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**INNOVATIVE APPROACH TO THE STUDY OF SPATIAL
AND TEMPORAL CONCEPTS IN PRESCHOOL CHILDREN
WITH CEREBRAL PALSY**

Abstract. The article discusses an innovative approach to developing a comprehensive program for the study of spatio-temporal concepts in preschool children with cerebral palsy. Child cerebral palsy is characterized by a complex structure of defect which manifests motor, psychic and speech disorders of different degrees of severity. It involves absence of formed spatio-temporal concepts, which makes successful social adaptation of children impossible, i.e. they cannot master various forms of activity, including learning and everyday ones. For organization of effective preventive work it is necessary to find out individual problems for each child. A diagnostic program for the study of spatio-temporal concepts of preschool children between the ages of 5 and 7 has been worked out for this purpose. The program presupposes two stages: 1) the study of psycho-physical properties of children; 2) the study of spatio-temporal concepts of the children of this category. The first stage involves a special scheme of observation of motor skills (keeping the upright position; method of movement – on crutches, with a walking-stick, etc.; handedness (left or right); use of the disabled arm in games and self-service). The second stage of the diagnostic complex includes the following blocks: concepts of parts of the human body; perception of distance from the object; perception of spatial relationships between objects; orientation in space; sense of time; understanding temporal sequence of events.

Keywords: cerebral palsy, spatial concepts, spatio-temporal concepts, diagnosis.

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Child cerebral palsy (CP) is a serious chronic disease of the central nervous system (CNS) leading to disablement; it has been spreading all over the world since the mid 20th century.

Recently it has become one of the most widely spread diseases of the nervous system in children. On the average, 6 out of 1000 babies are born with such pathology of the CNS which may lead to cerebral palsy [10; 11; 12; 13].

The given category of children have a complex structure of defect which results in motor, psychic and speech disorders of different degrees of manifestation [4]. Inadequate formation of spatial and temporal relationships is observed in the structure of disorder in preschool children; this means that there are problems with the formation of the complete picture of the world and the realization of one's position in it. The absence of

properly formed cognitions about space and time makes successful social adaptation of children, i.e. mastering various kinds of activity, including learning and everyday ones, impossible [6; 7; 8].

Many scholars highlighted the importance of formation of spatio-temporal concepts in preschool children with CP (E. F. Arkhipova, R. D. Babenkova, L. O. Badalyan, L. B. Baryaeva, E. A. Ekzhanova, L. A. Danilova, Z. M. Dunaeva, S. D. Zabramnaya, M. V. Ippolitova, E. S. Kalizhnyuk, I. Yu. Levchenko, V. I. Lubovskiy, N. N. Malofeev, I. I. Mamaychuk, E. M. Mastyukova, I. I. Panchenko, O. G. Prikhod'ko, N. V. Simonova, I. A. Smirnova, G. V. Tutorskaya, L. B. Khalilova, M. B. Eydinova, etc.). But in spite of a large enough number of detailed studies of peculiarities of children with CP, there are no special investigations of the formation of spatio-temporal concepts in preschool children with CP, which hinders the development of methods and programs of its remedial treatment. It is this fact that defines the urgency of the given article.

Special literature states that children with CP have difficulties with the formation of spatio-temporal concepts. Purposeful specially organized pedagogical work aimed at the formation of spatio-temporal concepts in children should be necessarily included in the structure of activity of preschool education institutions. Optimization of the pedagogical process of children's development presupposes the use of special content, forms, means and methods of pedagogical influence taking

into account the peculiarities of preschool children with CP.

Our research offers an innovative approach to the study of spatio-temporal concepts in the children of the given category. It is necessary to reveal individual problems for each child in order to organize effective remedial work. With this end in view, we worked out a diagnostic program aimed at the study of spatio-temporal concepts in preschool children between the ages of 5 and 7.

This program presupposes two stages.

Stage 1 – study of psycho-physical properties of children.

Stage 2 – study of spatio-temporal concepts in the children of the given category.

At stage 1, while studying the psycho-physical properties of children with CP, we used a scheme of observation of motor skills [5] including the following parameters:

1) keeping vertical posture (while sitting or standing);

2) method of movement – in a wheel-chair, on crutches, with a walking-stick, on one's own inside the room, on one's own on considerably long distances;

3) handedness (left or right);

4) functional possibilities of wrists (markedly limited, partially limited, unlimited);

5) use of the disabled arm in games and self-service (the disabled arm is unfunctionable, the disabled arm can be used for support, the disabled arm takes part in performing simple movements, the disabled arm takes part in performing complex movements).

Taking these peculiarities into account is very important because the difficulties of movement, limitations in the movement of arms and left-handedness hamper the process of formation of cognitive functions, especially spatial ones.

In our experiment we also studied the peculiarities of speech development: speech comprehension, skills of speech production, formation of coherent speech skills, and degree of speech intelligibility.

While defining *visual and auditory impairments*, if any, we paid attention to medical diagnosis which was entered in the protocol.

After having collected a full enough characteristic of the child's state by the moment of diagnostics, we started to study the formation of the spatio-temporal concepts of the preschooler.

At the second stage of investigation of spatio-temporal concepts in preschool children with CP we used the following methods as the basis of our program:

- the modified method by O. V. Titova adapted to the capacities of children with CP [15] based on the method by M. G. Abbasov, who studied the spatial concepts of junior school children with intellectual disability having no movement disorders [1; 2]. The given method takes into account the basic categories of knowledge about space and the stages of their formation;

- the method of development of children's orientation in time suggested by T. D. Rikhterman (1991) [9]. The method is a result of many years

of the author's research and practical work under his guidance;

- the method of investigation of the process of identification of gender and age by N. L. Belopol'skaya [3]. The author created it for the study of the level of formation of those aspects of self-consciousness which are connected with identification of gender and age of the child. The given method was used in order to assess the formation of temporal concepts in preschoolers.

The above mentioned methods have been systematized and assessment criteria have been worked out.

Each method needed an individual procedure; that is why observation included two interviews each lasting 30 minutes.

During the first interview we got acquainted with the person to be tested and examined his/her spatial concepts. The obtained information was entered in a specially worked out protocol. During observation we offered visual stimuli. The children followed the instruction and chose the necessary picture.

The procedure was carried out in a specially allotted room, which guaranteed comfortable and effective interaction between the specialist and the child.

During the second interview we studied the temporal concepts of the child. The information was entered in the same protocol. The children were offered visual stimuli; they followed the instruction and gave the necessary answers.

The diagnostic complex consists of 6 blocks.

1. Studying the child's body awareness.

1. Orientation skills of one's own body awareness. Instruction: "Sow me your right hand".

2. Orientation skills of one's own body awareness. Instruction: "Sow me your left hand".

3. Orientation skills of awareness of the parts of the body of the interlocutor. Instruction: "Sow me where my right hand is".

4. Orientation skills of awareness of the parts of the body of the interlocutor. Instruction: "Sow me where my left hand is".

5. Skills of orientation in the picture. Instruction: "Show me the girl who has a pyramid in her right hand".

6. Skills of orientation in the picture. Instruction: "Show me the girl who has a pyramid in her left hand".

7. Skills of orientation in the picture. Instruction: "What hand does the girl hold the flower in?".

8. Skills of orientation in the picture. Instruction: "What hand does the boy hold the flag in?".

2. Studying the concept of distance to an object and its position.

1. Skills to distinguish the spatial concept "closer". Instruction: "Show the doll that is closer to you".

2. Skills to distinguish the spatial concept "farther". Instruction: "Show the doll that is farther from you".

3. Skills to distinguish the spatial concept "above". Instruction: "Say what things are above".

4. Skills to distinguish the spatial concept "below". Instruction: "Say what things are below".

5. Skills to distinguish the spa-

tial concept "in front". Instruction: "Say what things are in front".

6. Skills to distinguish the spatial concept "behind". Instruction: "Say what things are behind".

3. Studying the concept of distance between objects.

1. Giving names of the shown objects. Instruction: "What is it?" (A glass and a spoon are shown).

2. Placing a spoon in relation to the glass according to the teacher's verbal instruction. Instruction: "Put the spoon into the glass", etc. (prepositions: in, on, under, right, left, between, behind, in front of).

3. Verbal denotation of positions of objects: *inside, on, under, in front of, behind the glass, to the right, left of it, between the glasses*. Instruction: "Where is the spoon?" Place the spoon according to the instruction.

4. Answering questions about the object in the picture. Instruction: "What is it?"

5. Showing pictures with the objects placed in the way verbally defined by the teacher. Instruction: "Show the picture in which the spoon is in, on, under, etc.".

6. Verbal definition of the poisoning of the objects in the picture (in, on, under, to the right, to the left, between, behind, in front of). Instruction: "Where is the spoon?"

4. Studying orientation on the flat surface.

1. Placing an object on a sheet of paper according to the verbal instruction of the teacher. Instruction: "Put the ball in the top left corner".

2. Placing an object on a sheet of paper according to the verbal instruc-

tion of the teacher. Instruction: “Put the cube in the bottom right corner”.

3. Placing an object on a sheet of paper according to the verbal instruction of the teacher. Instruction: “Put the car in the bottom left corner”.

4. Placing an object on a sheet of paper according to the verbal instruction of the teacher. Instruction: “Put the pyramid in the middle of the sheet”.

5. Verbal answer of the child to the question asked by the teacher. Instruction: “Where is the car?” (answer: “The car is in the top right corner”).

6. Verbal answer of the child to the question asked by the teacher. Instruction: “Where is the ball?” (answer: “The ball is in the middle of the sheet”).

7. Verbal answer of the child to the question asked by the teacher. Instruction: “Where is the pyramid?” (answer: “The pyramid is in the top right corner”).

8. Verbal answer of the child to the question asked by the teacher. Instruction: “Where is the car?” (answer: “The car is in the top right corner”).

9. Placing the same set of objects according to a visual instruction – showing: the teacher placed the same objects on a sheet of paper and gave children some time to remember the objects positioning. After that the objects were removed. The children were to place the objects on the sheet of paper by memory. Instruction: “Look at the objects and place them in the same positions”. The first object – ball – in the bottom left corner.

10. Instruction: “Look at the objects and place them in the same positions”. The second object – pyramid – in the top right corner.

11. Instruction: “Look at the objects and place them in the same positions”. The third object – car – in the top left corner.

12. Instruction: “Look at the objects and place them in the same positions”. The fourth object – cube – in the bottom right corner.

5. Assessment of the sense of time.

Knowledge of the seasons

1. Verbal answer of the child to the question asked by the teacher. Instruction: “What seasons do you know?”

2. Verbal answer of the child to the question asked by the teacher. Instruction: “Name the features of the seasons”.

3. Verbal answer of the child to the question asked by the teacher. Instruction: “What season is it now?”

4. Verbal answer of the child to the question asked by the teacher. Instruction: “What season was it then?”

5. Verbal answer of the child to the question asked by the teacher. Instruction: “What season will it be then?”

The concept of the “year”

1. Verbal answer of the child to the question asked by the teacher. Instruction: “What is the first month of the year?”

2. Verbal answer of the child to the question asked by the teacher. Instruction: “What is the last month of the year?”

3. Verbal answer of the child to the question asked by the teacher. Instruction: “What year is it now?”

4. Verbal answer of the child to the question asked by the teacher. Instruction: “What year will it be then?”

5. Verbal answer of the child to the question asked by the teacher. Instruction: "What year was it then?"

The concept of the "month"

1. Verbal answer of the child to the question asked by the teacher. Instruction: "What months do you know?"

2. Verbal answer of the child to the question asked by the teacher. Instruction: "What autumn months do you know?"

3. Verbal answer of the child to the question asked by the teacher. Instruction: "What winter months do you know?"

4. Verbal answer of the child to the question asked by the teacher. Instruction: "What spring months do you know?"

5. Verbal answer of the child to the question asked by the teacher. Instruction: "What summer months do you know?"

6. Verbal answer of the child to the question asked by the teacher. Instruction: "How many months are there in a year?"

The concept of the "week"

1. Verbal answer of the child to the question asked by the teacher. Instruction: "How many weeks are there in a months?"

2. Verbal answer of the child to the question asked by the teacher. Instruction: "How many days are there in a week?"

Learning the days of the week

1. Verbal answer of the child to the question asked by the teacher. Instruction: "What days of the week do you know?"

2. Verbal answer of the child to the

question asked by the teacher. Instruction: "Name the days of the week in the right order starting with Monday".

Formation of concepts about parts of the day

1. Verbal answer of the child to the question asked by the teacher. Instruction: "What time of the day is it?"

2. Verbal answer of the child to the question asked by the teacher. Instruction: "What other times of the day are there?"

3. Answer the question looking at the picture. Instruction: "When does it happen (or take place)?"

4. Placing the pictures with the parts of the day in the right order. Instruction: "I shall put a picture of the night. What pictures will you place after it in the right order?"

5. Verbal answer of the child to the question asked by the teacher. Instruction: "Say what it was before the morning came".

6. Verbal answer of the child to the question asked by the teacher. Instruction: "Say what it was before the daytime came".

7. Verbal answer of the child to the question asked by the teacher. Instruction: "Say what it was before the evening came".

8. Verbal answer of the child to the question asked by the teacher. Instruction: "Say what it was before the night came".

9. Verbal answer of the child to the question asked by the teacher. Instruction: "Say what will come after the morning".

10. Verbal answer of the child to the question asked by the teacher. Instruction: "Say what will come after

the daytime”.

11. Verbal answer of the child to the question asked by the teacher. Instruction: “Say what will come after the evening”.

12. Verbal answer of the child to the question asked by the teacher. Instruction: “Say what will come after the night”.

6. Understanding time sequence relationships.

1. Learning time sequence in the course of the child’s day. Instruction: “Tell me about the way your day goes (using pictures)”.

2. Putting events in a sequence. Instruction: “Place the pictures in a sequence: what it all began with and what it came to. Make up a story”.

3. Discovering time concepts. Instruction: “I’ll put the first picture, and you go on. What happened next? Tell me what happened”.

4. Learning the formation of gender identification of people at different ages. Instruction: “Put the pictures in the right order (baby, preschooler, schoolgirl, woman, old woman; baby, preschooler, schoolboy, man, old man)”.

The results were entered in a specially designed protocol which makes it possible to assess the obtained results. We worked out the following quantitative criteria of evaluation of the results of observation:

- 3 points – for doing tasks on one’s own;
- 2 points – for doing tasks with a little help from the teacher;
- 1 point – for doing tasks with a significant help from the teacher;
- 0 points – for failure to do the task.

The experience of application of the given program at the pilot stage of investigation allowed us to formulate some preliminary conclusions:

– the comparison of data about the method of movement and the results of learning spatial and temporal concepts showed that children devoid of ability to move on their own have serious difficulties in mastering the concepts of time and space;

– left-handedness has an utterly negative effect upon the formation of spatial concepts and practically no effect upon the development of temporal concepts;

– the concepts of different ages have not been formed in all preschool children with CP irrespective of the degree of motor and speech impairments.

Thus, the innovative approach in the form of a diagnostic program comprising the assessment of the motor and speech status of the child in combination with the methods of evaluation of spatial and temporal concepts allowed us to obtain new data about the cognitive development of preschool children with CP and carry out a deeper analysis of the difficulties such children come across.

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