

Formation of middle school pupil movements using basketball

GRYGORIY GRIBAN¹, KOSTIANTYN PRONTENKO², YULIYA KOSTYUK³, PAVLO TKACHENKO⁴,
TETIANA YAVORSKA⁵, YEVGENII ZHUKOVSKIY⁶, VICTOR SHAVERSKIY⁷
^{1, 3, 5, 6, 7} Zhytomyr Ivan Franko State University, Zhytomyr, UKRAINE
² Zhytomyr Military Institute named after S. P. Koroliyov, Zhytomyr, UKRAINE
⁴ Zhytomyr National Agroecological University, Zhytomyr, UKRAINE

Published online: March 30, 2018

(Accepted for publication March 16, 2018)

DOI:10.7752/jpes.2018.01041

Abstract:

The article substantiates the value of basketball in the system of physical education of pupils as a complex tool for physical development, health promotion, formation of vital skills and abilities, development of creative abilities and psycho-physiological qualities. In total, 64 pupils (32 boys and 32 girls) from 6th school grades took part in the investigation. The most informative psycho-physiological indicators of motor skills were discovered in both boys and girls during basketball trainings. Correlation analysis was used to study indicators of special physical fitness in basketball and psycho-physiological indices of the pupils. The method of differentiated training of physical exercises in basketball for the 6th grade pupils was developed. It supplements the generally accepted method of basketball training and allows to improve the educational process of physical education of pupils and creates new opportunities for improving their physical and technical fitness of pupils

Keywords: special physical fitness, psycho-physiological indicators, pupils, basketball

Introduction

Being one of the most popular sport games nowadays, basketball continues to gain popularity in the world and Ukraine not only as a spectacular sport show, but also as an effective tool of physical education for middle and upper secondary pupils. It is one of the primary tools for pupils to develop their basic physical skills and mental abilities. It also improves their ability to work and is considered to be effective in a comprehensive physical development with wide age range. In addition, the climatic, geographical and socio-economic conditions of living of children and teenagers have direct influence on their adaptation to the environment and motor development, which requires a differentiated approach to the organizational and methodological principles of conducting basketball trainings. The analysis of curricula and experience of practical work showed that the study of complex technical techniques in basketball should begin with the primary school, since the level of physical fitness contributes to a better learning of the educational material [3, 10].

High practical significance of basketball is determined by the complex nature of the impact of the game on the basic functions of the body and manifestation of motor abilities. This game challenges the body of the child with high requirements to general, special physical fitness and to motor reflexes when assimilating technical and tactical actions. Throws from different distances contribute to the development of coordination of movements and form the correct posture; jogging and jumping contribute to the active growth of the body; long distance handing and ball struggle develop muscle strength, with not so much of isometric strength, but dynamic. Static efforts in basketball are short-term and have no decisive value [2, 3, 4].

Speed is one of the most important qualities in basketball. High mobility of the nervous processes determine the rapid orientation of the players on the site and the speed of execution of actions, as well as the speed of tactical thinking, which manifests itself in tactical engagement of players. Therefore, the main form of brain activity is its «creative» activity – an instant assessment of the situation, the solution of the tactical task, the choice and the formation of appropriate actions. It is connected with the great importance of processes of perception and processing of information by the central nervous system.

Determination of psycho physiological functions of the organism of middle school pupils in rural areas is aimed at studying the mechanisms of brain dynamics used to process the information of varying degrees of complexity when performing physical activity [9]. One approach is to solve this problem by grouping tasks according to the types of exercises. The selection of material for cooperative trainings with pupils of all ages should focus on complexity and dosage of exercise. It is necessary to distribute the material during physical education (PE) classes, so that training is always carried out at the beginning, and improvement – later. In this case, in addition to studying or improving any type of movement, the main part of the lesson also includes the development of physical qualities, which is mandatory even in classes with pupils of different age. Otherwise,

the purpose of the lesson will be distorted.

Representatives of sport games are characterized by a relatively short latent time of motor reactions. This ensures quick and correct response in case of unexpected situations. Individual-typological peculiarities of the organism of the pupils, different levels of their morphofunctional abilities and abilities for studying and training require individualization and differentiation of training activities [10].

One of the main tasks for pupils of middle school age is to develop coordination (orientation in space, speed of reorganization of motor actions, speed and accuracy of motor reactions, coordination of movements, rhythm, equilibrium of the body, accuracy of reproduction and differentiation of strength, spatial and temporal parameters of movements) and conditional (speed, strength, speed-strength, endurance and flexibility) skills, as well as their combinations [3, 4, 8, 10]. Thus, the study of indicators of special physical fitness in basketball among middle school pupils is closely linked with their psycho-physiological peculiarities of the development of their growing organisms.

Materials and methods

Sixty four pupils (32 boys and 32 girls) from 6th school grades from Zhytomyr region of took part in the investigation. To determine the special physical fitness of the pupils, pedagogical testing in the gym was conducted. The following technical techniques were defined: free throws, ball handing, ball dribbling, double step. In order to determine the psycho-physiological characteristics of the body development of the middle classes pupils, techniques and tests were used: time of simple reaction (s); time of complex reaction (s); frequency of movements – tapping test (number of taps); sensation of muscular effort (%); accuracy of time intervals reproduction (s); volitional qualities (c. u.); short-term visual memory (points); proofreading «Landolt Rings» – speed of information processing (bit/s) and intensity of attention (%); distance differentiation (%); equilibrium of the body (points); mental performance (s).

The aim of the article is to determine the relationship of special physical fitness in basketball with psycho-physiological indices of middle school pupils in rural areas.

Tasks: 1. To determine the relationship of special physical fitness in basketball with psycho-physiological indices of middle school pupils in rural areas.

2. Develop a method of differentiated training of physical exercises in basketball for middle school pupils in rural areas.

Research methods: theoretical analysis and generalization of scientific and methodical literature, psycho-physiological testing, pedagogical testing of the level of special physical fitness, methods of mathematical statistics.

Results

To study the relationship between the indices of special physical fitness that are important for the successful training of the basketball game (ball handing, free throws, dual step, ball dribbling) and psycho-physiological tests (simple and complex motor reactions, reaction on a moving object, the frequency of movements of the upper limbs, a tapping test, a test for muscle sensation, a test for the sensation of time intervals, short-term visual memory, volume of attention, equilibrium of the body, mental performance, distance differentiation) a correlation analysis was conducted. It helps to discover certain differences between the age and sex of the studied adolescents. Thus, in the sixth-graders, the following psycho-physiological indicators are significantly influenced by the results of free throws: frequency of movements (-0.374), a sense of short time intervals (0.547), speed of visual information processing (-0.337) and a sense of maximum muscular effort (-0.342) etc. (Table 1).

Table 1. Dependence of the special physical fitness of middle school boys on the psycho-physiological indicators of the organism's development (n = 32)

| Psycho-physiological indicators | Special physical fitness | | | |
|--|--------------------------|--------------|-------------|----------------|
| | Free throws | Ball handing | Double step | Ball dribbling |
| Intensity of attention | -0.37 | 0.46 | -0.29 | 0.21 |
| Simple motor reaction | -0.27 | 0.24 | -0.15 | -0.54 |
| Feeling of muscular effort 50% | 0.09 | -0.26 | 0.37 | 0.32 |
| Reaction to a moving object | -0.15 | 0.33 | 0.27 | 0.09 |
| Frequency of movements | -0.37 | -0.25 | -0.65 | -0.32 |
| Volitional qualities | -0.32 | 0.12 | -0.48 | -0.25 |
| Speed of visual information processing | -0.37 | 0.14 | -0.40 | 0.21 |
| Short-term visual memory | 0.13 | 0.20 | -0.69 | -0.15 |
| Feeling of short time intervals | 0.55 | -0.35 | -0.43 | -0.34 |
| Performance | -0.25 | 0.36 | 0.13 | 0.40 |
| Feeling of muscular effort 100 % | -0.34 | 0.06 | -0.51 | -0.14 |
| Mental stability | -0.12 | -0.16 | 0.12 | -0.37 |

Ball handing has correlation relations with the reaction to a moving object (0.332), a sense of short time intervals (-0.350), performance (0.364) and intensity of attention (0.455). Double step is affected by feeling of muscular effort 50% (0.374), frequency of movements (-0.650), volitional quality (-0.475), speed of visual information processing (-0.401), intensity of attention (-0.291), feeling of short time intervals (-0.434), short-term visual memory (-0.694) and a sense of maximum muscular effort (-0.505). Ball dribbling is affected by a simple motor reaction (-0.535), a frequency of movements (-0.332), a feeling of muscular effort 50% (0.324) and mental resistance (-0.367).

In a case of middle-school girls, free throws were significantly correlated with a sensation of maximum muscular effort (0.401), intensity of attention (-0.342), frequency of movements (0.707), a feeling of short time intervals (0.278), equilibrium of the body (-0.354), performance (0.349) and work readiness (0.414) (Table 2).

Table 2. Dependence of the special physical fitness of middle school girls on the psycho-physiological indicators of the organism's development (n = 32)

| Psycho-physiological indicators | Special physical fitness | | | |
|--|--------------------------|--------------|-------------|----------------|
| | Free throws | Ball handing | Double step | Ball dribbling |
| Intensity of attention | -0.34 | 0.25 | 0.28 | 0.38 |
| Simple motor reaction | -0.21 | -0.17 | 0.23 | -0.31 |
| Short-term visual memory | 0.07 | -0.11 | -0.49 | 0.53 |
| Feeling of muscular effort 50% | -0.07 | -0.29 | 0.19 | -0.22 |
| Feeling of muscular effort 100 % | 0.40 | -0.28 | -0.19 | 0.07 |
| Frequency of movements | 0.71 | -0.33 | -0.04 | -0.12 |
| Volitional qualities | 0.22 | -0.47 | -0.26 | -0.38 |
| Speed of visual information processing | 0.25 | 0.17 | 0.27 | 0.39 |
| Performance | 0.35 | -0.15 | 0.66 | 0.24 |
| Feeling of short time intervals | 0.28 | -0.03 | 0.13 | -0.39 |
| Differentiation of distance | 0.19 | 0.27 | 0.40 | 0.26 |
| Equilibrium of the body | -0.35 | -0.18 | 0.15 | -0.53 |
| Work readiness | 0.41 | -0.33 | -0.22 | 0.28 |

Ball handing is affected by frequency of movements (-0.332), volitional quality (-0.474) and sensation of muscular effort 50% (-0.290). Double step is affected by short-term visual memory (-0.492) and distance differentiation (0.395). The indicators of the ball dribbling have reliable correlations with a simple motor reaction (-0.307), short-term visual memory (0.526), volitional qualities (-0.375), speed of visual information processing (0.388), sensation of short time intervals (-0.393) and equilibrium of the body (-0.530).

Thus, in the conducted research, a sufficient number of reliable correlation bonds of the middle level has been established, which gives grounds to assert that at this age the psycho-physiological features of children are important for indicators of special physical fitness in basketball. Therefore, the obtained results of psycho-physiological characteristics formed the basis for the substantiation and development of a method of differentiated training of motor activity of pupils of middle classes of rural schools in the process of playing basketball. Moreover, the discovered dependence of special physical fitness on the level of manifestation of psycho-physiological indicators confirms that the execution of motor activity in space and time is closely related to the ability to evaluate them with muscular effort, volitional qualities, concentration of attention, memory, coordination of movements etc.

The main criteria for differentiating the method of training physical exercises in the process of basketball game is to improve the psycho-physiological indicators. It is an important factor in the formation of motor skills and abilities, the development of physical qualities for improving motor experience and the systematic use of new types of motor activity during training. The method of training motor skills includes a set of special exercises for the development of psycho-physiological indicators of pupils, which are most significant for one or another game action, depending on age and gender, in particular: speed of motor reactions, volitional qualities, frequency of movements, kinesthetic sensation (feeling of muscular effort), balance, time orientation (reproduction of short and long time intervals), different characteristics of attention, distance differentiation, visual memory, as well as mental performance. Complexes of special exercises were used in the preparatory part of the training in the form of general and specially developed exercises, as well as in the main part – in the form of mobile and sport games and relay.

For the development of muscle sensation in children of sixth grades of rural schools, exercises were selected and taught correctly and economically to distribute muscular strength, that is, to correct and specify parameters of movements in terms of amplitude, magnitude of effort and trajectory: juggle-a-ball and tennis ball exercises, small dumbbells and expanders exercises. Very important moment in the exercise is the ability of pupils to correctly evaluate their own muscular effort, which further forms the feeling of the ball.

The speed of motor reactions is a component of most motor actions in basketball. The speed of motor reactions is not related to the level of manifestation of skill, since the time of a simple motor reaction is genetically determined and the change of this index under the influence of the environment and sports is relatively small. Basketball is characterized by manifestations of different aspects of speed: the speed of performing individual techniques (ball dribbling, throwing into the basket), the speed of perception and evaluation of gaming situations, the speed of decision-making and the choice of the most effective ways in the game. Therefore, we used general and special exercises, which are characterized by sudden reaction due to the constant change of the situation, relays with movement changes on the teacher's signal. For the development of the frequency of movements of middle school pupils in rural areas, exercises of high-speed orientation with and without objects were used. Such exercises are performed in short intervals of time with several approaches with rest till full recovery.

To develop a sense of equilibrium, which depends to a large extent on the vestibular analyzer, we used a variety of exercises with rotation in different planes of the head, limbs, and trunk: somersaults, flips, turns, combinations of exercises, exercises for saving rack, various types of climbing, jumping, elements of gymnastic exercises, running with abrupt stops and changes of direction, and exercises with restraint visual control.

To improve the ability to master the time parameters of movements in PE classes, we have selected exercises that are strictly limited in time parameters and require time control during their execution. These are exercises with a specific number of repetitions per unit time, exercises that are performed slowly on count, tempo movements for a given time, etc. At the same time, the ability to independently keep a count is important, thus keeping an eye on time.

When developing volitional qualities it is necessary to create a variety of difficulties to overcome which is necessary to identify different types of volitional efforts and tensions. Particular attention is paid to the game-type-exercises, combinations of exercises with opposition, the application of which forms the pupils' courage, perseverance, ability to overcome difficulties.

The main tools in the development of volitional qualities is the use of bilateral basketball training games that prompt decisions, demonstrate initiative and determination in complex and unexpected moments of gaming situations. Speed competitions, accuracy and performance, relay race, basic jumps, acrobatic exercises, as well as mobile games and exercises to manifest creative activity in action.

In order to form attention, rapid perception and processing of information, tactical thinking, visual, auditory and motor memory in the sixth grade pupils, we used mobile games, relays, elements of sport games that required simultaneous asymmetric movements of different parts of the body. Exercises requiring team interactions, simultaneous exercise of the entire class, as well as basketball techniques that formed the «school of ball games».

Mental performance was developed through preparatory games in which pupils were accustomed to teamwork and ball interaction, educational games with simplified and strict rules, and the implementation and use of tactical combinations, such as the interaction of two (three) attackers, attack techniques, personal protection, fast breakdown attack, street ball game. It has shown that the ability to reproduce, evaluate, measure and differentiate the parameters of movements, which are based mainly on the accuracy and subtlety of motor sensation and perception, are the most important coordination abilities for sport games. Therefore, in order to develop a sense of distance, we used exercises and relays for accuracy, throwing a small ball, exercises for passing distance with and without visual control, variation of distance during ball handing, various throws, dribbling, ball handing on different distance with different speeds, the throwing of different balls (volleyball, jungle-a-ball, football) for a certain distance, as well as long distance handing at the teacher's signal.

Method of differentiated training of physical exercises in basketball for middle school pupils in rural areas includes: movement; knocking and ball handing with one hand from the shoulder, dribbling a ball, one hand top throws, free throw, countering the striker with the ball, selecting the place for ball handing, technical methods of attack and defense. In developing the method of differentiated training of physical exercises in basketball for middle school pupils, we took into account the most significant psycho-physiological indicators, the purposeful development of which influenced the effectiveness of the learning process.

Discussion

Analysis of the study showed that when training ball handing in boys of the sixth grade, the most informative are the amount of attention, the speed of reaction to the moving object and the sense of short time intervals ($p < 0.05$). In the case of girls of the sixth grade, some other indicators, such as a sense of 50% muscle effort, frequency of movements, mental performance and volitional quality, are influenced by this motor activity ($p < 0.05$). Therefore, the structure of classes consisted of the following exercises. To develop volume of attention: exercises in two and three-person teams in catching and handing the ball, relays on the accuracy of handing. To develop the speed of reaction on a moving object: handing during counter traffic, mobile games and relays with use of handing. To improve the sense of short time intervals: exercises with clearly specified time of execution, moving games and relay, which require time orientation. To improve the sense of 50% muscle effort: exercises with objects of different mass, handing of balls of different mass. To develop the frequency of

movements: high-speed exercises that require high frequency of movements relay speeds and accuracy of gears. To improve mental performance: tactical exercises, training games 2 vs 2. To improve volitional qualities: acrobatic exercises, basic jumps, mobile games and relays that require independent decisions and reveal creativity and initiative in choosing action.

While training pupils, the technique of ball dribbling makes motor reaction important for both boys and girls ($p < 0.05$). In addition, this game is affected by the feeling of muscular effort 50%, the frequency of movements, mental performance in case of sixth grade boys ($p < 0.05$). In case of sixth grade girls, the game is affected by the development of short-term visual memory, volitional qualities, the speed of visual information processing and the sense of short time intervals ($p < 0.05$). To the content of PE classes, we specifically included the following exercises. To improve the simple motor reaction: ball dribbling and changing the height of the rebound on signal, dribbling in pairs in motion. To develop a sense of 50% muscle effort: exercises with objects of different mass, juggling the balls of different mass. To develop the frequency of movements: two balls dribbling exercises, high-speed exercises requiring urgent response and high frequency of movements. To improve mental performance: technical techniques in two or three person teams without a defender and with him, feints, training games 2 vs 2, 3 vs 3. To develop short-term visual memory: exercises for reproduction of various movements by different parts of the body in different planes, asymmetric movements, exercises involving all pupils. To develop volitional qualities: elements of gymnastic exercises, sport games and relays for a small number of pupils. To develop visual information processing speed: exercises for the reproduction of simultaneous movements of various parts of the body, mobile games that require a rapid response to a change in the situation. To develop a sense of short time intervals: short-term exercises with a clear time limit, mobile games and relay that require time orientation.

In the process of pedagogical molding experiment it was discovered that the indicator of short-term visual memory ($p < 0.05$) was more informative on the effectiveness of the double step in pupils of different sex. At the same time, in case of boys, this action is affected by intensity of attention, the sense of 50% and maximum muscular effort, frequency of movements, volitional qualities, speed of processing of visual information and feeling of short time intervals ($p < 0.05$). In case of girls, it is affected by the development of distance differentiation ($p < 0.05$). Therefore, while training the double step, our focus was on the use of such exercises. To improve short-term visual memory: deceptive movements with steps, various combinations of movements with different parts of the body in different directions. To increase the intensity of attention: exercises with various types of signals (whistle, applause, commands), exercises with given or variation spatial parameters. To develop sense of a 50% and maximum muscular effort: exercises on differentiation of muscular effort, variation of maximum, moderate and minimum efforts, exercises with objects of different mass. To develop the frequency of movements: short-term paced exercises, juggling with objects. To improve volitional qualities: elements of gymnastic exercises, basic jumps, mobile games and relays for a small number of pupils. To develop visual information processing speed: exercises for the reproduction of simultaneous movements of various parts of the body, mobile games that require a rapid response to a change in the situation. To develop a sense of short time intervals: exercises with a clearly specified time of execution, exercises on the differentiation of spatial and temporal characteristics, exercises with variation of execution time. To improve the distance differentiation: throws of balls of different mass (volleyball, juggle-a-ball, football) for a certain distance, jumps, throwing at a given distance.

While training a free throw in the sixth grades among all of the psycho-physiological indicators, special importance belongs to the frequency of movements, the sensation of short time intervals and a sense of maximum muscular effort ($p < 0.05$). However, in case of boys, this game is influenced by the speed of the processing of visual information; in case of girls by the equilibrium of the body and mental performance ($p < 0.05$). The following exercises were included in the free throw training. To improve the frequency of movements: juggling objects, speed handing of a ball to a given target, dribbling a ball with low rebound height. To develop a sense of short time intervals: short-term exercises with a clear time limit, mobile games and relay that require time orientation. To improve maximal muscular effort: exercises for reproduction of given strength characteristics of motion, exercises with objects of different masses. To develop visual information processing speed: exercises with ball dribbling between racks, stroke racks, counter-defense, exercises for the simultaneous use of different parts of the body, mobile games that require quick reaction to a change in the situation and actions of a partner or rival. To develop equilibrium of the body: acrobatic exercises, racks and turns with equilibrium, holding static poses, moving games with keeping posture for an hour. To improve mental performance: individual tactical actions in pairs, mobile games and relays in pairs.

Thus, the verification of the effectiveness of the implemented differentiated method of training physical exercises in basketball, has discovered a number of positive changes in both the indicators of psycho-physiological peculiarities of the body's development and in the physical exercises of pupils of middle-school in rural areas as a result of the purposeful pedagogical influence of special methods of physical education. This method supplements the generally accepted method of basketball training, allows improving the educational process of PE classes in primary school in rural areas and creates new opportunities for improvement of physical and technical fitness of pupils. The conducted research does not cover all aspects of the training of physical

exercises of pupils of the primary rural school by means of basketball. It reveals the prospects for further finding new ways to improve the effectiveness of teaching physical education of pupils in rural areas.

Conclusions

1. Reliably close correlation ($p < 0.05$) was found between special physical fitness among boys of middle school age with psycho-physiological indicators of body development: with intensity of attention $r = -0.37-0.46$; frequency of movements $r = -0.37-0.65$; volitional qualities $r = -0.32-0.40$; the speed of visual information processing $r = -0.31-0.40$; short-term visual memory $r = -0.69$; sensations of short time intervals $r = -0.43-0.55$, which confirms the ability to assess technical actions by means of muscular effort, volitional qualities, concentration of attention, memory and coordination of movements. Similar data was obtained from girls of middle school age with the intensity of attention $r = -0.34-0.38$; short-term visual memory $r = -0.49-0.53$; Frequency of movements 0.33-0.71; volitional qualities -0.38-0.47 and other indicators.

2. It is discovered that the degree of expression of each of the studied psycho physiological factors is significant and effective in the training of physical exercises in basketball classes for middle school pupils in rural areas.

References

- Amosov, M. M. (2002). The Amosovs' encyclopaedia. Algorithm of health. Man and society, AST; Stalker, 464 p.
- Apanasenko, H. L. (2007). Book about health, *Medkniga*, 132 p.
- Kozina, Zh., Sobko, I., Yermakova, T., Cieslicka, M., Zukow, W., Chia, M., Goncharenko, V., Goncharenko, O., Korobeinik, V. (2016). Psycho-physiological characteristics of female basketball players with hearing problems as the basis for the technical tactic training methodic in world level teams. *Journal of Physical Education and Sport*, 16 (4), pp. 1348–1359.
- Kyrychenko, V. (2011). Forming of motive abilities and skills from basket-ball at the pupils of the specialized classes. *Physical culture, sport that physical rehabilitation in modern society*, pp. 44–46.
- Kyslenko, D., Prontenko, K., Bondarenko, V., Iukhno, Iu., Radzievskii, R., Prontenko, V., Kizyun, O. (2017). Development of the physical qualities of future specialists in protective activities due to the use of the kettlebell sport during studies. *Journal of Physical Education and Sport*, 17 (2), pp. 789–794.
- Prontenko, K., Griban, G., Prontenko, V., Bezpaliy, S., Bondarenko, V., Andreychuk, V., Tkachenko, P. (2017). Correlation analysis of indicators of athletes' readiness and their competitive results in kettlebell sport. *Journal of Physical Education and Sport*, 17 (Supplement issue 4). pp. 2123–2128.
- Prontenko, K., Prontenko, V., Bondarenko, V., Bezpaliy, S., Bykova, G., Zeleniuk, O., Dvoretzky, V. (2017). Improvement of the physical state of cadets from higher educational establishments in the Ukrainian Armed Forces due to the use of the kettlebell sport. *Journal of Physical Education and Sport*, 17 (1), pp. 447–451.
- Roghovyk, L. (1999). Diagnostics of psychomotorical capacities for teaching, *Primary school*, 1, pp. 4–6.
- Volkov, L. V. (1980). Method of education of physical capabilities of pupils, *Rad. shkola*, 104 p.
- Zheleznyak, Yu. D. (2002). Sport games: *on and Sport*, 17 (Supplement issue 4). pp. 2123–2128