Journal of Physical Education and Sport ® (JPES), Vol.20 (3), Art 220, pp. 1613 - 1620, 2020
online ISSN: 2247 - 806X; p-ISSN: 2247 – 8051; ISSN - L = 2247 - 8051 © JPES

Original Article

The factor structure of physical and motor fitness of 12-year-old children while playing basketball

OLENA ANDRIEIEVA[1], OLENA YARMAK[2], VIKTORIIA KYRYCHENKO[3], TETIANA RAVLIUK[4], TAISIIA TSURKAN[5], TETIANA ZAVGORODNIA[6], INNA STRAZHNIKOVA[7], VLADIMIR POTOP[8]
[1,3] National University of Physical Education and Sport of Ukraine, Kiev, UKRAINE
[2] Bila Tserkva National Agrarian University, Bila Tserkva, UKRAINE
[4,5] Yuriy Fedkovych Chernivtsi National University, Chernivtsi, UKRAINE
[6,7] Vasyl Stefanyk Precarpathian National University, Ivano Frankivsk, UKRAINE
[8] Ecological University of Bucharest, Bucharest, ROMANIA

Published online: May 30, 2020
(Accepted for publication: May 18, 2020)
DOI:10.7752/jpes.2020.03220

Abstract
Background: This article presents the results of an educational experiment in which 148 children of 12 years of age from different regions of Ukraine participated. The aim of the study was to analyse the factor structure of the physical fitness of 12-year-old children while playing basketball. *Materials and methods:* analysis and systematization of scientific and methodological publications, educational research methods, mathematical statistics method. The parametric Student's t-test was applied to the samples that followed the law of normal distribution; the non-parametric Kruskal–Wallis test was used for the samples that did not follow the law of normal distribution. *Results of the study:* The principal aspect of the study was to test various coordination abilities of 12-year-old children while playing basketball. We presented research data on the relationship and interdependence of motor qualities in 12-year-old children as an integrated dynamic system. By implementing factorial and correlation analyses, the factors were revealed that reflected the structure of pupils' physical fitness. Among the overall factors in the groups of boys, we studied: "physical and coordination abilities" with a 68.0 % contribution to the total dispersion; "throwing accuracy and endurance", which explained 10 % the total sample variance; the factor with the least contribution to the total variance "restructuring of the actions under particular conditions, speed and strength abilities" explained 7.5 % of the total sample variance. *Conclusions:* The distribution of factors confirms the assumption that the development of physical abilities is a multifaceted process, which allows to develop any particular physical quality without influencing others.
Keywords: coordination ability, vestibular reactions, sensory system, sports, schools

Introduction

According to the researchers, the present school system of physical education is not able to provide the proper level of physical and intellectual capacity, which the current employment market will require from them and which will be necessary for them for further professional activity (Krutsevich, 2003; Zhuravleva, 2011; Dvorkina, 2013; Bolotin et al., 2017; Galan et al., 2017; Andrieieva et al., 2017; Nakonechnyi, 2017; Pasichnyk et al., 2018; Osipov et al., 2018; Galan et al., 2019). The principal argument in favour of it is the low level of physical fitness, which is serious trouble for contemporary society. The search and scientific substantiation of means and methods that ensure efficient development of motor qualities of children and adolescents, including the coordination abilities, is one of the promising tasks of improving the physical education system of a present comprehensive school (Koval, 2015; Kirichenko, 2015; Tsurkan, 2016; Bakayev et al., 2018). The results of numerous studies conducted in recent decades (Trofimenko et al., 2019) indicate that the formation of the foundation for the development of coordination abilities in a child occurs at the age of 7-12 years, due to some physiological and psychological factors.

The interaction with 12-year-old students of different levels of physical and motor fitness will depend on the teaching skill of the physical education teachers and their motivation for self-improvement.

The relevance of the problem of formation and development of coordination abilities of secondary school children in physical education classes requires the development of new approaches to its solution, the use of which would contribute to the development of various manifestations of coordination abilities that a person needs in his daily professional or sports activities.

The universal means of physical education, suitable for use by all categories of the population, are the sports games helping to form the foundations of physical education and improve the general state of human health (Galan et al., 2018; Vaskan et al., 2019). Systematic participation in sports games contributes to the comprehensive development of pupils, a particularly noticeable positive effect is observed on the development of

Corresponding Author: TAISIIA TSURKAN, E-mail: y.galan@chnu.edu.ua

physical abilities such as speed and power endurance, speed, agility and coordination of movements. The school program for physical education includes classes in sports games, in particular, football, volleyball and tennis. Basketball also obtains a significant place in the physical education curriculum for grades 5-9 of general educational establishments (Kirichenko, 2015; Pityn et al., 2017; Kozina et al., 2017).

However, despite the significant potential of using sports games in school physical education, analysis of the research and methodological literature indicates a lack of research on the use of basketball as a means of forming coordination abilities in secondary school children. The limited publications covering the potential use of basketball to develop and improve coordination of movements in pupils in grades 5-9 determine the relevance of this study (Galan et al., 2018).

Material and methods

Design and participants

We used theoretical and empirical methods to solve the tasks of our study. The theoretical methods were applied to determine the state of disclosures of the research problem in pedagogical, scientific, educational, methodical and specialized literature, and to study curricula and programmes. The empirical methods (observation, educational testing, educational experiment), were used to study the level of development of coordination abilities and technical and tactical indicators.

In the course of the study, we used the "shuttle running" 4 × 9 m test exercise, with and without dribbling a ball

Kopylov's exercise (ten "eights") enables determining the level of development of the ability for sound manifestation and restructuring of motor actions in specific conditions. Its motor structure provides for the passing of the ball with the highest speed from left to right and from right to left. In this case, a participant has to control the ball so that it does not fall out of the hands and control the body position to follow the rules of the exercise. The participant has a specific condition, namely the number of repetitions and a specified motion structure. The participant of the test takes the starting position - the forward inclination of the body, the ball is held in one hand, helping with the other. At the command “Move on!”, a participant, as fast as possible, starts to pass the ball from one hand to another between the legs at the level of the knees - to make the imaginary "eights".

The amplitude of the arms is optional, but the participant of the test should not take their feet off the floor. Previously, to get acquainted with the test, the pupils make 4-5 full “eights”. One credit attempt is provided. If the ball falls from the hands, the attempt is repeated.

The execution time of ten “eights” is recorded with an accuracy of 0.1 s. To control the ability of orienteering in space, we practised the test exercise “Running towards the numbered stuffed balls”. For the test, we used 6 stuffed balls, a stopwatch, a tape measure. The test procedure included the following: the pupil is standing in front of a stuffed ball, behind at a distance of 3 m (and 1.5 m from each other) lie in circles of 5 stuffed balls with random numbering. The teacher calls the number, the pupil turns 180°, runs to the corresponding stuffed ball, touches it with his hand and returns to the starting position. As soon as he touched this ball, the teacher calls another number, etc. The exercise ends after the pupil completed it three times and returned to the starting position. The result is recorded with an accuracy of 0.1 s After explaining and demonstrating, a pupil makes one attempt. It is relevant that before each new participant the order of the balls was changed.

To determine the level of development of dynamic equilibrium in our study, we used the Balance Error Scoring System (the BESS technique), recommended for children of middle and senior school age. To conduct the test, it is necessary to draw with chalk 11 circles on the floor in the room. The distance from the circle “X” to the circle “1” is 46 cm. The distance between the rest of the circles is 84 cm. The test procedure involves jumping through all 11 circles, starting from circle X and ending at circle 10. The following rules are observed: in circle X they acquire their starting position - standing high on the right toes. At the signal, the pupil jumps to the left toes in the first circle, where he must fix this position for 5 seconds. Then he jumps on the toes of his right foot in the second circle, where he also fixes the position for 5 s, and in such a manner to circle 10. An attempt is credited if it is performed in less than 50 s. In this case, the following errors are considered: touching the floor with the heel, stepping out of the circle line, touching the floor with the hand or the other foot, unstable position - bouncing or turning on the supporting leg while fixing the pose in a circle. The result is a correct going of the distance if it is performed in the required time of 50 s. A participant can make previous some tries before running the test. The participant of the test is given two scoring attempts. The best result is recorded.

To determine the level of development of static equilibrium in our studies, we used the Yarotskyi’s test, which involves performing continuous circular head movements in one direction at a pace of two moves per second from the starting position - the normal standing position, eyes closed. The result is determined with an accuracy of 0.1 s from the start of the exercise and to the loss of balance. Rating: equilibrium retention 35 s - excellent, 20 s - good, 16 s - satisfactory.

To determine the level of overall coordination of movements in the children of middle and senior school age, as well as young basketball players, experts use the test exercise "Remote basketball shots for speed and

accuracy", which provides for running movements along a given route and performing the main game technique in basketball - throwing a ball into the basket. This test involves two sets of five shots from the specified points on the basketball court. The first and the fifth points are located at a distance of 450 cm to the right and the left of the basket, the second and the fourth points are at an angle of 45 ° and a distance of 450 cm, respectively, to the right and left of the basket. The third point is also located at a distance of 450 cm at an angle of 90°; five basketballs are used; a stopwatch. After the "March!" command, the participant of the test starts from behind the front line and, as soon as possible, performs five shots in the basket from the specified points, trying to shot the ball in the basket. After shooting the fifth throw, he runs over the front line, returns to the start position and performs another 5 shots in the basket. After the 10th throw, the participant runs around "a trapezium" and finishes. The speed of the test is determined by the time of performance of10 shots into the basket, fixed from the start signal to the crossing of the front line (finish). The accuracy of time recording is 0.1 s.

To estimate the level of physical fitness, we used a series of tests characterizing the level of development of such physical qualities: running 30 m (s) - to determine the level of development of speed; "shuttle" running 4x9 (s) - to determine the level of development of dexterity; bending forward from a sitting position (cm) - to determine the level of development of flexibility; standing long jump (cm) - to determine the level of development of speed and strength qualities; flexion and extension of arms in front lying support (times) and pulling up on a high pull-up bar (times) - to determine the level of development of strength (for boys and girls, respectively); running in a steady pace without taking into account time, m - to determine the level of development of endurance. The test performance requirements were consistent with the generally accepted methods. The sample was checked for compliance with the law of normal distribution based on the Shapiro-Wilk criterion. To determine the relationships between indicators of the development of physical qualities and varieties of coordination abilities of pupils of grade 6, an analysis of the correlation fields was carried out using the Pearson correlation coefficient. We used such a method of mathematical statistics as factor analysis, which allowed us to reduce the number of variables to a minimum set of factors with a statistically significant contribution.

Methods of mathematical statistics

Statistical processing of the obtained data was carried out using the Statistica 10 package of documents (StatSoft, USA) and Excel 2015 spreadsheets (Microsoft, USA), which made it possible to analyse the measurements and calculate the base values.

The study was carried out with children of grade 6 during 2019. The study involved 148 pupils aged 12 years (general education school of the I-III stages of the village of Bobryk, Brovary district, Kyiv region; general education school of the I-III stages of the village of Murovane, Pustomyty district, Lviv region; general education school of the I-III stages of the village of Kozinets of the Lipovets Regional State Administration of Vinnytsia Region; general education schools of the I-III stage No.320 of the Desnianskyi district of the city of Kyiv and general education schools of the I-III stages No. 6 of the city of Chernivtsi).

Results

One of the objectives of our study was to determine the presence and informative significance of the relationships between the components of physical qualities and varieties of coordination abilities of schoolchildren in the process of playing basketball.

For the analysis, 14 variables were selected: $\mathbf{x_1}$ – speed (running 30 m, s)
$\mathbf{x_2}$ – endurance (running at a steady pace, m)
$\mathbf{x_3}$- force, (flexion and extension of the arms in a front lying position, times)
$\mathbf{x_4}$ – flexibility (bending forward from the sitting position, cm)
$\mathbf{x_5}$ – speed and strength abilities (standing long jump, cm)
$\mathbf{x_6}$ – agility ("shuttle running" 4x9 m, s)
$\mathbf{x_7}$ – the ability to space-temporal orientation ("shuttle running" 4x9 m with dribbling of a ball, s)
$\mathbf{x_8}$ – the ability for rational manifestation and restructuring of actions (Kopylov's exercise, s)
$\mathbf{x_9}$ - orientation in space and time (running to the numbered balls, s)
$\mathbf{x_{10}}$ – dynamic equilibrium (the Bess method, s)
$\mathbf{x_{11}}$ – static equilibrium (the Yarotskyi's test, s)
$\mathbf{x_{12}}$ – coordination of movements (remote shots, nominal units)
$\mathbf{x_{13}}$ – foul shots, (times)
$\mathbf{x_{14}}$ – throws from a middle distance (times)

To analyse the structure of factors, the threshold value of the factor load was determined at the level of $n \geq 0.700$. The factor analysis allowed us to establish the most significant factors that determine the development of the physical qualities of pupils and varieties of coordination abilities. The results of the factor analysis of the boys and girls are presented in table 1. We determined 3 factors in the structure of the physical fitness of the boys. The factors identified according to the results of the first stage of the study explain the total variance of the sample by 85.5 %.

Table 1. The matrix of the factor loads of indicators of physical fitness and the development of coordination abilities of pupils in the process of playing basketball

Variables	Boys (n=66)			Girls(n=82)	
	Factor 1	Factor 2	Factor 3	Factor 1	Factor 2
x_1 – speed (running 30 m, s)	**0.926**	0.316	0.068	0.228	**0.897**
x_2 – endurance (running in a steady pace, m)	**0.797**	**0.532**	0.012	0.579	0.431
x_3- force, (flexion and extension of the arms in an front lying position, times)	**0.974**	0.028	0.031	0.583	0.018
x_4 – flexibility (bending forward from the sitting positi, cm)	**0.863**	0.087	0.042	**0.850**	0.451
x_5 – speed and strength abilities (standing long jump, cm)	0.358	0.483	**0.489**	0.285	**0.829**
x_6 – agility ("shuttle running" 4x9 m, s)	**0.949**	0.091	0.012	**0.910**	0.379
x_7 – the ability to space-temporal orientation ("shuttle running" 4x9 m with dribbling of a ball, s)	**0.905**	0.075	0.242	**0.931**	0.320
x_8 – ability for rational manifestation and restructuring of actions (Kopylov's exercise, s)	0.278	0.115	**0.762**	**0.942**	0.221
x_9- orientation in space and time (running to the numbered balls, s)	**0.947**	0.238	0.022	**0.885**	0.365
x_{10} – dynamic equilibrium (the Bess method, s)	**0.976**	0.065	0.061	**0.925**	0.387
x_{11} – static equilibrium (the Yarotskyi's test, s)	**0.965**	0.112	0.049	**0.934**	0.375
x_{12} – coordination of movements (remote shots, nominal units)	**0.945**	0.153	0.033	**0.927**	0.357
x_{13} – foul shots, (times)	0.415	**0.642**	0.428	0.644	0.583
x_{14} – throws from middle distance (times)	0.592	**0.747**	0.021	0.617	0.149
Contribution of the factor to the total dispersion, %	**68.0**	**10.0**	**7.5**	**58.2**	**21.20**

The leading factor is "physical and coordination qualities" with a contribution to the final dispersion of 68.0 %. This factor includes the following indicators: speed ($r = 0.926$ at $p < 0.01$); endurance ($r = 0.797$ at $p < 0.01$); strength ($r = 0.974$ at $p < 0.01$); flexibility ($r = 0.863$ at $p < 0.01$); dexterity ($r = 0.949$ at $p < 0.01$); the ability to space-temporal orientation ($r = 0.905$ at $p < 0.01$); orientation in space and time ($r = 0.947$ at $p < 0.01$); the dynamic equilibrium ($r = 0.976$ at $p < 0.01$); the static equilibrium ($r = 0.965$ at $p < 0.01$); coordination of movements ($r = 0.945$ at $p < 0.01$). The dominance of the aforementioned factor in boys is explained by the fact that during this age period there is a natural increase in the studied physical qualities, in addition, in the process of physical education at school a rather high attention is paid to the development of physical qualities. The second factor, "shot accuracy and endurance," which explains the total variance of the sample by 10%, includes shots from the middle distance ($r = 0.736$ at $p < 0.01$), shots from the from behind the foul line ($r = 0.639$ at $p < 0, 01$), endurance ($r = 0.531$ at $p < 0.01$).

The factor with the smallest contribution to the total variance "action restructuring under certain conditions and speed and strength abilities", explains the total variance of the sample by 7.5 % and includes the ability to rationally display and reorganize actions ($r = 0.756$ at $p < 0.01$) and speed and strength abilities ($r = 0.491$ at $p < 0.01$). A high level of sensitivity of skin receptors, motor and vestibular sensory systems, clear differentiation of muscle sensations, contribute to the development of high coordination of movements, their smoothness and clarity. The stability of vestibular reactions in girls especially increases in the period from 8 to 13-14 years. At this age, the motor-sensory system is quickly improving, the ability to differentiate the amplitude of movements increases. It is essential to use this period to enhance coordination of movements, increase the stability of the vestibular apparatus, mastery of static and dynamic balance and the formation of complex motor skills. The factor analysis based on indicators of physical fitness and coordination abilities of the girls, obtained during the first stage of the study, allowed us to identify two factors, with 79.3 % of the contribution to the total variance of the sample. A smaller number of factors than in the boys is explained by the features of the body of the girls who, up to the age of 12 years, already master complex coordination movements.

The overall factor is "physical and coordination abilities" with a contribution of 58.2 % to the total sample variance. It consists of the following components: flexibility ($r = 0.850$ at $p < 0.01$); agility ($r = 0.910$ at $p < 0.01$); the ability to space-temporal orientation ($r = 0.931$ at $p < 0.01$); the ability to rationally manifest and reconstruct actions under specific conditions ($r = 0.942$ at $p < 0.01$); orientation in space and time ($r = 0.885$ at $p < 0.01$); dynamic equilibrium ($r = 0.925$) static equilibrium ($r = 0.934$ at $p < 0.01$); coordination of movements ($r = 0.927$ at $p < 0.01$). The second factor with a contribution to the total dispersion of 21.20 % was the factor that we defined as "speed and strength abilities". The most significant here is speed ($r = 0.897$ at $p < 0.01$) and speed and strength abilities ($r = 0.829$ at $p < 0.01$). Given the foregoing, we can state that the indicators that we used during the study are quite informative and fully characterize the development of the physical and coordination abilities of schoolchildren since the total variance of the sample was explained by 79.3 % in the girls and 85.5 % in the boys. The next step in our study was to determine the degree of interconnection between physical fitness

indicators and the level of development of various manifestations of the children's coordination abilities. For analysis, we used 14 variables. Correlation analysis data indicate a multidirectional, both quantitatively and qualitatively, the relationship between physical fitness indicators and the level of development of coordination abilities of pupils. The obtained results are presented in Table 2.

Analyzing the degree of correlation of physical fitness indicators and coordination abilities of the tested girls at the beginning of the experiment, we noticed that the greatest number of relationships with coordination abilities has such a physical quality as speed, namely the ability to evaluate and control the space-temporal parameters of movements ($r = 0.512$ at $p < 0.001$); the ability to orient in space ($r = 0.462$ at $p < 0.001$); the ability to control the dynamic equilibrium ($r = 0.532$ at $p < 0.001$); the ability to control the static equilibrium ($r = 0.481$ at $p < 0.001$); the ability to coordinate movements ($r = 0.514$ at $p < 0.001$). At the same time, there was a slightly lower level of correlation between the speed and the ability for rational manifestation and restructuring of actions under specific conditions ($r = 0.345$ at $p < 0.01$). It should be noted that a high level of correlation relationships was observed with flexibility indicators: the ability to evaluate and control the space-temporal parameters of movements ($r = 0.923$ at $p < 0.001$); the ability to orient in space ($r = 0.902$ at $p < 0.001$); the ability to maintain dynamic equilibrium ($r = 0.932$ at $p < 0.001$); the ability to maintain static equilibrium ($r = 0.862$); the ability to coordinate movements ($r = 0.933$ at $p < 0.001$); the ability for rational manifestation and restructuring of actions under specific conditions ($r = 0.891$ at $p < 0.001$).

Table 2. Correlation relationships of indicators of physical fitness and development of coordination abilities of the 12-year-old children (n = 148)

	1	2	3	4	5	6	7	8	9	10	11	12	13
						Girls (n=82)							
1	1.0												
2	0.142	1.0											
3	0.051	-0.091	1.0										
4	**0.534**	-0.332	**0.522**	1.0									
5	**0.741**	0.031	0.241	0.622	1.0								
6	**0.542**	-0.332	**0.492**	**0.932**	0.542	1.0							
7	**0.512**	-0.362	**0.491**	**0.923**	0.483	**0.971**	1.0						
8	0.345	-0.453	**0.514**	**0.891**	0.491	**0.920**	**0.922**	1.0					
9	0.462	-0.372	**0.522**	**0.902**	**0.600**	**0.942**	**0.901**	**0.901**	1.0				
10	0.532	-0.351	**0.523**	**0.932**	**0.551**	**0.973**	**0.973**	**0.930**	**0.923**	1.0			
11	0.481	-0.302	**0.541**	**0.862**	0.453	**0.964**	**0.970**	**0.884**	**0.892**	**0.952**	1.0		
12	0.514	-0.362	**0.512**	**0.933**	0.562	**0.981**	**0.960**	**0.922**	**0.961**	**0.973**	**0.963**	1.0	
13	**0.632**	-0.223	0.342	**0.754**	**0.621**	**0.812**	**0.741**	**0.753**	**0.763**	**0.831**	**0.732**	**0.784**	1.0
14	0.322	-0.131	0.193	0.441	0.134	**0.624**	**0.684**	0.484	0.452	0.593	**0.711**	**0.622**	0.36
	1	2	3	4	5	6	7	8	9	10	11	12	13
						Boys (n=66)							
1	1.0												
2	-0.450	1.0											
3	**0.892**	-0.363	1.0										
4	**0.793**	-0.382	**0.820**	1.0									
5	0.154	-0.340	0.351	0.213	1.0								
6	**0.923**	-0.371	**0.933**	0.780	0.260	1.0							
7	**0.862**	-0.462	**0.880**	0.791	0.174	**0.831**	1.0						
8	0.270	-0.263	0.233	0.104	0.103	0.223	0.380	1.0					
9	**0.975**	-0.404	**0.912**	**0.842**	0.192	**0.920**	**0.862**	0.213	1.0				
10	**0.892**	-0.441	**0.950**	**0.851**	0.391	**0.932**	**0.853**	0.211	**0.903**	1.0			
11	**0.921**	-0.430	**0.952**	**0.790**	0.343	**0.960**	**0.870**	0.264	**0.923**	**0.952**	1.0		
12	**0.902**	-0.392	**0.913**	**0.792**	0.332	**0.862**	**0.871**	0.293	**0.945**	**0.883**	**0.890**	1.0	
13	**0.662**	-0.221	**0.642**	0.353	0.310	0.594	0.503	0.016	**0.664**	0.572	**0.641**	0.722	1.0
14	0.321	-0.142	**0.543**	0.591	0.382	0.511	0.462	0.178	0.403	0.634	0.463	0.445	0.09

Notes: n = 82; $r = 0.223$ at $p < 0.05$; $r = 0.302$ at $p < 0.01$; $r = 0.362$ at $p < 0.001$;

n is 66; $r = 0.260$ at $p < 0.05$; $r = 0.332$ at $p < 0.01$; $r = -0.430$ at $p < 0.001$

1 - speed, s; 2 - endurance, m; 3 - strength, number of times; 4 - flexibility, cm; 5 - speed and strength qualities, cm; 6 - agility, s; 7 - the ability to space-temporal orientation, s; 8 - the ability for rational

manifestation and restructuring of actions under specific conditions, s; 9 - the ability to orientate in space, s; 10 - the ability to maintain the posture stability (dynamic balance), s; 11 - the ability to maintain the posture stability (static balance), s; 12 - coordination of movements, nominal units; 13 – foul shots from the penalty distance, times; 14 – shots from the middle distance.

Coordination, as a physical quality, is a complex set of abilities. It is quite well developed and improved in the process of individual development of the human body. In contrast, flexibility is under significant genetic control; it requires careful selection and early development in ontogenesis. At the same time, as the researchers note, flexibility depends on the morphological and functional capabilities of the body (muscle elasticity, the state of intervertebral discs) and the ability to control the motor apparatus. That is, between the level of development of flexibility and the level of development of various manifestations of coordination abilities is a stable relationship.

We have identified the following relationships: the ability to evaluate and control the space-temporal parameters of movements ($r = 0.491$ at $p < 0.001$); the ability to orient in space ($r = 0.522$ at $p < 0.001$); the ability to maintain dynamic equilibrium ($r = 0.523$); the ability to maintain static equilibrium ($r = 0.541$ at $p < 0.001$); the ability to coordinate movements ($r = 0.512$ at $p < 0.001$); the ability for rational manifestation and restructuring of actions under specific conditions ($r = 0.514$ at $p < 0.001$).

The significant indicators in the correlation relationships between the development of strength and various manifestations of coordination abilities are determined by the close relationship between the level of development of both qualities. After all, it is impossible for a long time to maintain a static pose or perform the maximum number of repetitions of a given movement without having well-developed strength qualities. That is why the improvement of coordination abilities is impossible without a sufficient level of development of strength abilities.

The data obtained as a result of a correlation analysis of the indicators of the level of development of endurance and coordination qualities indicate a low level of the direct correlation between these indicators. Moreover, we noted that in the boys the degree of such a correlation is higher than in the girls.

So the correlation between the coordination of movements and the shooting of free throws is $r = 0.784$ at $p < 0.001$, between the coordination of movements and throws from the middle distance, is $r = 0.622$ at $p < 0.001$. Analyzing the degree of correlation of physical fitness indicators of the studied boys of grade 6 at the beginning of the school year, it should be noted that a large number of significant correlation relationships were found between the level of development of coordination abilities and the level of physical fitness (Table 2).

Our findings confirm that speed has high correlation relationships with such varieties of coordination abilities as: the ability to assess and control the space-temporal parameters of movements ($r = 0.862$ at $p < 0.001$), the ability to orientate in space ($r = 0.975$ at $p < 0.001$), the ability to maintain dynamic equilibrium ($r = 0.892$ at $p < 0.001$), the ability to maintain static equilibrium ($r = 0.921$ at $p < 0.001$), the ability to coordinate movements ($r = 0.902$ at $p < 0.001$). At the same time, there was a much lower level of correlation between the speed and ability to rationally present and rearrange actions in specific conditions ($r = 0.270$ at $p < 0.05$).

Attention is drawn to the data of correlation relationships between the level of development of strength and various types of coordination abilities. So, high correlation relationships with the development of strength have: the ability to assess and control the space-temporal parameters of movements ($r = 0.880$ at $p < 0.001$), the ability to orient in space ($r = 0.912$ at $p < 0.001$), the ability to maintain dynamic equilibrium ($r = 0.950$ at $p < 0.001$), the ability to maintain static equilibrium ($r = 0.952$ at $p < 0.001$), the ability to coordinate movements ($r = 0.913$ at $p < 0.001$). At the same time, there was a lack of correlation between power and the ability to rationally manifest and to rearrange actions in specific conditions ($r = 0.233$).The obtained results prove a satisfactory level of correlation relationships between the studied indicators. So the correlation between the overall coordination of movements (dexterity) and the performance of the basketball free throws is $r = 0.722$ at $p < 0.001$; between the coordination of movements and throws from an average distance, is $r = 0.445$ at $p < 0.001$, which is logical, because throwing from diverse distances is a combination of movements of various coordination direction, therefore, a satisfactory level of its development will positively impact the accuracy of shots.

Discussion

The development and improvement of the coordination abilities associated with the use of various physical exercises, the performing of which requires the participation of all muscle groups, activation of the cardiorespiratory system, and the advancement of analyzers. Therefore, as the coordination of movements increases, other physical qualities improve. Coordination of movements as the ability to reasonably manifest and reconstruct motor actions in particular conditions based on the available motor skills is especially relevant for achieving high results in sports games, martial arts, complex coordination sports; that is, in those kinds where steadily there is a necessity for a speedy change of motor actions while maintaining their appropriate interrelation and sequence (Loboda et al., 2012; Yarmak et al., 2018; Baidiuk et al., 2019).

The data obtained in the course of the study were more developed: the substantiation of the provisions of the existing theory of improving movements in physical education by the suitability of using proper exercises

to develop coordination qualities; the substantiation of the practice of basketball training exercises in the lesson system to enhance coordination qualities (Clark et al., 2018); it was supplemented the data: by age peculiarities of the physical fitness of pupils of secondary school (Rebryna et al., 2011; Kozina et al., 2013; Utesch et al., 2018; Konieczna et al., 2019); on the formation and development of components of coordination qualities that are of priority concern for the game activity (Kyrychenko et al., 2015; Paliichuk et al., 2018); on the content and methods of improving the coordination qualities of primary school children (Ratkowski et al., 2018).

Conclusions

The obtained results of the factorial and correlation analysis revealed the factors that reflect the structure of physical fitness of 12-year-old children in the process of playing basketball.

Among the overall factors in the groups of children, the following was revealed: "physical and coordination abilities"- the contribution of 68.0 % to the explained variance; "throwing accuracy and endurance" with the contribution of 10.0 % to the explained variance and "restructuring of actions under particular conditions and speed and strength abilities" with the contribution of 7.5 % to the explained variance. The overall factor among the studied groups of girls is "physical and coordination abilities" with the contribution of 58.2 % of the explained variance and "speed and strength abilities" with the contribution of 21.20 % of the explained variance.

Competing Interests

The authors declare that they have no competing interests.

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