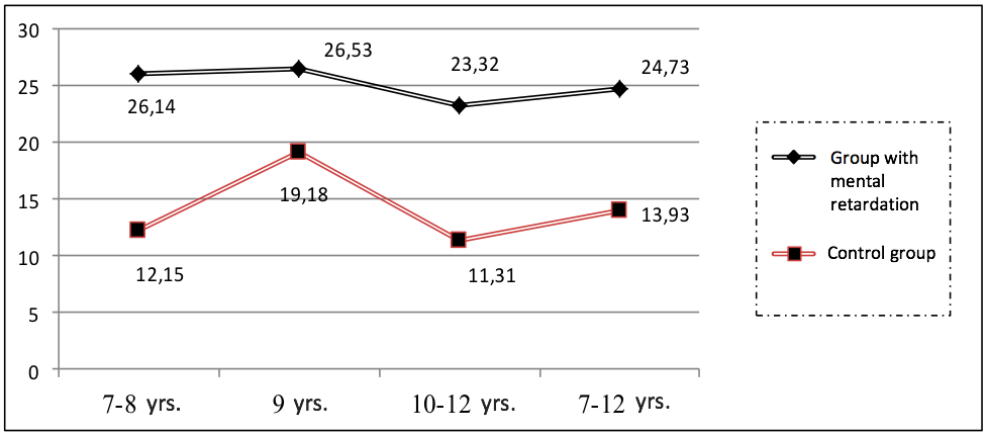


Fig. 2. Memory productivity based on FM MA of the experimental and control group (average, in seconds.).

Thus, memorization occurs at the same level of productivity of functional mechanisms, within its "diagnosis" regardless of the age of 7-8, 9, 10-12 years. In the experimental group, this is the average level, and in the control group is above the average.

This proves the existence of a trend in the development of memorization based on the functional mechanisms of mnemic abilities and the dependence of the development of abilities on the course of normal or impaired delayed mental development.

Statistically significant differences in memorization based on functional mechanisms (according to the Mann-Whitney U criterion) were revealed:

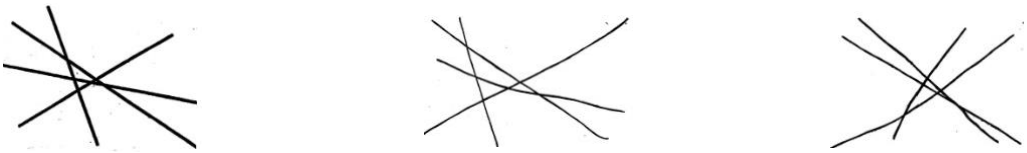
- 7-8 year-olds with DMD and the control group are at the level of $p<0.5$ with $p=0,012$;
- 10-12 year-olds with DMD and the control group are at the level of $p<0.001$ with $p=0,001$.

The highly significant difference $p = 0.000$ was found when comparing the experimental and control groups aged 7-12 years old (71 and 105, respectively) in memorizing material.

The results of implementing the sophisticated non-verbal material (card No. 3) showed that, 23% of 7-8-year-olds, 41% of 9-year-olds, and 66% of 10-12-year-olds coped with the task in the control group, and only 7% of school children of 9-12 years with the DMD coped with the task in the experimental group. Thus, 44% of students in the control group memorize material, including educational material, based on the functional and operational mechanisms of mnemic abilities. The results of the survey showed that only 7% of schoolchildren with DMD have such operational mechanisms as associations, repetition and reference point.

Upon further analysis of the results of memorizing the card No. 2 by the subjects, the pronounced distortions in the quality of copying the already memorized and previously reproduced material were found. *The effect of inability to copy previously memorized material* after its correct memorization and reproduction is revealed (Cheremoshkina, Murafa,2010,2011,2012, 2015).

44% of 7-8-year-olds, 45% of 9-year-olds, 50% of 10-12 years old schoolchildren with MR had an effect. And 9%, 9%, 3% of schoolchildren in the control group had an effect, respectively.



Sample card No. 2 | Correct reproduction of card No. 2 t = 3 sec. | Subject No.3 sketched wrong

Fig. 3. Example of the task "Draw a card after memorization".

After analyzing the manifestation of the "effect" on the DMD options, we got the following result: the "effect" shown is characteristic for the DMD of constitutional origin of 7-8-year-olds (32%), 9-year-olds (32%), and 10-12-year-olds (31%).

Thus, the results show that the "effect" is a specific feature of the cognitive activity of children with DMD of constitutional origin.

Based on the neuropsychological data, it can be assumed that structural disorders in the link of the volume of perception (defect of perception), recognition, violation (defect) of images-representations, visual images are detected in this case. The results confirm that these children have minimal brain dysfunction (MBD). MBD is associated with impaired functioning of the brain as a whole and / or impaired functioning of its individual structures.

In the longitudinal study (25 students), the stimulus material (card No 2) used was the same. Consequently, we were able to determine the correlation coefficient between the indices of the memorization time of one stimulus in the same subjects in two studies conducted with an interval of 2 years.

According to the results of the r-rank correlation for Spearman, a correlation was found between the indicators of the memorization time of simple non-verbal material (card No. 2) with a study interval of 2 years (with $p \leq 0.05$). The "effect" in the first study appeared in 92% of the subjects, and it was the second one in 75% of the subjects.

The Wilcoxon T-test was applied when comparing the results of memorization indicators based on the functional mechanisms of mnemonic abilities (card No. 2) at the beginning of the study and after 2 years on the same subjects; and a statistically significant difference was found, which was 0.003 with $p<0,01$. The average memorization time is 35 seconds at the beginning of the study, and 15 seconds after 2 years. Memorization times at the first and second stages of the study are significantly different. Consequently, the same mechanisms of mnemonic abilities are involved in memorizing the stimulus in two studies: memorization relies primarily on functional and emerging operational mechanisms.

Gender differences in memorization based on FM MA according to the Mann-Whitney U-test were not identified. The average time of memorization of simple non-verbal material in boys is 25.29, and it is 23.5 in girls with DMD; and in the control group, this indicator is 15.41 and 13.07, respectively.

4. Conclusion

Based on the study, the following features in memorizing younger students were highlighted:

- Developing mnemonic abilities of younger schoolchildren with DMD occurs unevenly and heterochronously;
- The structure of mnemonic abilities of 7–12-year-old children with DMD is characterized by specificity, in which operational mechanisms and regulatory mechanisms are almost absent;
- Deviations in the development of memory are characteristic signs for all forms of MR;
- The operational mechanisms of the mnemonic abilities of 7–12-year-old schoolchildren with DMD are in the early stages of their formation. At the same time, some children have a certain underdevelopment of perceptual and attenuation abilities;

- The ability to memorize schoolchildren with DMD and with the usual rate of delayed mental development occurs along fundamentally different trajectories;
- "The effect of the inability to copy children with DMD non-verbal meaningless material after its memorization and correct reproduction" needs a systemic justification using not only psychological, but also neuropsychological and neurophysiological research methods can be applied.
- The longitudinal study confirmed our hypothesis;
- The development of mnemonic abilities does not depend on the gender of schoolchildren of 7-12 years old with a detainee and the usual rate of delayed mental development.

Summing up the study, it can be argued that with the favorable development of perceptual and mental functions of schoolchildren, as well as their correction, by the end of primary school, progress is possible in changing the structure and effectiveness of mnemic abilities of children with DMD. The obtained data, once again, confirms the possibility of developing skills and the need for methodological developments in the field of education for working with children of various nosologies.

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