ON THE PROBLEMS OF CHILDREN’S SPACE ORIENTATION

(Preliminary communications)

Ivan Glushkov and Petya Pacheva
South-West University “Neofit Rilski”, Blagoevgrad,
Faculty of “Public Health and Sports, Department of” Sport and kinesitherapy”,
Blagoevgrad, Bulgaria.

Abstract
It was developed a diagnostic system for the study of spatial orientation of children as part of physical education in the preparatory classes for school. In this context, we aim to conduct research and identify opportunities of physical education to develop children’s spatial orientation of the preparatory group for school. The number of children studied from the experimental and control groups were 138, divided by gender. To achieve the goals and objectives we used 7 indicators, which we reduced to one after checking their reliability. Within the conducted experiment it was determined the condition of the mentioned orientation in children in Bulgaria. Through the experiment we identified the age and gender characteristics and the development intensity of orientation during the year, as natural process of mental and physical development, without directed impact. Also it was elaborated a technological model for the development of children’s spatial orientation. A pedagogical experiment (developing) in practice was conducted, for evaluation of the model. Through a comparative analysis of the results, in the control and experimental groups, were identified the aspects of performance of the model.

Keywords: physical education, school, boys, girls, physical development, motor learning, control group, experimental group, pedagogical testing, mean, standard deviation

INTRODUCTION
The formation of motor skills and habits of children in physical education is determined by the orientation of their activities in motor learning. It shall conduct audits of the situation and to form an image of the actions that must be met. Therefore, depending on how it is formed, the indicative basis of motor learning depends on the speed of learning and quality of implementation of specific motor action.

The available literature sources revealed the existing of scarce researches in children’s orientation in small age groups related to the motor learning (Glushkov, 2010).

In the course of the study, we determined researches on children’s orientation for the needs of mathematics and psychology (Vaneva & Garcheva, 2003); (Galabova, 2004); (Piaget, 1969); (Ilieva, 1993). There are few studies on the needs of pre-school physical education which drew our attention to the problem.

For this purpose, one-year study was conducted with 6-7 year olds on their spatial orientation and opportunities for their development.

METHODS
In this context, we aim to conduct research and identify opportunities of physical education to develop children’s spatial orientation of the preparatory group for school.

To achieve this purpose it was necessary to solve the following tasks:
1. Development of a diagnostic test for examination of the condition and changes in the spatial orientation.
2. Elaboration of an experimental technological model for their development in the physical education.
3. Application the experimental model in pedagogical practice.
4. Examination the effectiveness of this model

The study was conducted in three kindergartens in Blagoevgrad, Bulgaria. The number of children studied from the experimental and control groups were 138, divided by gender.

Table 1. Structure of the research contingent children

<table>
<thead>
<tr>
<th></th>
<th>Control group (CG)</th>
<th>Experimental group (EG)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys</td>
<td>34</td>
<td>33</td>
<td>67</td>
</tr>
<tr>
<td>Girls</td>
<td>37</td>
<td>34</td>
<td>71</td>
</tr>
</tbody>
</table>
Basic research methods:
1. Analysis of the available literature on the issues. (by the method of deduction)
2. Testing of the conditions and the changes in various aspects of the orientation of the children.
3. Pedagogical experiment (developing).
4. Methods of mathematical statistics, including:
   • Variation - to establish conditions, changes and gender differences.
   • Alternative - to prove the accuracy of the differences between the two average values, including the specifying of the effectiveness of the experimental technological model.

The nature of the study is transversal with the instantaneous recording of the state of the indicators - before and after the experiment, within one year.

To achieve the goals and objectives we used 7 indicators, which we reduced to one after checking their reliability.

1. For the research of the children orientation in the basics positions and directions of the movement (forward - backward, left - right, up – down, front - behind, in and out) we developed a graphical network on a card in the form of a football field and we gave a task to the studied child to roll out a small soccer ball (ball) in the direction defined by us, to put the ball in front of "goalposts" behind it, etc.

We noted in the protocol the number of correct spatial orientation of children from 10 possible.

2. Ranking of values (sizes) – descending.

3. Gradation of sizes - upward.

4. Arrange the 10 children in the column in height (high to low) - number of correct decisions (due to low reliability, the index dropped).

5. Orientation at distances of the objects in the depths of space (the objects are the same shape and size).

For this purpose, the studied child sits on a stool in the experimental room. In front of him are sorted 5 identical rubber balls (in diagram), in various distances. The child is required to navigate and rank the distances of each object from it, orienting in the distances of objects between them.

We reported the number of correct orientation.

6. As with № 5, but the objects are of different sizes.

The aim is to establish whether the size of the objects influence the orientation of children in their distances.


Table 2. Indicators for the study of spatial orientation of children

<table>
<thead>
<tr>
<th>№</th>
<th>Indicators</th>
<th>Measurement unit</th>
<th>Accuracy</th>
<th>Evaluation system</th>
<th>Reliability ($r_{t}$)</th>
<th>Boys</th>
<th>Girls</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Spatial orientation in the basic positions and directions of movements</td>
<td>Number of the correct orientations</td>
<td>1 number</td>
<td>Of 10 set directions and positions</td>
<td>0,86</td>
<td>0,88</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Dimensional orientation of objects and descending rank</td>
<td>Number of the correct orientations</td>
<td>1 number</td>
<td>Of 10 objects</td>
<td>0,74</td>
<td>0,72</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Dimensional orientation of objects and upward gradation</td>
<td>- // -</td>
<td>- // -</td>
<td>- // -</td>
<td>0,76</td>
<td>0,75</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Spatial orientation in arrangement of 10 children in height (descending)</td>
<td>Number of the correct orientations</td>
<td>1 number</td>
<td>For 10 children</td>
<td>0,58</td>
<td>0,63 failed</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Orientation at distances of objects (of the same shape and dimensions)</td>
<td>Number of the correct orientations</td>
<td>1 number</td>
<td>Of 5 of the object in the same shape and dimensions</td>
<td>0,78</td>
<td>0,80</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Orientation at distances of objects (the same shape but different size)</td>
<td>- // -</td>
<td>- // -</td>
<td>5 of the object have the same shape but of different sizes</td>
<td>0,72</td>
<td>0,78</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Spatial orientation in rhythmic image sequences from different postures</td>
<td>Points</td>
<td>1 point</td>
<td>In the correct orientation - 2 points, partially correct - 1 point false - 0 points</td>
<td>0,70</td>
<td>0,73</td>
<td></td>
</tr>
</tbody>
</table>

We used 10 different sized sports gear (balls), including beach, basketball, football, volleyball, handball, big, medium, small rubber ball, tennis ball and ball for table tennis. The balls are stirred in examination room (methodological study of kindergarten) and studied child had to orient in their sizes and to sort them by ascending gradation of size, from the largest to the smallest. We reported the correct orientation.
The aim for the child is by watching the schemes to find (decrypt) the principles involved:
- Rhythm of the positions and postures;
- To find the regularity of the alternation of the two sexes.

The studied child should be oriented in the principle of alternation of children and to point who’s next (the figures on the right), which should continue the left sequence. This develops the ability to compose a series in patterns. The evaluation is defined by points, while incorrect orientation - 0 points, partially correct - 1 point and completely corrects - 2 points.

Characteristics of the technological model for developing the spatial orientation of children

The theoretical basis of the experimental model rests on the results of a conducted experiment and subsequent variation, correlation, factorial and alternative analysis, published by Glashow, 2010.

After the development of the model it was embedded in teaching practice in physical education. For this purpose there were separated experimental and control groups separated by age and sex. Of the total number of children, the physical education with 67 of them was conducted on the experimental model, and with 71 children in the control group was working on the current program of the Ministry of Education and Science.

Experimental work on the model was carried out in weekly sessions “Natural and applied movements” and “Sports preparatory exercises and games” or 2 times a week. Along with the program material in these forms, we deliberately influenced on the development of children’s orientation within the estimated duration of sessions - 30 minutes (when the form is for consolidation, and 35 minutes at mixed forms).

For this purpose, kindergarten teachers from the experimental groups were trained to conduct the experiment. The control over the implementation was done by the author and by the directors of kindergartens in the days of its conducting, i.e. permanently.

The technological model includes activities aiming to develop heterogeneous spatial orientation of children and related processes of identifying, classifying, comparing, grading, and other series and sets - distances, sizes, widths, depths and other. It is expressed in the following:

1. Formation of the children concept for the variables used in physical education and their measurement.

2. Developing the ability to rank the variables (far, far away, a little less, at least, etc.).

3. Development of children’s ability to compare and evaluate quantitative and qualitative relations, connected with studied orientation activity.

4. Development their capacity for orientation in the one-dimensional space - through graphic exemplars of models figuratively, in the laboratory and three-dimensional (orientation by the magnitude of the forms in the natural environment).

5. Development of children’s ability to identify processes and phenomena, related to the orientation activity and physical education and so on.

6. Developing the ability to recognize shapes, distances, etc.

7. Work on developing the skills of series and sets. Series and sets is an operation related to the arrangement of objects, classes and more, in ascending or descending order in compliance to certain rules relating to the nature of the relationship between the elements and the whole. This enables stacking of the elements in the whole in various properties (e.g., sizes).

For this purpose, the children were set the tasks:

a). To order (repeatedly) in a free way series of sports gear, taking into account the changes and the relationship in the multiple articles.

b). To order (repeatedly) 5 sports gear referred to in ascending or descending order in number (simple series and sets).

c). To order (repeatedly) by trial and error in the right series number up to 7 items (so-called perceptual series and sets).

d). Multiple alignment, in ascending or descending order (operationally series and sets) taking into account the relations between 5-7 elements (i.e. if the blue jumping rope is longer than black, then it is longer than yellow, pink, green, red, white etc.).

g). Developing the children’s ability to organize in various other series ranks, taking into account two or three signs (multiple series and sets) - space, power, etc..

f). Teaching children to detect the exact location of an object (with little difference from others) in series range of 7-10 objects - depending on the size of the objects according to their shape or weight and other signs.

8. Development of their ability to classify; Development of children’s classification ability
included separation and classification - such as sports supplies - in shapes, sizes and other characteristics; classification of human movements (natural and practical), classification of movements performed in different ways in space and others.

Classification is the process by which a child rationalizes the “part - whole” or „phase - integrity“ relation. It is connected with the formation of watchfulness and analyzing, the ability to compare (by comparison) of elements (e.g., certain movements and overall motor acts). Children were trained to classify the sports gear, sportswear and different body positions and its parts in space, in sorts of movements (locomotion). They classified the movement direction (major and minor), separated the exercises in simple (arguing why they are simple) and complex etc.

The specific tasks included:

a). **Grouping.** The children were required to group the sports gear and explain why they apply them to a certain group in reference to the distances, elongation, quantity (a group of large and small objects, of short distance, distant and remote objects, using comparative and superlative degree).

b). **Separation** of certain multitude into two exclusive classes - by type, by gender, by size (largest and smallest) in form or function.

We trained them to separate elements of the same set, taking into account simultaneously two or three signs (complex multiple classification).

Example, the children play the following game: if they are 20 children in the group dressed in tracksuits and seemingly identical, but actually 10 of them are boys and 10 are girls. Furthermore, five of the boys wear red tracksuit, five wear green one; 5 girls are with yellow ant other 5 are with blue tracksuit.

Therefore, the children are 4 teams and two of them have a badge on his chest. The task for the children is to see look at other and to decide how to divide themselves into groups.

Depending on whether they are arranged in one sign (e.g. sex), the children receive one point, if the arrange themselves by 2 signs (color and gender) - 2 points, and three characteristics (gender, color and badge) - 3 points.

c). **Developing the children’s ability for classification** and analysis the processes and phenomena in physical education and sport at the „What is excessive?“.

In this regard, there were elaborate numerous games such as: In the playfield we placed appliances, such as water sports (fins, goggles, lifebelt, but also appliance unrelated to water sports , such as scooter, skating etc). Children were needed to discover what was unnecessary. These games have been implemented in various variants.

9. **Measurement.** The experimental model predicted development of children’s ability to perform measurement.

For this purpose, children are taught:

- To measure (and thus realize) the distances of several identical measures: feet, steps (step by step) with gymnastic stick, with jumping rope, wi-th pin and other items of counting. Child at the end of preschool age counts and performs simple arithmetic operations with numbers up to 10.

  - To measure the distance and fix any measure, while separate „tokens“ or write ticks to mark each measurement, and then count the tokens or the ticks and indicate that the length of the thick rope is twice the length of the jumping ropes, or the 4 feet or 10 steps.

  - We trained them to measure and recognize the amount of bulk substances (water, candies, and grains) placed in a large glass with a conventional measure - a small cup.

  - Children were asked to quantify how many small cups are equal to one large glass and to determine the result.

  - Another task was to measure how many cups of small beans can fill the bag toss used in physical education and so that it can be utilized as a sports tool.

  - We taught the children both to measure and count; we explained and demonstrated the relationship between the measured variables, conditional measure and the outcome of the measurement. The children were required also:

    - To measure and compare different objects (e.g. length of gymnastic bench and the thick rope) with the same unit. We guided them to understand that the number of the units for the larger object would be great;

    - To realize that the same object can be measured by various measures (e.g. the thick rope - with steps and feet). We demonstrated them that the higher the measure, the less is the resulting number and vice versa;

10. **Teaching kids to solve practical and logical problems, to understand quantitative relationships such as:**

    - The thick rope is longer than the jumping rope - two or three times?

    - The jumping rope is shorter than the thick rope (from the bench) with a half length or more, or less?

    - Identify if the thick rope is longer than three jumping ropes? And how many jumping ropes are equal to the thick ropes? Measure it by the jumping rope, and then with the stick

    - The big solid ball (which weighs 1 kg.) is heavier than the children’s basketball ball - twice or not?

    - The cat is smaller than the dog - 10 times or not? How many times?

    - Which is longer – the bench for steady walking or the thick rope? What is the difference? Measured it with the gymnastics stick! Then - with steps.

11. **Development of the ability to understand**

We used games such as: in a living room we placed 5 gymnastic hoops on the floor and within 4 of them we placed 5 rings. Within one of the hoops there are three rings. Children were required to find the non-compliance and to indicate how many rings are short? How many more are needed and for which of the hoops?

12. **Development of orientation in space.**

In this respect, we set the children some tasks, associated with:
• Determination of the location of the objects compared to themselves (more upward – more downward, more forward – more backward, more left – more right, more outwards - deeper, more lower-up.

The same task with the superlative degree.
• We educated them in practical distinguishing and understanding the bidirectional (and possibly three-directional) in the spatial dimensions and appropriately their labeling (forward - backward, left - right, up - down).

• To differentiate various areas and sections in space and in the playing fields, by naming them (at the front – on the left, at the bottom – on the right). We educated them to determine the location of other players and sports gear. For example – on the shuttlecock for badminton is on the left of Ivan, shuttlecock in front of Alexander, but behind the net, etc.).

• To model the spatial relationships by objects (to leave a sporting tool at different spatial locations and in different situations and to determine their location).

• We taught them to orient themselves in a restricted part of the three-dimensional space (playground) and to operate within its borders.

• We trained them to determine the size of the objects at different distances in the depths of space and to orient themselves in the relationship “distance - size of the object.”

• To find the middle of the line drawn on the floor with a length of 1 m and over; to determine the center of a circle or a square.

• We set them tasks such as:
  - Look left, right, forward, backward, up, down!
  - Raise your right hand (left leg)!
  - Stand to the left of me!
  - Stand (particular child demonstrator) between the second and third ball, and closer to the third! Stand in front of the gymnastics bench, but closer to the racket for tennis, etc.

• We trained them to orient themselves on the drawn floor square grid (scheme), to place objects in the specified coordinates, for example a particular child demonstrator to place the sport tool on the second row in the first square to the left or in the fourth square on the right column and so on by teacher’s instructions. The game was sedative, in the final part of the activity.

The same task was performed again, but the instructions are defined by the children, which require the determination of the coordinates of the square in which we put the object in the square grid.

- By variation of the game we taught the children to encode and to graphically model spatial relations, by drawing arrows in the square grid on the floor to indicate different directions, or move from square to square different sports tools or children in directions indicated by the teacher and then by the children (forward, on the left, on the right, etc.). The game was played as a sedative - in the final part of the activity.

A more complex version of the game - child (demonstrator) slowly rolling ball with his hand or foot in the direction indicated by the teacher and the other children, implemented in the form „Sports preparatory exercises and games."

- We taught the children to orient themselves in a graphical scheme - plan (specifying the location of an object in a simple diagrammatic layout (with familiar figures in the yard, such as tree, the building of the kindergarten, alcove, sandstone), which reproduces a real situation in the field and must find hidden sporting tool. The game takes place in the form „Sports preparatory exercises and games’ outdoors, in the yard, as a team, like a sedative game while there is no need for speed, and spatial orientation.

13. We trained the children in activation of the thinking (developing practical intelligence) in the expression of combinations and reflexivity by combining different shapes in different combinations. For this purpose, a child demonstrate a variety of postures, then of the hands (in stance, kneeling, seat, etc.) and the other children identify suitable positions and movements of the legs, that is, the first child invents the top of the exercise, and the group provide suitable bottom.

The game takes place in different variants as a sedative game at the end of the classes „Natural and applied movements.“

Version A of the game: it is directed to the manifestation of creativity when playing manipulative activity – in a particular drawing there are given hands on person in different positions; legs in various positions, body, head. The children are displayed a model of exercise and they assembled a figure which performs the same exercise. We observed for compliance with axes and planes and other features, as we guide and support the children. Then, on the basis of the available elements, they assembled exercise alone.

Version B of the game: the elements reflect different phases of a particular exercise, which the children arranged chronologically.

14. We trained the children in extending orders and clustering by a familiar feature (close order in the column; extended order in the column; close order in rows; extended order in rows). How are the carriages ordered: in column - one behind the other or in row – next to each other? Arrange the children in a column, row! Order column, row! Arrange them in 2 columns in 2 rows in 2 opposing columns in two opposing rows, in a circle, in 2 concentric circles. The exercises are performed in the preparation part of the form „Natural and applied movements.“

15. We explained and demonstrated the relationship between the length and density of elements in two columns with different lengths and densities. To determine where the elements are more – where the column is longer but spaced out or where it is short and thick.

The number of elements: a) is the same, b) is different, and as in the thick column there are more elements. It was conducted in the preparation part of the format „Natural and applied movements."

16. We trained them to identify objects in space,
to recognize properties, positions and movements (different in shape, size, height, length, width, depth, speed of movement, etc.).

Recognizing and naming: who jumps the farthest, and which is that animal? Which child from the group throws the farthest and most accurately? Which athletes (of which sports), which birds (and vehicles) can run, fly, move the longest? Who will take the longest time? What is the most tenacious of the athletes and the animals? Why?

The training was conducted in all parts of activities, in parallel of solving the planned tasks.

17. We worked on the realization of spatial relations:

18. Toward understanding the relations of the form: What do you need to throw far away (we explained and demonstrated the „power – distance” relationship)? To run quickly and get first (speed - time - distance)? To jump far away (force - distance).

Version A of the task: in the playground we draw four large geometric shapes - circle, triangle, square and rectangle roughly the same circumference. Children were states: Watch here 4 children will go around together the four figures. Which child will be the winner? Why? The goal is to be aware and understand the relationship between the distance and time for overcoming it and study the relationship of the shape and length of the path that must be walked.

Version B of the task – the pieces have different tour.

RESULTS AND DISCUSSION

The management of the pedagogical activity in physical education shall assess the impact of targeted effects to provide feedback and to correct inconsistencies in the acting model.

In this regard, we found baseline of the interesting aspects of the guide activities for children, developed a technological model for its development, examined it in practice and found its effectiveness, the results will be discuss below.

The spatial orientation is related to the orientation in the movement direction, assessment of the distances between objects and their move on the field and more. To assess the spatial orientation of children we used graphical network which reproduces a football field, divided into squares, in which the child is moving by rolling a soccer ball. The test is described above. The order to move in different directions and taking the set positions were 10 and were mixed, in order to exclude an association with similar and opposite. We judge the degree of the development in this kind of orientation by the changes in the number of correct spatial orientation for 1 year in the control (CG) and experimental groups (EG). Changes made for one academic year in the boy’s control group are 5.83 correct orientations (from 10.) at the beginning of the school year, to 6.48 at the end of the year or growth d% = 11.13%.

The boys from the experimental group marked a growth of 12.98%. Or at the end of the school year the boys from the control group achieved X2 = 6.5, while the experimental group - 7.86 pc, which shows good development of spatial orientation, good knowledge and proper application of the basic directions.

For the girls, the growth in the control group for a year is 8.70% and an average of 6.57 correct orientation marked development to 7.14.

In the experimental group, the development is 10.65% (average of 7.3 correct orientation - increase with 8.1 units. It is observed higher level of development in the experimental group, but the growth rate was lower in comparison to other indicators which are strongly influenced by the experimental model. In relation with the sex the development of the indicator is higher for the boys experimental group than the girls one in the same group (with 2.329%), but this is due to the lower baseline for boys. Similar differences in growth in favor of the boys and in the control group, which was 2.43% higher than girls’, but by a considerably low base performance. The precise location of a child in the space among the other children is important for the organization and implementation of physical activity. This contributes to its higher efficiency. For the study of accuracy assessment of children in determination of the object location

<table>
<thead>
<tr>
<th>Feature</th>
<th>BOYS</th>
<th>GIRLS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>At the beginning of the school year</td>
<td>At the end of the school year</td>
</tr>
<tr>
<td></td>
<td>CG</td>
<td>EG</td>
</tr>
<tr>
<td>X</td>
<td>5.83</td>
<td>6.95</td>
</tr>
<tr>
<td>S</td>
<td>1.93</td>
<td>2.10</td>
</tr>
<tr>
<td>M</td>
<td>0.35</td>
<td>0.44</td>
</tr>
<tr>
<td>Vc</td>
<td>33.1</td>
<td>30.2</td>
</tr>
<tr>
<td>dc</td>
<td>11.1</td>
<td>12.9</td>
</tr>
<tr>
<td>Ta</td>
<td>2.86</td>
<td>3.19</td>
</tr>
</tbody>
</table>
in the space among the examined children (individual) we provided 10 different sized sports gear (balls) and required their order descending - from the largest toward the smallest ones, they had to determine the exact location of each ball by comparison and ranking of sizes.

We reported the number of correct spatial orientation (out of maximum 10). The results obtained in the control group and in the experimental group in both sexes are very good. So the boys in the control group at the beginning of the school year realized an average of 8.8 correct orientation and the end of the school year it reached 9.063 or d% = 2.91. The low values of Tstudent -1.07 (TCritical = 2.04) however, talk about the lack of statistical significance of growth.

The results from the boys’ experimental group are similar - from 8.9 right decisions early in the school year to the end of the year, as a result of targeted impacts – the average score reached 9.88 and d% = 10.88 at Tst = 3.11, P = 0.00067. This indicates a very high potential of boys surveyed ability.

For the girls in the control group of $X_g = 8.87$ at the beginning of the school year to the end of the year reached $X_g = 9.09$ or d% = 2.48, but Tst < Tcrit. In the experimental group girls shows growth by 8.739 to 9.783 at the end of the year or d% = 11.94, at Tst = 3.6 and P=0.0016. The results showed low values of m, and V% - from 4.91% to 16.76, indicating that there is a relative compactness of children in the groups of examined tests by studied indicator.

Working with children in the developed experimental teaching model has had a positive impact on the results by the indicator № 3, which is same as № 2, but the hierarchical ranking is ascending (increasing in series and sets). The child finds the smallest ball and put it in the first place, then finds a proper location of any of the 10 sports gear.

From the analysis of variance it was clear that children cope with the task at the beginning of the school year. The boys in the control group have $X_{max} = 8.8$ pc. correct orientation (out of 10) at a low coefficient of variation of 13.48% and S = 1.186 and for an year improving their performance to 9.031. Or this is growth with 2.63%.

Among the boys from experimental group, the outputs are approximately as in the control group, but by the end of the school year had greater growth: $X_{max} = 9.824$ at low V% (5,38%) and d% = 11.85, which is 9.22% higher growth rate compared to the control group.

For the girls, the results were similar. In the control group, $X_g = 8.83, X_g = 9.13, d% = 3.45%$ in Tst = 0.3043 and $d = 0.4115, V% = 12.49$, which variation is relatively low. There are higher baseline (baseline) performance of girls in the experimental group at the beginning of the school year, and therefore interpret annual growth rate, which is 6.73% and even significantly higher than the control group (by 3.28%) is lower than the growth in boys from experimental group (with 5.119%).

In absolute terms, however, the girls in the experimental group have high performance $X = 9.65$ (out of 10 possible correct decisions). This shows a good spatial orientation in both sexes in the experimental group.

The experimental model consisted of targeted impact on the development of children’s orientation at distances of objects in space.

For this purpose, in one case, the objects are the same size and shape but of different distances (scheduled), in the latter case the distances to the objects and the shape are the same, but the size (dimensions) are different. The task is to establish whether the size of the object affect the assessment of their distances in space, we will analyze the results.

In the process of developing a specific spatial orientation, the children were taught to perceive and analyze the location of the objects, the ratio of the distances between them, to assess the size and shape of objects to rank by rank the objects (e.g. closest subject № 3 farther away the object № 2, etc.). This ability is important for assessing the distances of other children in the game situation at bowling and more.

The data show that the maximum possible score of 5 correct orientations with one sized objects $X$, in the control group of boys was 4.03 at the beginning of the school year and 4.18 at the end of the year, and growth is 3.76%.

**Table 4. Results from developing the ability to grade dimensions (10 objects - descending).**

<table>
<thead>
<tr>
<th>Feature</th>
<th>BOYS At the beginning of the school year</th>
<th>GIRLS At the beginning of the school year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CG</td>
<td>EG</td>
</tr>
<tr>
<td>$\bar{X}$</td>
<td>8.80</td>
<td>8.91</td>
</tr>
<tr>
<td>$S$</td>
<td>0.91</td>
<td>1.24</td>
</tr>
<tr>
<td>$M$</td>
<td>0.16</td>
<td>0.25</td>
</tr>
<tr>
<td>$V_1$</td>
<td>10.3</td>
<td>13.9</td>
</tr>
<tr>
<td>$d_1$</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>$T_1$</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
For GIRLS CG EG GIRLS CG EG
rate was 3.44% at Tst = 0.1407, which is lower than Tcrt.
research indicator.
suggests that targeted effects had a positive impact on
boys is 18.16% growth in Tst = 3.49, a result which
difference in the results. In the experimental group, for
Tсrt (2.04) , indicating a lack of statistically significant
Tst, however, is 1.45 and is significantly below the
school year - to 4.31 at the end of the school year.

Of the indicator is 10.78% (from 3,893 at the beginning
space to different sized objects.
model in the orientation of children in the distances in
2.9882 and Tсrt = 2,04). This suggests that the apparent
increase was not statistically significant.
In the experimental group girls Tst> Tсrt. (Tst =
4.8 or growth is 22.22%. In both groups Tst> Tcrt. For
girls in the control group X1 - 4.00 correct orientations
and the end of the school year increase to 4,180, or growth
is with 4.55%. Meanwhile, in the experimental group
girls improve their score from 4,042 at the beginning of
the school year to 4,955 or growth is 22.587%.
Tst value of the control group is 0.1818, i.e. less
than Tcrt, which is 2.04. This suggests that the apparent
increase was not statistically significant.
In the experimental group girls Tst> Tcrt. (Tst =
2.9882 and Tcrt = 2,04).

We ascertainment a positive impact of the experimental
model in the orientation of children in the distances in
space to different sized objects.
So in the boys’ control group the annual growth rate
of the indicator is 10.78% (from 3,893 at the beginning
of the school year - to 4.31 at the end of the school year.
Tst, however, is 1.45 and is significantly below the
Tcrt (2.04) , indicating a lack of statistically significant
difference in the results. In the experimental group, for
boys is 18.16% growth in Tst = 3.49, a result which
suggests that targeted effects had a positive impact on
research indicator.

For the girls in the control group the annual growth
rate was 3.44% at Tst = 0.1407, which is lower than Tcrt.
While the work on the experimental model strongly
influenced the researched indicator for girls and d% =
41.950 and Tst = 4.4927.
Moreover, the results show a stronger influence of
the experimental model to the girls from experimental
group than to the boys (d% = 18,16 at 41.95% in girls
In the physical training series of children is used
(ands other formations.) This may also be intermittent
in nature. For example, each child in the first row to
be hands forward every second - with hands above and
other options - for example, every first boy with his
hands forward, and every second is a girl with her hands
up.
In the first case, the children have to find the rhythm
and to orient themselves in the principle of prioritizing
occupied positions and used planes, i.e. series and sets
is by 2 features: initial position and plane.
In the second case there is a third sign: alternating
by gender.

The ability to detect and decode the preparation
of rhythmic sequences of basic principles of the body
and its parts is associated with significant intellectual
activity. To stimulate that ability by forming experiment
affect we affected its development. The results show
significant development in both sexes, with boys in the
control group d% = 18,23, but Tst < Tcrt.

<table>
<thead>
<tr>
<th>Feature</th>
<th>BOYS</th>
<th>GIRLS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>At the beginning of the school year</td>
<td>At the end of the school year</td>
</tr>
<tr>
<td></td>
<td>At the beginning of the school year</td>
<td>At the end of the school year</td>
</tr>
<tr>
<td>CG</td>
<td>EG</td>
<td>CG</td>
</tr>
<tr>
<td>X</td>
<td>8,80</td>
<td>8,78</td>
</tr>
<tr>
<td>S</td>
<td>1,18</td>
<td>1,16</td>
</tr>
<tr>
<td>Mx</td>
<td>0,21</td>
<td>0,24</td>
</tr>
<tr>
<td>Vx</td>
<td>13,4</td>
<td>13,2</td>
</tr>
<tr>
<td>dx</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Ts</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

<table>
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<tr>
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<th>BOYS</th>
<th>GIRLS</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>At the beginning of the school year</td>
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</tr>
<tr>
<td></td>
<td>At the beginning of the school year</td>
<td>At the end of the school year</td>
</tr>
<tr>
<td>CG</td>
<td>EG</td>
<td>CG</td>
</tr>
<tr>
<td>X</td>
<td>4,03</td>
<td>4,00</td>
</tr>
<tr>
<td>S</td>
<td>1,34</td>
<td>1,12</td>
</tr>
<tr>
<td>Mx</td>
<td>0,25</td>
<td>0,23</td>
</tr>
<tr>
<td>Vx</td>
<td>33,3</td>
<td>28,2</td>
</tr>
<tr>
<td>dx</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Ts</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 5. Number of correct orientation for grading the size
of the 10 objects - ascending.

Table 6. Number of correct orientation at distances
of objects – of the same size

In the experimental group X1 from 4.0 increases to
4.8 or growth is 22.22%. In both groups Tst> Tcrt. For
girls in the control group X1 - 4.00 correct orientations
and the end of the school year increase to 4,180, or growth
is with 4.55%. Meanwhile, in the experimental group
girls improve their score from 4,042 at the beginning of
the school year to 4,955 or growth is 22.587%.

Tst value of the control group is 0.1818, i.e. less
than Tcrt, which is 2.04. This suggests that the apparent
increase was not statistically significant.

In the experimental group girls Tst> Tcrt. (Tst =
2.9882 and Tcrt = 2,04).

We ascertainment a positive impact of the experimental
model in the orientation of children in the distances in
space to different sized objects.

So in the boys’ control group the annual growth rate
of the indicator is 10.78% (from 3,893 at the beginning
of the school year - to 4.31 at the end of the school year.
Tst, however, is 1.45 and is significantly below the
Tcrt (2.04) , indicating a lack of statistically significant
difference in the results. In the experimental group, for
boys is 18.16% growth in Tst = 3.49, a result which
suggests that targeted effects had a positive impact on
research indicator.

For the girls in the control group the annual growth
rate was 3.44% at Tst = 0.1407, which is lower than Tcrt.
Table 7. Changes in orientation at distances of objects of different sizes.

<table>
<thead>
<tr>
<th>Feature</th>
<th>BOYS At the beginning of the school year</th>
<th>BOYS At the end of the school year</th>
<th>GIRLS At the beginning of the school year</th>
<th>GIRLS At the end of the school year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CG</td>
<td>EG</td>
<td>CG</td>
<td>EG</td>
</tr>
<tr>
<td>X</td>
<td>3,89</td>
<td>4,04</td>
<td>4,31</td>
<td>4,77</td>
</tr>
<tr>
<td>S</td>
<td>1,39</td>
<td>1,22</td>
<td>0,85</td>
<td>0,54</td>
</tr>
<tr>
<td>M_s</td>
<td>0,26</td>
<td>0,25</td>
<td>0,15</td>
<td>0,12</td>
</tr>
<tr>
<td>V_s</td>
<td>35,8</td>
<td>30,2</td>
<td>19,9</td>
<td>11,4</td>
</tr>
<tr>
<td>d_s</td>
<td>-</td>
<td>-</td>
<td>10,7</td>
<td>18,1</td>
</tr>
<tr>
<td>T_s</td>
<td>-</td>
<td>-</td>
<td>1,45</td>
<td>3,49</td>
</tr>
</tbody>
</table>

Table 8. Orientation in rhythmic sequences (series and sets from different positions of the body)

<table>
<thead>
<tr>
<th>Feature</th>
<th>BOYS At the beginning of the school year</th>
<th>BOYS At the end of the school year</th>
<th>GIRLS At the beginning of the school year</th>
<th>GIRLS At the end of the school year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CG</td>
<td>EG</td>
<td>CG</td>
<td>EG</td>
</tr>
<tr>
<td>X</td>
<td>0,87</td>
<td>1,33</td>
<td>1,03</td>
<td>1,60</td>
</tr>
<tr>
<td>S</td>
<td>0,80</td>
<td>0,79</td>
<td>0,90</td>
<td>0,72</td>
</tr>
<tr>
<td>M_s</td>
<td>0,20</td>
<td>0,17</td>
<td>1,16</td>
<td>0,15</td>
</tr>
<tr>
<td>V_s</td>
<td>92,1</td>
<td>59,6</td>
<td>87,5</td>
<td>44,9</td>
</tr>
<tr>
<td>D_s</td>
<td>-</td>
<td>-</td>
<td>18,2</td>
<td>20,6</td>
</tr>
<tr>
<td>T_s</td>
<td>-</td>
<td>-</td>
<td>1,43</td>
<td>1,00</td>
</tr>
</tbody>
</table>

Similar results were seen in the experimental group in which d% = 20.65, but here values Tst (1,0012) is lower than Tcrt.

This suggests that the experimental model did not contribute to the development of research capacity in boys. For the girls, however, the growth in the control group was 18.18%, while in the experimental it was 43.33% and Tst = 4.2 suggesting that their experimental model is effective. The reason for these results probably lies in the more developed analytic-synthetic mental activity in girls, which can be found in subsequent studies.

So, the analysis of the results from the pedagogical experiment shows high efficiency of the model and on the spatial orientation, such as:

1. The orientation in the direction of movement and positions of the body and its parts in space are improved. So the growth in the performance for the boys from the experimental group is 12.98% when Tst = 3.19, but the improvement was less than other heavily influenced performance. The reason for this are the high output (respectively - final) results. Or out of 10 spatial orientation, X_1 = 7 adequate and X_2 = 7.9 after the experiment, i.e. 79% of the maximum possible score.

For the girls, the growth in the experimental group is 10.65% at Tst = 2.8 and outcome in absolute terms - the number of adequate orientation is 8.13 (out of 10) and 81.3% right decisions.

In relation to the sex the experimental model has had a strong positive impact on the performance of boys (12.98% increase) versus 10.65% (for the girls), but in absolute values outcomes for girls are higher.

2. The experimental model is effective in relation to the ability to rank the objects in their size. So the growth in boys of the experimental group was 10.88%, Tst = 3.6 (for d = 2.91% in the control group and Tst = 1.07) in descending rank.

For the girls in the experimental group, the results are similar – the growth is 11.94 %, Tst = 3.6 (in the control group d = 2.48% and Tst = 0.17).

However, in both (control and experimental) girls groups, the results at the end of the year are very high – the number of the adequate orientation in the control group is 9.1 (out of 10) and 9.8 for the experimental girls group.

With regard to the ascending hierarchy of sizes, children from the experimental group achieved in both sexes similar results. The growth in girls is 11.85% (control group - 2.63%), in comparison to the growth in girls experimental group which is 6.73% and in control group- 3.45%. There is statistical significance in the increments only in the experimental group in both sexes.
3. The experimental model has had a strong positive influence on the orientation of children in the distances of objects of the same size in space and the distances between them. So the growth results in boys experimental group was 22.2% (for 3, 76% in the control). In both groups Tst > Tcrt.

For the girls in the experimental group the improvement in the result is 22.58% (control group - 4.55%) and Tst > Tcrt only in the experimental group.

The experimental model has a positive impact on the orientation of children in the distances of objects of different sizes. So the boys from experimental group realized a growth score of 18.16% (in the control group - 10.78%, but Tst < Tcrt). Tst in the experimental group was 3.5. For girls in the experimental group d = 41.95% (at 3.44% in the control group and Tst = 0.14). Overall, the impact of the experimental model is stronger in girls than in boys.

4. The results show that the experimental model did not contribute to the development of the ability of children’s’ decoding and structuring of series and sets ranks. Despite the high growth in the index in boys from the experimental group - 20.65% in the control group it is also high - 18.23%. The difference between the two results is not statistically significant. For the girls, the directed effects in the experimental group have improved to 43.33% (Tst = 4.24) and in the control group 18.18%, but this difference was statistically significant.

CONCLUSIONS
The following are the conclusions arrive from the survey on the impact of the experimental model on the spatial orientation of children:

1. The children spatial orientation in the experimental groups was improved with respect to the direction of movement, in their judgment of distances of objects in space (with the same or different sizes), the ranking of values (descending and ascending) in both sexes.

2. The model did not contribute in boys from experimental group in developing their ability in decoding and structuring rhythmical spatial sequences.

3. For girls in the experimental group the directed effects have improved the results in spatial orientation in rhythmic sequences.

4. As a whole, the impact of the experimental model is more emphasized in girls in comparison to the boys.

The conducted survey shows that this important aspect of motor learning - key stage results implicated in subsequent executive and correction phase is underestimated and unexplored. The indicative activity in the early age groups when they form their perceptions of values (large, small, near, far, fast, slow, strong, stronger, strongest, etc.) is especially significant. They contribute to the realization of the motor actions and the causal relationship between their biomechanical parameters.

In this sense, it is necessary to expand the research on the problem of orientation activities for children in the upper age groups. It is recommended to include purposeful work to develop the orientation activities of the students in physical education and sport pedagogy, in the nucleus of the state educational requirements and educational content in physical education.

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Correspondence: 
Ivan Glushkov 
South-West University „Neofit Rilski“, Blagoevgrad 
Faculty of “Public Health and Sports” 
Department of “Sport and kinesitherapy” 
„Ivan Mihailov“, str, 66, 2700 Blagoevgrad, Bulgaria. 
E-mail: iv_glushkov@abv.bg