

## ORIGINAL ARTICLE

**Correlation of Coordination Abilities, Physical Qualities and Mental Processes of Football Players**POLEVOY G.G.<sup>1,2,3</sup><sup>1</sup>Moscow Aviation Institute (National Research University), Moscow, Russia.<sup>2</sup>Moscow Polytechnic University, Moscow, Russia.<sup>3</sup>Vyatka State University, Kirov, Russia.Correspondence to: Polevoy G.G, Email: [g.g.polevoy@gmail.com](mailto:g.g.polevoy@gmail.com)**ABSTRACT**

The aim set out in Article research is to find new of methodical approaches to improve the methods of development of coordination abilities of young players. Despite the proven efficacy of the differentiated approach in the preparation of sports reserve, no data found, taking into account the typological features of display properties of the nervous system of children involved in football.

**Methods and techniques:** We used statistical methods to determine the validity and reliability of the results of scientific research. Statistical analysis was performed using a personal computer Pentium- 4 and using the Microsoft standard statistical software package Excel 2007. Correlation analysis was performed using the program Bio Stat 2016.

**Results:** Identified and synthesized a new classification of specific coordination abilities in terms of their impact on mental processes of young football players. The new data that expand and deepen the modern theory and methodology of football with new knowledge about the coordination abilities, peculiarities of the relationship indicators conditional abilities and mental processes with the indicators of specific coordination abilities of the players with strong and weak nervous system.

**Scientific novelty:** Demonstrated prospect for a differentiated approach based on a typology. The features of the relationship of coordination abilities indicators with indicators of conditional abilities and mental processes of the players of 11-12 years with a "strong" and "weak" the nervous system. Defined "leading" and "additional" specific types of coordination abilities in different groups of players.

**Practical significance:** Accounting data obtained as a result of the correlation analysis, in the training process of young players can provide a significant increase in the efficiency of the development process -specific coordination abilities, level of mastery of the technical and tactical methods and competitive performance, as well as improve the performance of the mental processes of children involved in football.

**Keywords:** differentiated approach, the properties of the nervous system, coordination abilities, psychical processes.

**INTRODUCTION**

Due to the fact that Russia has been granted the honorary right to organize the 2018 FIFA World Cup, it is necessary to bring the sports reserve training system to a new level. It is well known that the degree to which a football player has mastered all the variety of technical and tactical techniques of football and how he has learned to use these techniques in variable game situations depends on the level of his sports skills in football<sup>1,2,3</sup>.

In recent years, the game of football has placed high demands on the level of development of coordination abilities, which determine the effectiveness of performing game actions in dynamic and unpredictable game situations. It is difficult to overestimate the importance of coordination abilities in the technical training of athletes<sup>4,5,6</sup>.

The issue of the development of coordination abilities in athletes of various sports is systematically studied abroad, the most active position on this topic is occupied by Polish and German specialists<sup>7-10</sup>.

It is proved that it is most expedient to develop and improve the coordination abilities of football players at the age of 11-12 years<sup>11</sup>.

It is revealed that at the stage of initial sports training in game sports, one of the directions for improving the process of developing coordination abilities is the implementation of a differentiated approach<sup>12-15</sup>.

A number of scientific studies have established that the effectiveness of training effects is associated with the influence of various typological features of the manifestation of the properties of the athlete's nervous system<sup>16-18</sup>.

At the same time, no studies have been found on the differentiated development of specific coordination abilities of football players, taking into account the peculiarities of the manifestation of the properties of the nervous system. This indicates the relevance of scientific research in this direction and their effectiveness.

Thus, it should be noted that there is a contradiction between the modern requirements for the preparation of the football reserve and the lack of methods for developing the coordination abilities of football players aged 11-12 years with different typological properties of the nervous system.

The analysis of literary sources revealed the basic classification of specific coordination abilities of football players, which include the following abilities:

- 1 Adaptation and restructuring of motor actions.
- 2 Kinesthetic differentiation of motion parameters.
- 3 Spatial orientation.
- 4 Coordination (connection) of movements.
- 5 Quick response.
- 6 A sense of the rhythm of movements.
- 7 Equilibrium in dynamic and static conditions.

As part of the pedagogical experiment, 11-12-year-old football players engaged in sports sections were tested. Basic testing was carried out according to generally accepted methods to identify the level of development of the following indicators: specific coordination abilities, conditioned abilities (long jump from a standstill, 30 m running, 6-minute running and leaning forward) and mental processes (short-term memory, volume, intensity, stability and attention switching, and operational thinking).

It should be noted that the importance of mental processes when playing football is very high. For example, the player's RAM allows him to remember the leading technical actions of the opponent and at a certain moment choose the game action that will be unexpected for him. The main thing in the operational thinking of a football player is to choose from a variety of options one that is most suitable for this situation. In the process of playing football, you have to simultaneously perceive a large number of objects or their elements (the position of partners, opponents and the movement of the ball), and this places increased demands on the amount of attention. In addition, the duration of the game and the variety of tactical situations in it require high stability of attention from the players, the speed of its switching to various objects, from one motor actions of the partner or opponent to others.

**MATERIAL AND METHODS**

**Participants:** The study involved 40 young football players. 20 children in the control group (CG) and 20 children in the experimental group (EG). Before the start of the study, all the children were healthy and allowed by a medical professional to play football.

All procedures met the ethical standards of the 1964 Declaration of Helsinki. Informed consent was obtained from all parents of the children included in the study.

**Procedure:** Mathematical and statistical processing of the results was carried out using Microsoft Excel and Biostatistica 2016. The average values and standard deviation in the intellectual ability test scores were determined, and their percentage increase by the end of the experiment was determined. The Student's T-Test Was used.

After the basic testing, an additional one was carried out, which allowed the studied football players to be differentiated into groups taking into account the "strength-weakness" of the nervous system by the process of excitation (tapping test).

In order to establish the presence of features in the correlation relationships between the indicators of coordination abilities, physical qualities (conditioned abilities) and mental processes of these groups of football players, a correlation analysis was carried out<sup>19</sup>.

The need to formulate and solve such a problem is due to the results of previous studies, which indicate that the development of physical qualities and mental processes of a person occurs simultaneously. Moreover, there is evidence that changes in the development of some physical abilities occur in parallel and unidirectional with others.

The general classification and the magnitude of the correlation coefficients were determined according to M. A.

Kharchenko: strong, or close, at  $r > 0.70$ ; average, at  $r$  from 0.50 to 0.69; moderate, at  $r$  from 0.30 to 0.49; weak, at  $r$  from 0.20 to 0.29; very weak, at  $r < 0.19$ ; at the same time, if the correlation coefficient = 0, then the variables are completely independent of each other<sup>20</sup>.

**RESULTS**

There was no visible correlation between indicators of specific coordination abilities and indicators of physical qualities, as well as between physical qualities and mental processes in both football players with weak and strong nervous systems.

At the same time, the analysis of the structure of the correlation matrix revealed the presence of correlations of various nature, degree of significance and quantity between indicators of specific coordination abilities and indicators of mental processes in football players with a strong nervous system (Table 1) and a weak nervous system (Table 2).

Table 1: The number of correlations between indicators of specific coordination abilities and indicators of mental processes in football players with a strong nervous system

№	Specific coordination abilities	Mental processes				
		Short-term memory (points)	Attention span (units)	Intensity, stability and attention switching (points)	Operational thinking (sec)	Total
1	Ability to adapt and rearrange motor actions (sec)	-1	1	1	-1	1
2	Ability to differentiate movement parameters (sum of points)	-1	1	1	-1	3
3	Spatial orientation ability (sec)	-1	1	-1	1	3
4	Ability to coordinate (connect) movements (sec)	1	1	1	-1	0
5	Ability to react (cm)	-1	1	-1	1	3
6	Ability to rhythm (sec)	1	-1	1	-1	1
7	Ability to balance (number of times)	-1	-1	1	1	1

Thus, Table 1 shows that in football players with a strong nervous system, the ability to differentiate movement parameters, spatial orientation and reaction have the greatest number (three) unidirectional relationships with indicators of mental processes.

It should be noted that under unidirectional correlational correlations of coordination abilities and mental processes, we mean those in the presence of which it can be assumed that the improvement of a number of the studied coordination abilities can lead to the improvement of specific mental processes.

The presence of such unidirectional direct and inverse correlations of indicators of specific coordination abilities with indicators of mental processes in football players with a strong nervous system is presented below:

Improving indicators of the ability to differentiate movement parameters can lead to improved indicators of

intensity, stability and attention switching ( $r=0.61$ ), attention span ( $r=0.3$ ) and operational thinking ( $r=-0.34$ ).

At the same time, changes of indicators of ability to differenziata-level motion parameters and indicators of short-term memory have different relationships and therefore influence each other in the training activities, in all probability, will be neutral or, more likely, negative ( $r=-0.57$ ).

Improvement in the ability of spatial orientation can lead to an improvement in the intensity, stability, and switching attention ( $r=-0.47$ ), short-term memory ( $r$ =mobility in soil  $-0.35$ ) and on-line thinking ( $r=0.52$ ).

At the same time, the changes in the indicators of the ability of spatial orientation and measures of attention have different relationships and therefore influence each other in the process treniro-Nochnoi activities is likely to be neutral or, more likely, negative ( $r=0.28$ ).

Improvement in responsiveness may lead to an improvement of operational thinking ( $r=0.67$ ), intensity, stability, and switching attention ( $r=-0.38$ ) and short-term memory ( $r=-0.39$ ).

At the same time, changes in the indices of responsiveness and levels of attention have different interties, and therefore influence each other in the training activities, in all probability, will be negative ( $r=0.24$ ).

Improvement in responsiveness may lead to an improvement of operational thinking ( $r=0.67$ ), intensity, stability, and switching attention ( $r=-0.38$ ) and short-term memory ( $r=-0.39$ ).

At the same time, changes in the indicators of the ability to react and the indicators of the volume of attention have a multidirectional nature of interrelations, and therefore the influence on each other in the process of training activity is likely to be negative ( $r=0.24$ ).

The obtained results of the correlation analysis of the relationships between indicators of specific coordination abilities and indicators of mental processes showed that the following abilities should be attributed to the "leading" specific coordination abilities of football players with a strong nervous system: differentiation of movement parameters, spatial orientation and reaction. It is established that each of them has a unidirectional nature of correlational relationships with three of the four indicators of mental processes.

Considering the correlations of indicators of mental processes with specific coordination abilities, such as the ability to adapt and rearrange motor actions, rhythm and balance, we found that each of them has one unidirectional correlation with indicators of mental processes, and the ability to coordinate movements with indicators of mental processes has no unidirectional correlations. Because of the above, these specific coordination abilities are called by us as "complementary".

Correlations of various nature, degree of significance and quantity between indicators of specific coordination abilities and indicators of mental processes in football players with a weak nervous system are presented in Table 2.

Table 2 shows that in football players with a weak nervous system, the ability to adapt and rebuild motor actions, rhythm and balance have the greatest number (three each) of unidirectional correlations with indicators of

mental processes.

Table 2: The number of correlations between indicators of specific coordination abilities and indicators of mental processes in football players with a weak nervous system

№	Specific coordination abilities	Mental processes				
		Short-term memory (points)	Attention span (units)	Intensity, stability and attention switching (points)	Operational thinking (sec)	Total
1	Ability to adapt and rearrange motor actions (sec)	1	-1	-1	1	3
2	Ability to differentiate movement parameters (sum of points)	1	-1	-1	1	1
3	Spatial orientation ability (sec)	1	-1	-	-1	1
4	Ability to coordinate (connect) movements (sec)	1	1	-1	-1	1
5	Ability to react (cm)	-1	1	1	-1	1
6	Ability to rhythm (sec)	-1	1	-1	1	3
7	Ability to balance (number of times)	-	1	1	-1	3

The presence of unidirectional direct and inverse correlation correlations of indicators of specific coordination abilities with indicators of mental processes in football players with a weak nervous system is presented below:

Improvement in the ability to adapt and rearrange motor actions can lead to an improvement in intensity, stability, and switching attention ( $r=-0.46$ ), of attention ( $r=-0.43$ ) and operative thinking ( $r=0.59$ ).

At the same time, changes in the indices of the ability to adapt and rebuild of motor actions and indicators of short-term memory have different relationships and therefore influence each other in the training activities, in all probability, will be neutral or, more likely, negative ( $r=-0.49$ ).

Improvement in the ability to rhythm can lead to an improvement in short-term memory ( $r=-0.74$ ), intensity, stability, and switching attention ( $r=-0.44$ ) and operative thinking ( $r=0.46$ ).

At the same time, changes in the indices of the ability to rhythm and volume measures of attention have different relationships and therefore influence each other in the training activities, in all probability, will be neutral or, more likely, negative ( $r=0.42$ ).

Improvement in the ability to balance can lead to an improvement of operational thinking ( $r=-0.44$ ), and attention ( $r=0.61$ ), intensity, stability, and switching attention ( $r=0.56$ ).

At the same time, changes in the indices of the ability to balance, most likely, will have no impact on the performance of short-term memory, since between them there is no correlation relationship ( $r=0$ ).

The obtained results of the correlation analysis of the relationships between indicators of specific coordination abilities and indicators of mental processes showed that the following abilities should be attributed to the "leading" specific coordination abilities of football players with a weak

nervous system: adaptation and restructuring of motor actions, rhythm and balance. It is established that each of them has a unidirectional nature of correlational relationships with three of the four indicators of mental processes.

It can be assumed that their predominant, accentuated development will have a conjugate and progressive impact on the development of the majority of mental processes of young football players with a weak nervous system.

Considering the correlational relationships of mental processes with specific coordination abilities, such as the ability to differentiate movement parameters, spatial orientation, coordination (connection) of movements and reaction, we found that each of them has one unidirectional correlation with indicators of mental processes. By virtue of the above, these specific coordination abilities are designated by us as "additional".

Thus, during the analysis of the correlation matrix, it was revealed that the types and number of unidirectional relationships between indicators of specific coordination abilities and mental processes in football players with strong and weak nervous systems are different.

The generalized table 3 shows the total number of correlations between indicators of specific coordination abilities with indicators of conditioned abilities and mental processes in football players with strong and weak nervous systems, respectively.

Table 3: The total number of correlations between indicators of specific coordination abilities with indicators of conditioned abilities and psychological processes in football players with strong and weak nervous systems

№	Specific coordination abilities	Football players with a strong NS		Football players with weak NS	
		Conditioning abilities	Mental processes	Conditioning abilities	Mental processes
1	Ability to adapt and rearrange motor actions (sec)	1	1	2	3
2	Ability to differentiate movement parameters (sum of points)	1	3	2	1
3	Spatial orientation ability (sec)	2	3	2	1
4	Ability to coordinate (connect) movements (sec)	1	0	1	1
5	Ability to react (cm)	2	3	0	1
6	Ability to rhythm (sec)	0	1	2	3
7	Ability to balance (number of times)	0	1	2	3
Bcero		7	12	11	13

Thus, in football players with a strong nervous system, indicators of the ability to differentiate movement parameters, spatial orientation and reaction have the largest number of unidirectional correlations with indicators of mental processes (three each). Whereas in football players with a weak nervous system, the same number of

unidirectional correlations (three each) were revealed between indicators of the ability to adapt and rebuild motor actions, rhythm and balance with indicators of mental processes.

Thus, based on the data obtained on the presence of different correlations between indicators of specific coordination abilities and indicators of mental processes in football players with strong and weak nervous systems, it is advisable, in our opinion, to classify specific coordination abilities as follows (Table 4).

Table 3: Classification of specific coordination abilities, taking into account their combined development with mental processes in football players with a strong and weak nervous system

Specific coordination abilities	Football players with a strong NS	Football players with weak NS
«Presenters»	1) ability to differentiate movement parameters	1) ability to adapt and rearrange motor actions
	2) ability to spatial orientation	2) ability to rhythm
	3) ability to react	3) ability to balance
«Additional»	1) ability to adapt and rearrange motor actions	1) ability to differentiate movement parameters
	2) ability to coordinate (connect) movements	2) ability to spatial orientation
	3) ability to rhythm	3) ability to coordinate (connect) movements
	4) ability to balance	4) ability to react

**DISCUSSION AND CONCLUSION**

The obtained results of the correlation analysis suggest that a new methodological approach to improving the content of the methodology for the development of coordination abilities of football players aged 11-12, based on the principle of the conjugate development of coordination abilities and mental processes, will be the differentiation of means of development in football players with a strong and weak nervous system.

Based on the data obtained on the number of correlations of indicators of specific coordination abilities with indicators of conditioned abilities and mental processes in football players with strong and weak nervous systems, the "leading" specific coordination abilities were determined in terms of their influence on mental processes and conditioned abilities:

1 for football players with a strong nervous system - the ability to differentiate movement parameters, spatial orientation and reaction;

2 for football players with a weak nervous system - the ability to adapt and rebuild motor actions, rhythm and balance.

**The "additional" specific coordination abilities include the following abilities:**

1 for football players with a strong nervous system - the ability to adapt and rebuild motor actions, coordination (connection) of movements, rhythm and balance;

2 for football players with a weak nervous system - the ability to differentiate the parameters of movements, spatial orientation, coordination (connection) of movements,

reaction.

It can be assumed that the predominant development of the "leading" specific coordination abilities of football players with a strong and weak nervous system will ensure the conjugate development of the specific coordination abilities and conditioning abilities of football players themselves and the simultaneous progressive development of their mental processes. Ultimately, this will improve the quality of technical actions of football players and the effectiveness of their competitive activities.

The obtained research results can be used in the system of physical culture and sports education to modernize the content of the process of professional training of football coaches.

## REFERENCES

- 1 Abramov, E.E. Differentiated approach to construction training loads players of training groups [Text] : dis . ... Cand. ped . Science / EE Abramov. - Malakhovka, 2006. - 134 p.
- 2 Averyanov, I.V. Technique of perfection of kinesthetic coordinate - ordination abilities of football players of 10-11 years [Text] : dis . ... Cand. ped. Science / I.V. Averyanov. - Omsk, 2008. - 240 p.
- 3 Witkowski, Z. Coordination abilities in football : diagnostics , forecasting of development , training / Z. Witkowski , V.I. Lyakh // Physical culture : education, education and training . - 2006. - № 4. - S. 28-31.
- 4 Gerasimenko, A.P. Improving fundamentals of technical and tactical skills of young football players [Text] / A.P. Gerasimenko. - Volgograd: VGAFK , 2007. - 87 p.
- 5 Golomazov, S.V. Theory and methodology of football . The playing technique [Text] / S.V. Golomazov, B.G. Chirwa. - M. : Sport Academic Press, 2002. - 472 p.
- 6 Grigoryan, M.R. Technical training of young football players taking into account the differentiation of specialized loads increased coordination complexity [Text] : dis . ... Cand. ped. Science / M.R. Grigoryan. - Krasnodar, 2009. - 172 p.
- 7 Zhelezniak, Y.D. Fundamentals of scientific and methodological activities in physical culture and sports [Text] : studies. benefits for students. ped. Proc. Head. / Y.D. Zhelezniak, P.K. Petrov. - Moscow: Academy , 2002. - 264 p.
- 8 Kozhevnikov, V.S. Differentiated planning, plant and equipment training football players of 15-16 years in the preparatory period, based on the account of their bioenergy types [Text] : dis . ... Cand. ped. Science / V.S. Kozhevnikov. - Naberezhnye Chelny, 2011. - 168 p.
- 9 Krivoshchekova, O.N. Development of speed-power abilities of young gymnasts differing individual psychological characteristics [Text] : dis . ... Cand. ped. Science / O.M. Krivoshchekova. - Omsk, 2005. - 167 p.
- 10 Lubkin, Y.V. The effectiveness of actions of basketball players of various game role in connection with the typological features of nervous system properties : dis. ... Cand. psychol. Sciences: / Lubkin Yury Viktorovich ; [Ros. state. ped. Univ them. Al Herzen] . SPb., 2004. P. 44-54.
- 11 Lyakh, V.I. Specific coordination abilities as a criterion for predicting sport achievements of football players [Text] / V.I. Lyakh, Z. Witkowski, V. Zhmuda // Theory and Practice of Physical Culture . - 2002. - № 4. - S. 21-25.
- 12 Petukhov, A.V. Forming the basis of individual technical and tactical skills of young football players [Text] / A.V. Petukhov . - Moscow: Sov. sport, 2006. - 340 p.
- 13 Revenko, E.M. Individualization of precompetitive preparation boxing -ditch differing individual psychological characteristics [Text] : dis . ... Cand. ped. Science / E.M. Revenko. - Omsk, 2002. - 154 p.
- 14 Usmanova, E.N. Psycho- pedagogical maintenance of the sports - Preparation players of 14-16 years on the basis of the individually-differentiated approach [Text] : Author. Dis. ... Cand. ped. Science / E.N. Usmanova. - Naberezhnye Chelny, 2014. - P. 7-8.
- 15 Kharchenko, M.A. Correlation analysis [Text] : Textbook . for students. Universities / M.A. Kharchenko; ed. N.M. Nosilova. - Voronezh: Publishing house Voronezh. University Press, 2008. - 31 p.
- 16 Chesno, J.L. Football. Learn basic techniques [Text] : ucheb method . ed . / J.L. Chesno , J. Duray : Per. with France. - M. : TBT Division, 2006. - 176 p.
- 17 Blume, D.-D. Some major theoretical positions for the study of coordinative abilities [Text] / D.-D. Blume // Theory and Practice of Physical Culture. - 1978. - № 1. - P. 29-36.
- 18 Hirtz , P. coordinative motorishen perfectioning in physical education and in Norteurere results and Pozitionen [Text] / P. Hirtz // Theory and Practice of Kirperkultur . - 1983. - № 1. - P. 29-32.
- 19 Schnabel, G. The coordination skills and the problem of skill [Text] / G. Schnabel // Theory and Practice of Physical Culture. - 1973. - № 3. - P. 263-269.
- 20 Zimmermann, K. For further development of the theory of coordinative ability - s [Text] / K. Zimmermann // Wissenschaftliche Journal of the German College of Physical Culture. - 1983. - № 3. - P. 33-34.