ORIGINAL ARTICLE

The Influence of Coordination on the Thinking of Children with Different Nervous System

GEORGIY GEORGIEVICH POLEVOY

ABSTRACT

Background: Differentiated development of coordination abilities of children, taking into account their nervous system, has a positive impact on the level of their thinking.
Aim: To determine the effect of coordination training on the ability to think of children with different of the nervous system.
Methods: The study involved 60 children aged 7-8 years, who were differentiated into 3 groups of 20 people. To determine the strength of the nervous system used in the «Tapping-test». The level of development of coordination abilities was determined by the test «Shuttle run». Thinking was determined by the test «15». Statistical analysis was carried out with the help of t-student.
Results: After 7 months of the study, there were changes in the indicators of all groups of the level of development of coordination abilities and ability to think. In the KG, in which children were engaged in the usual methodics, the indicators deteriorated in the test for coordination ability from 10,3 s to 10,4 s $p>0.05$ and in the test for thinking from 14,1 s to 14,2 s. In EG-1, in which students performed exercises for coordination of movements, indicators in both tests improved, but not significantly. In the test "Shuttle run" from 10,3 s to 10,1 s ($p>0.05$). In the test «15» from 14,7 s to 14,5 s ($p>0.05$). In EG-2 in children who were engaged in a differentiated methodic of development of coordination abilities, taking into account the strength of the nervous system indicators in both tests have improved significantly. In the test "Shuttle run" with 10,3 s to 9,7 s ($p<0.05$) in the test «15» from 15,3 s to 13,6 s ($p<0.05$).
Conclusion: Thinking children will develop faster if on the physical education classes to devote time to coordination training and use a differentiated approach, which is based on the nervous system.
Keywords: differentiated approach, nervous system, children, thinking, coordination abilities.

INTRODUCTION

Coordination of movement is very important for a person. It allows you to perform the most complex operations and actions. The higher the level of development of coordination abilities, the more effective a person copes with the difficulties that require him to the finest motor actions[1-3]. Types of coordination abilities are diverse, but they never develop separately[4]. A favorable period for the development of coordination abilities is the age of 6-10 years[5,6].

Thinking for a person is also very important, the speed of implementation of an action depending the level of development of thinking[7].

Thinking and coordination are interconnected. A person who has a high level of thinking and coordination of movement, is able not only to quickly but also accurately perform almost any task[8].

The effectiveness of using a differentiated approach in the educational and training process is not in doubt[9,10].

One of the effective criteria of differentiation of children into groups is the strength of the nervous system[11,12].

The main purpose of the study is to study the effect of coordination training on the thinking of children with different type nervous systems.

Hypothesis of the study-it is assumed that systematic coordination training children 7-8 years will increase the level of development of their coordination abilities and improve the performance of thinking, especially in the group that deals with the use of a differentiated approach based on the strength of the nervous system.

Department of Physical Education, faculty of Physical Culture and Sports, the Vyatka State University, Kirov, Russia.
Correspondence to Georgiy Georgiveich Polevoy
Email: gera_lider1@mail.ru

METHODS

The study involved 60 children (boys and girls) from 1st grade of primary school number 10 (Kirov, Russia). Age of children 7-8 years. Physical education classes were held 2 times a week for 45 minutes. During the 7 months of the study, 59 sessions were conducted in each group. The study participants were divided into 3 groups by random sampling[13].

1. Control group (KG) 20 children were engaged in the standard program of physical cultural for students of 1 class[14].
2. The experimental group-1 (EG-1) 20 children were engaged in the standard program, but at the beginning of each lesson they performed exercises for coordination of movement for 12-15 minutes.
3. Experimental group-2 (EG-2) 20 children were differentiated into 2 subgroups according to the typology (10 children with strong nervous system, 10 – with weak). Children in this group also performed exercises to develop coordination abilities, but taking into account the strength of the nervous system, they were offered a different load. For children with a strong nervous system, the load was intense, and for children with a weak nervous system – volume. The intensity was increased by increasing the number of exercises and reducing rest time. The volume of the load increased due to the increase in the number of

repetitions and time of rest.

Coordination training is a set of physical exercises that are aimed at the development of coordination abilities. The main physical exercises for the development of coordination include exercises without objects (running, jumping, somersaults) and with objects (balls, gymnastic sticks, jump ropes) and sports games. Basic methods – standard-re exercises, flexible exercises, games, competitive.

The complexity of physical exercise increased by changing the spatial, temporal and dynamic parameters, external conditions, changing the area of support, their weight, height; changing the area of support or increasing its mobility in the exercises for balance; combining motor skills; combining walking with jumping, running and catching objects; performing exercises on the signal or for a limited period of time[15].

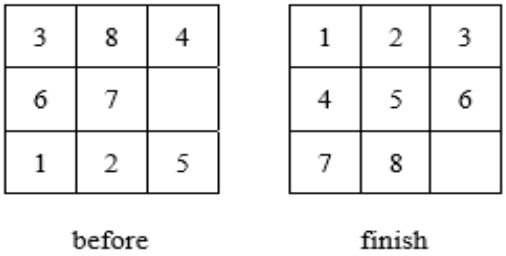
Before the beginning of the pedagogical experiment, all children passed tests that show the level of coordination abilities and thinking. In EG-2 was determined by the strength of the nervous system.

To determine the strength of the nervous system was used «Tapping-test»[16]. A sheet of A4 paper divided into 6 squares. 3 squares at the top and 3 squares at the bottom. on a signal of the trainer athletes put points as quickly as possible in each square. For each square is given 5 seconds. The transition from one square to another is carried out by the signal. After 6 square - finish. The result-the number of points in each square is calculated and a graph is plotted. Result – graph that determines the strength of the nervous system.

The level of development of coordination abilities was determined by the test «Shuttle run» 3x10 m[14]. At a distance of 10 m – 2 parallel lines are drawn – «Start» and «Finish». At the signal, the athlete runs to the finish line, touches the line with his hand, returns to the start line, touches it with his hand and overcomes the last segment – without touching the finish line with his hand. Result – up to 0,1 s.

The level of development of logical thinking of children was determined by the test «15»[17]. The size of the field 3 on 3 cells. All cells are occupied by numbers except one (empty). The numbers are arranged in random order. The aim of the game is to arrange the cells in order from 1 to 8 using a free (empty) cell, which should be at the end (figure 1). Result – up to 0,1 s.

Fig. 1: The playing field «15» to the before and after the end of the job.



Statistical analysis of the results of the study was carried out using the parametric t-student test. The correlation analysis was performed using the BIOSTAT 2009 program. The result was significant at $P<0.05$[18,19].

RESULTS

According to the test results before and after the pedagogical experiment the following data were obtained (table 1). The distribution of children into groups and subgroups was made in such a way that there were no significant differences in coordination capacity between all groups and subgroups prior to the study ($p>0.05$).

However, after the experiment there were changes in all groups. In the KG, which was engaged in the standard program, children did not perform exercises to develop coordination of movements, the results in the test "Shuttle run" deteriorated from 10,3 to 10,4 $p>0.05$. In the test for thinking «15» indicators also deteriorated by 0,1 s. ($p>0.05$). In the EG-1 indicators improved, but slightly in both tests. In the test «Shuttle run» from 10,3 s to 10,1 s ($p>0.05$). In the test «15» from 14,7 s to 14,5 s ($p>0.05$).

In EG-2 indicators significantly improved in the test «Shuttle run» from 10,3 s to 9,7 s ($p<0.05$) and in the test «15» from 15,3 s to 13,6 s ($p<0.05$).

It should be noted that after the pedagogical experiment the difference in the coordination abilities indicators has increased between the groups. Children from EG-1 surpassed their peers from KG, but not to a large extent ($p>0.05$). However, children from EG-2 significantly increased their advantage in comparison with children from KG from 10,4 s to 9,7 s ($p<0,05$).

Table-1: Indicators of thinking ability and the level of development of coordination abilities of children 7-8 years before and after the experiment (M ± m)

Indicators	Group	Before	After	P
«Shuttle run» (s)	KG	10,3 ± 0,6	10,4 ± 0,6	p>0,05
	EG-1	10,3 ± 0,6	10,1 ± 0,5	p>0,05
	EG-2	10,3 ± 0,6	9,7 ± 0,5	**p<0,05**
«15» (s)	KG	14,1 ± 0,9	14,2 ± 0,8	p>0,05
	EG-1	14,7 ± 0,8	14,5 ± 0,7	p>0,05
	EG-2	15,3 ± 0,9	13,6 ± 0,8	**p<0,05**

DISCUSSION

The importance of coordination abilities in human life is difficult to overestimate. Despite their diversity, they are all needed for the implementation of a motor action[1-4].

The level of development of mental processes allow a person to respond quickly to events and their variability. Of course, thinking and coordination of movements are interrelated, at least because their starting point to action is in the cerebral cortex[8,20].

It should be noted the positive importance of differential approach in the education and development of children. This approach allows you to realize the individual capabilities of the person, the hidden reserves of his body.[9,10]

Differentiation of children into groups occurs according to different criteria, for example: body type, biological age, playing roles and others[21-23].

The study confirms the authors opinion that differentiated training in physical culture and sports is effective. One of these criteria for the division into groups is the type of strength of the nervous system. There are few studies devoted to the typology of the nervous system, all of which have proven to be effective.[11,12] The basis of research in the field of typology is a different load for people with different types of nervous system. For a strong nervous system will be more effective intensive load, and for the weak – volume.[24,25] Such studies are confirmed by the results of the pedagogical experiment.

However, no studies have been found that focus on the impact of coordination training on the thinking of children 7-8 years, who have different strengths of the nervous system, such a study was conducted for the first time. The study provides specific recommendations and interprets the methodic of development of coordination of children's movements, taking into account the strength of the nervous system, which not only improves their coordination performance, but also improves the quality of mental processes, such as thinking.

CONCLUSION

The results of the study allow us to make several important conclusions. Systematic coordination training of children increases the level of development of coordination abilities. Coordination abilities influence thinking processes. The higher the level of coordination abilities, the higher the level of thinking. If used a differentiated approach in training, the performance will improve, especially if this approach is based on the strength of the nervous system. Such results can be useful for coaches in sports, for teachers of physical culture. The study is relevant and promising.

REFERENCES

1. Erceg M, Zagorac N, Katić R. The impact of football training on motor development in male children. *Collegium antropologicum* 2010; 32(1):241-247.
2. Issurin VB, Lyakh VI. Coordination abilities of athletes: basics of manifestation, evaluation and elucidation: a review. *Journal of athletic enhancement* 2017; 2.
3. Sadowski J, WoŁosz P, Zieliński J, Niźnikowski T, Buszta M. Structure of coordination motor abilities in male basketball players at different levels of competition. *Polish journal of sport and tourism* 2015; 21 (4):234-239.
4. https://doi.org/10.1515/pjst-2015-0004
5. Alexandrova VA, Shian VV. Some types of the coordination abilities of the athlete-dancers. *Uchenye zapiski universiteta imeni P.F. Lesgafta* 2014; 112 (6):12-17. https://doi.org/10.5930/issn.1994-4683.2014.06.112.p12-17
6. Karpeev AG. Long-term strategy of sports and technical preparation with due regard for age peculiarities of motor coordination development. *Uchenye zapiski universiteta imeni P.F. Lesgafta* 2008; 38 (4):35-39. https://doi.org/10.5930/1994-4683.2008.04.38.p35-39
7. Feoktistov MF. Periods of sensitivity of development of physical abilities among various contingents of pupils at average school age. *Uchenye zapiski universiteta imeni P.F. Lesgafta* 2010; 62 (4):118-120. http://doi.org/10.5930/1994-4683.2010.04.62.p118-120
8. Furley P, Memmert D. Creativity and working memory capacity in sports: working memory capacity is not a limiting factor in creative decision making amongst skilled performers. *Movement Science and Sport Psychology* 2015; 6:115. DOI: 10.3389/fpsyg.2015.00115
9. Vespalec T, Zhu W, Zvonar M. Relationship between physical activity and coordination: a middle-age adult study. *Medicine & science in sports & exercise* 2014; 46:770. DOI: 10.1249/01.mss.0000495808.88582.1f
10. Santos S, Coutinho D, Gonçalves B, Schöllhorn W, Sampaio J, Leite N. Differential Learning as a Key Training Approach to Improve Creative and Tactical Behavior in Soccer. *Research Quarterly for Exercise and Sport* 2018; 89 (1):11.
11. DOI: 10.1080/02701367.2017.1412063. Solomatin VR. Individual approach in elaborating the many-year training of young male swimmers. *Uchenye zapiski universiteta imeni P.F. Lesgafta* 2010; 61:103-107. Makarov YM, Hussain A-T. Typological profile of person properties of the basketball players aged 16-18 years old depending on the style of game activity. *Uchenye zapiski universiteta imeni P.F. Lesgafta* 2011; 73:122-4.
12. Kostyunina LI, Kiryanova LA, AnisimovaYA. Special features of the manifestation of nervous system typological properties among sprint track and field athletes. *Uchenye zapiski universiteta imeni P.F. Lesgafta* 2010; 62:38-42.
13. Шкляр ВМ. Usage of statistical methods in the pedagogical researches. *Science Rise* 2015; 5:39.
14. Lyakh VI, Zdanevich AA. Work program on physical culture, grade 1-4. Moscow: *Education* 2010; 80 p.
15. Holodov ZhK, Khuznetsov VS. Theory and methodics of physical training and sports. Moscow: *Akademia* 2009; 480 p.
16. Raigorodskiy DJ. Practical psychodiagnostics. Methodics and tests. Samara: *Bakhrakh-M* 2017; 672 p.
17. Johnson WW, Story WE. Notes on the "15" Puzzle. *American Journal of Mathematics* 1879; 4(2):397-404. doi:10.2307/2369492
18. Oldham J. Statistical tests (Part 2): parametric tests. *Nursing standard* 1993; 44:28-30. https://doi.org/10.7748/ns.7.44.28.s54
19. David FN, Cramer H. Mathematical methods of statistics. *Biometrika* 1947; 3/4 (34):374. https://doi.org/10.2307/2332454
20. Greig M, Marchant D, Lovell R, Clough P. McNaughton L. A continuous mental task decreases the physiological response to soccer-specific intermittent exercise. *British Journal of Sports Medicine* 2007; 41(12): 908-913. doi: 10.1136/bjsm.2006.030387
21. Shakhanova AV, Chelyshkova TV, Kuzmin AA, Silantyev MN, Grechishkina SS. Effect of team sports on aerobic performance of human body in view of somatotype. *Indian Journal of Science and Technology* 2016; 9 (42):104257. DOI**:** 10.17485/ijst/2016/v9i42/104257
22. Holienka M, Babic M, Doležajová L, Šelinger P, Musilová E. Motor performance of young soccer players based on their biological age. *Journal of Physical Education and Sport* 2017; 17(4):2508-2512.
23. Ion C, Serghei S, Constantin C. Differentiated physical training within the framework of a yearly training cycle of young footballers specialized on the position of goalkeeper. *Journal of Physical Education and Sport* 2018; 18(1):270-275.
24. Polevoy G. The spatial orientation of the players with different type of nervous system. *International Journal of Applied Exercise Physiology* 2017; 6(4):1-6. DOI: https://doi.org/10.22631/ijaep.v6i4.175
25. Drozdovski AK. The connection between typological complexes of properties of the nervous system, temperaments, and personality types in the professions and sports. *Open access journal of sports medicine* 2015; 6:72-161. DOI:10.2147/OAJSM.S75612.