Ivashchenko, O., Prykhodko, V., & Cieslicka, M. (2018). Movement Coordination: Factor Structure of Development in 5th-7th Grade Girls. *Teorìâ ta Metodika Fìzičnogo Vihovannâ [Theory and Methods of the Physical Education], 18*(1), 38–49. https://doi.org/10.17309/tmfv.2018.1.05
ISSN 1993-7989 (print). ISSN 1993-7997 (online)

MOVEMENT COORDINATION: FACTOR STRUCTURE OF DEVELOPMENT IN 5TH-7TH GRADE GIRLS

Ivashchenko Olga[1], Prykhodko Volodymyr[2], Cieslicka Miroslava[3]
[1]H.S. Skovoroda Kharkiv National Pedagogical University, UKRAINE
[2]Start-School, Kharkiv, UKRAINE
[3]Kazimierz Wielki University, Bydgoszcz, POLAND

Corresponding author: Ivashchenko Olga, e-mail: olga@tmfv.com.ua
Accepted for publication: February 15, 2018
Published: March 30, 2018

DOI:10.17309/tmfv.2018.1.05

Abstract

The study objective is to determine the structure of coordination abilities development in 5th-7th grade girls.

Materials and methods. The participants in the study were 5th grade girls (n = 20), 6th grade girls (n = 23), 7th grade girls (n = 19). The study used the following methods: analysis and collation of scientific and methodological literature, general scientific methods of theoretical level, such as analogy, analysis, synthesis, abstraction, induction, as well as general scientific methods of empirical level: observation, testing, experiment. To evaluate motor preparedness, the study recorded the results of motor tests, body height and weight. The IBM SPSS 20 statistical analysis software was used to process the study materials. A factor analysis was performed, for which the study used principal component analysis with the rotation method: Variamax with Kaiser Normalization.

Results. The analysis of similarities shows that the most informative tests in the structure of motor preparedness of the 5th grade girls are the following: test 11 "Evaluation of the ability for vestibular (statokinetic) stability. Running with turns" (.884), test 9 "Static equilibrium evaluation by E. Ya. Bondarevsky's method" (.826), test 6 "Evaluation of the sense of movement speed in sprinting" (.824); of the 6th grade girls — test 11 "Evaluation of the ability for vestibular (statokinetic) stability. Running with turns" (0.884), test 9 "Static equilibrium evaluation by E. Ya. Bondarevsky's method" (.826), test 6 "Evaluation of the sense of movement speed in sprinting" (.824); of the 7th grade girls — test 8 "Evaluation of the ability to differentiate movement speed (reproduction accuracy of running speed at 90% intensity of maximum)" (.902), test 11 "Evaluation of the ability for vestibular (statokinetic) stability. Running with turns" (.900), test 1 "30 m running (s)" (.869).

Conclusions. In the structure of coordination abilities of the 5th-7th grade girls, the most informative components are the sense and differentiation of running speed, vestibular stability in exercises that require static and dynamic equilibrium. To carry out pedagogical control of coordination preparedness of 5th-7th grade girls, the study recommends using the following tests: test 11 "Evaluation of the ability for vestibular (statokinetic) stability. Running with turns", test 9 "Static equilibrium evaluation by E. Ya. Bondarevsky's method", test 6 "Evaluation of the sense of movement speed in sprinting".

Keywords: girls; coordination abilities; motor preparedness.

Introduction

The main tasks being addressed in physical education of schoolchildren are to optimize children's physical development (Balsevich, 2000; Ilyin, 2003), to improve their motor abilities, to promote and protect their health (Vlasenko, & Nosko, 2000; Ivashchenko, 2016; Emeljanovas, Mieziene, & Putriute, 2015).

Numerous studies conducted in this field led to the following conclusions:

- on the need for comprehensive motor abilities development in children (Liakh, 2000; Nosko, 2001; Krutsevych, & Bezverkhnia, 2010);

- on the importance of movement coordination development in physical education of schoolchildren (Nosko, Kryvenko, & Manievych, 2001; Ivashchenko, 2017; Lopatiev, Ivashchenko, Khudolii, Pjanylo, Chernenko, & Yermakova, 2017);
- on the relationship between anthropometric, motor and cognitive abilities in children (Drid, Vujkov, Jaksic, Trivic, Marinkovic, & Bala, 2013; Iadreev, Cherkashin, Vujkov, & Drid, 2015; Novak, Podnar, Emeljanovas, & Marttinen, 2015);
- on the effect of physical loads on motor skills plasticity in schoolchildren (Hadžić, Bjelica, Vujović, & Popović, 2015; Khudolii, & Ivashchenko, 2014).

Previously published works focused on clarifying the concept of coordination abilities (Liakh, V. I., 2000; Ilyin, 2003; Nosko, 2001), as well as on determining their structure (Ivashchenko, Khudolii, & Miroshnichenko, 2016; Ivashchenko, Khudolii, Iermakov, Lochbaum, Cieslicka, Zukow, Nosko, & Yermakova, 2016; Khudolii, Iermakov, & Prusik, 2015).

Coordination abilities are of key importance in children's and adolescents' motor preparedness (Nosko, & Sumak, 2000; Serhiienko, Chekmarova, & Khadzhynov, 2012; Khudolii, 2008). Research has found that it is effective to use multidimensional methods of mathematical statistics when studying the structure of motor preparedness of schoolchildren (Ivashchenko, 2016; Vlasov, Demichkovskyi, Ivashchenko, Lopatiev, Pityn, Pianylo, & Khudolii, 2016; Lopatiev et al., 2017). In available literature, however, there are not enough data on the peculiarities of coordination abilities development in middle school students.

Therefore, it is relevant to study the peculiarities of coordination abilities development in middle school girls.

The study objective is to determine the structure of coordination abilities development in 5th-7th grade girls.

Materials and methods

Study participants. The participants in the study were 5th (n = 20), 6th (n = 23), 7th (n = 19) grade girls.

Study organization. The study used the following methods: analysis and collation of scientific and methodological literature, general scientific methods of theoretical level, such as analogy, analysis, synthesis, abstraction, induction, as well as general scientific methods of empirical level: observation, testing, experiment.

Testing procedure. The testing program included well-known tests (Liakh, 2000; Serhiienko, 2001; Ivashchenko, 2016). To evaluate motor preparedness, the study recorded the results of motor tests, body height and weight:

Test 1 "30 m running (s)":

Equipment required. Stopwatch, 30-meter-long distance having start/finish lines.

Testing procedure. At the "On Your Mark" command, the test participant takes up a crouch start position at the starting line. At the "Get Set" command, the participant rises, on "Go" she begins to run to the finish line.

Result. Time measured with an accuracy of 0.1 seconds.

Comments

1. Starting and distance covered signals are given by an assistant starter.
2. One attempt is made.

Test 2 "Standing long jump (cm)":

Equipment required. Non-slip surface with a line, marked *in centimeters*.

Testing procedure. The test participant toes the line, swings her arms backward, then abruptly swings them forward and jumps off from both legs as far forward as possible.

Result. The longest distance jumped *in centimeters*, the best of two attempts.

Comments

The test should be carried out in accordance with the rules for the standing long jump. Jump-off and landing points should be at the same level.

Test 3 "Six standing accuracy ball handlings to a partner from a 7 m distance using one of the techniques learned".

Test 4 "Pull-ups (number of times)":

Equipment required. Horizontal bar having a diameter of 2-3 cm.

Testing procedure. The test participant grabs the bar with an overhand grip, arms straight and shoulder-width apart, her feet not touching the floor. At the "Go" command, she bends her arms, chin above the bar. Then the participant fully extends her arms, lowering to hang.

Result. Number of flawless pull-ups.

Test 5 "Sit-ups in 30 seconds":

Equipment required. Stopwatch, gym mats.

Testing procedure. The test participant *lies* down on *her back* on a *gym mat* with her knees bent at a 90-degree angle, with her feet flat on the floor. The distance between the feet is 30 cm, fingers crossed behind the head. The partner holds her feet. After the "Go" command, the participant sits up, touching elbows to knees, and returns to the starting position. The participant repeats the exercise for 30 seconds at a maximum frequency.

Result. Number of sit-ups from a lying to a sitting position in 30 seconds.

Test 6 "Evaluation of the sense of movement speed in sprinting":

Equipment required. 70-80-meter-long running track, stopwatch.

Testing procedure. At first, the pupil runs 60 m at a speed that is convenient for her. The pupil is informed about the measured time. Then, during the two following attempts, the pupil is asked to reproduce the time of the first race as accurately as possible.

Result. Time measured with an accuracy of 0.1 seconds, sprinting 60 m in three races.

Comments

1. After the second attempt, the pupil is not informed about the measured time.
2. The result is evaluated by taking the average deviation of the second and third attempts from the result of the first one.

Test 7 "Evaluation of the ability to differentiate movement speed (reproduction accuracy of running speed at 80% intensity of maximum)":

Equipment required. 50-meter-long running track; stopwatch, flag, calculator.

Testing procedure. The pupil is asked to run 30 m for a maximum result using a flying start. At the second attempt, the pupil runs 30 m at 80% intensity of maximum.

Result. Determining the reproduction precision of the target time with an accuracy of 0.01 seconds.

Comments

1. Two best tries are given. The best result is recorded.
2. The pupil is not informed about the results of the first best try.

Evaluation. The test evaluates the reproduction accuracy of running speed at 80% intensity of maximum.

Test 8 "Evaluation of the ability to differentiate movement speed (reproduction accuracy of running speed at 90% intensity of maximum)":

Equipment required. 50-meter-long running track; stopwatch, flag, calculator.

Testing procedure. The pupil is asked to run 30 m for a maximum result using a flying start. At the second attempt, the pupil runs 30 m at 90% intensity of maximum.

Result. Determining the reproduction precision of the target time with an accuracy of 0.01 seconds.

Comments

1. Two best tries are given. The best result is recorded.
2. The pupil is not informed about the results of the first best try.

Evaluation. The test evaluates the reproduction accuracy of running speed at 90% intensity of maximum.

Test 9 "Static equilibrium evaluation by E. Ya. Bondarevsky's method":

Equipment required. Stopwatch.

Testing procedure. The test participant stands steadily on one leg. The other leg is bent, its foot touching the knee joint of the support leg, hands on hips, head straight. The participant should hold the position for as long as possible. Time measuring with the stopwatch begins after the participant has taken up a steady body position, and ends at the moment when she loses equilibrium (lowering her leg and arms).

Result. Determining the time of holding a static position.

Comments

1. The test can be performed with closed and open eyes.
2. Slight movements of the body are not considered a loss of equilibrium.
3. Time should be measured with an accuracy of 0.1 seconds.
4. Static position can be held on the right or left foot. After three attempts, the best result is recorded.

The test should be performed in sports shoes and on a hard surface.

Test 10 "Evaluation of dynamic equilibrium by the BESS method":

The test is recommended for use with middle school-aged children (Serhiienko, 2001).

Equipment required. Eleven circles should be drawn with chalk on the gym floor. The diameter of each circle is 22 cm, The distance from circle X to circle 1 is 46 cm. The distance between the other circles is 84 cm.

Testing procedure. The test participant jumps across all the circles: from circle X to circle 10. In circle X, she returns to the starting position, which is standing on the right toes. Upon command, the pupil jumps into the first circle, landing on her left toes, and holds this position for 5 seconds. She lands on her right toes as she jumps into the second circle and holds this position for 5 seconds, and so to circle 10.

Result. Covering the distance in 50 seconds.

Comments.

1. Errors:
   - touching the floor with the heel;
   - stepping over the circle line;
   - touching the floor with the hand or other foot;
   - unstable position — hopping or twisting on the support leg while holding the position in the circle.
2. Preliminary attempts are allowed before performing the test.
3. The pupil is given two best tries. The best result is recorded.

Test 11 "Evaluation of the ability for vestibular (statokinetic) stability. Running with turns":

Equipment required. Running track having a length of 25 m and width of 150 cm. Stopwatch.

Testing procedure. From a standing start, the pupil runs 25 m at a maximum speed. Then she runs the distance of 25 m with five turns.

Result. Determining the difference between the ordinary running time and running with turns time. Recording the number of exits from the lane while running.

Comments.

1. The pupil makes one attempt of ordinary running and one attempt of running with turns.
2. Turns can be performed in any direction.
3. Series of turns are not allowed.

Evaluation. The result is considered excellent if the time has increased by no more than 3 seconds and there has not been a single exit from the running lane.

Test 12 "Rhythmic hand tapping":

Equipment required. Table; two chairs; stopwatch.

Testing procedure. The pupil sits down on the chair, her palms on the table. A testologist sits in a similar position next to her. He/she explains and shows the participant how to move her hands in a certain rhythm. The participant is asked to repeat the following movements: to lightly tap on the table twice with her left palm. After performing the cross-movement of the hands, the participant should tap on the table twice with her right palm in a similar rhythm. After this, the right hand touches the forehead and returns to the starting position. The task of the participant is to master the given cycle of movements and to rhythmically perform as many cycles as possible in 20 seconds.

Result. Number of full cycles of movements performed in 20 seconds.

Comments

To properly master the cycle of rhythmic movements, the pupil is given 10 seconds.

Test 13 "Rhythmic movements of upper and lower limbs":

Equipment required. Stopwatch.

Testing procedure. The test participant stands in an empty corner of the gym, face to the wall, so that her extended arms and legs could touch the walls. At the "Go" command, the participant performs a rhythmic cycle of movements as fast as possible within 20 seconds. The cycle of movements consists of four phases:

1. Two light kicks on the left side of the corner with the left foot.
2. One kick on the right side of the corner with the right palm.
3. Two kicks on the left side of the corner with the left palm.
4. One light kick on the right side of the corner with the right foot.

Result. Number of correctly performed full cycles of rhythmic movements within 20 seconds.

Comments

1. To master the consecutive phases of the movement cycle, the participant is given 10 seconds.
2. Incorrect sequence of the cycle phases should not be included in the final calculation.

Test 14 "Shuttle run (4×9 m)":

Equipment required. Stopwatches, 9-meter-long smooth running track limited by two parallel lines, behind each line — two semi-circles, each with a radius of 50 centimeters centered on the line, two wooden blocks (5×5 centimeters).

Testing procedure. At the "On Your Mark" command, the participant takes up a standing start position behind the starting line. At the "Go" command, she runs 9 meters to the opposite line, takes one of the two wooden blocks lying in the circle, runs back and puts it into the starting circle. Then she runs for the second block, takes it, runs back and puts it into the starting circle.

Result. Time from the start to the moment when the test participant puts the second block into the starting circle. The participant's result is determined by the best of two attempts.

Comments

1. The block should be put into the semi-circle, if it is thrown, the attempt is not scored.
2. The running track should be smooth and non-slip.

Test 15 "Tossing a ring over a peg":

Equipment required. Sports ground or a gym with floor markings. Measuring tape. 10-cm-high peg. Rubber ring with a diameter of 20 cm.

Testing procedure. The test participant tosses the ring over the peg from the distance as follows:

from 1 m — 5 attempts;
from 5 m — 5 attempts;
from 2 m — 5 attempts;
from 4 m — 5 attempts;
from 3 m — 5 attempts.

The result should be determined by the total number of hits from all the distances.

Comments

The participant makes two attempts of the full test, starting in a straddle stand, right leg in front on the starting line. Her trunk should not lean forward. A hit is scored if the ring stays on the peg when it lands. The best result is to be taken for evaluation.

No. 16 "Height (cm)"

No. 17 "Body weight (kg)"

The study carried out a pedagogical testing in order to determine the structure of coordination abilities of the 5th-6th grade girls.

Statistical analysis. The IBM SPSS 20 statistical analysis software was used to process the study materials. A factor analysis was performed, for

which the study used principal component analysis with the rotation method: Variamax with Kaiser Normalization.

The study protocol was approved by the Ethical Committee of H. S. Skovoroda Kharkiv National Pedagogical University. In addition, the children and their parents or legal guardians were fully informed about all the features of the study, and a signed informed-consent document was obtained from all the parents.

Study results

Tables 1-3 show the results of the factor analysis.

By analyzing the results of the 5th grade girls, the study identified seven factors explaining 80.708% of the dispersion (tabl. 1).

Table 1. Factor structure of motor preparedness of the 5th grade girls. Method: principal component analysis. Rotation method: Varimax with Kaiser Normalization (n = 20)

No.	Test	Component							h2
		1	2	3	4	5	6	7	
1	30 m running (s)							.828	.688
2	Standing long jump (cm)		.733	.509					.497
3	Six standing accuracy ball handlings to a partner from a 7 m distance using one of the techniques learned	-.387					.588	-.574	.659
4	Pull-ups (number of times)	.803							.683
5	Sit-ups in 30 seconds						.783		.805
6	Evaluation of the sense of movement speed in sprinting	.529	-.535			.360			.824
7	Evaluation of the ability to differentiate movement speed (reproduction accuracy of running speed at 80% intensity of maximum)		.650			.386			.457
8	Evaluation of the ability to differentiate movement speed (reproduction accuracy of running speed at 90% intensity of maximum)	.321		.416	-.309		.606		.679
9	Static equilibrium evaluation by E. Ya. Bondarevsky's method	-.468			.711				.826
10	Evaluation of dynamic equilibrium by the BESS method		.680		-.323		-.439		.705
11	Evaluation of the ability for vestibular (statokinetic) stability. Running with turns	-.896							.884
12	Rhythmic hand tapping			.861					.646
13	Rhythmic movements of upper and lower limbs				.921				.645
14	Shuttle run (4x9 m)		.631					-.362	.681
15	Tossing a ring over a peg	.452		.673			-.323		.700
16	Height (cm)		.364	-.329		.700			.836
17	Body weight (kg)					.950			.913
	% dispersion	15.057	13.950	11.850	10.744	10.630	10.532	7.945	80.708

Table 2. Factor structure of motor preparedness of the 6th grade girls. Method: principal component analysis. Rotation method: Varimax with Kaiser Normalization (n = 23)

No.	Test	Component						h^2
		1	2	3	4	5	6	
1	30 m running (s)		.792					.688
2	Standing long jump (cm)			.684				.497
3	Six standing accuracy ball handlings to a partner from a 7 m distance using one of the techniques learned		.708				-.348	.659
4	Pull-ups (number of times)					.796		.683
5	Sit-ups in 30 seconds				.857			.805
6	Evaluation of the sense of movement speed in sprinting			-.353	.733			.824
7	Evaluation of the ability to differentiate movement speed (reproduction accuracy of running speed at 80% intensity of maximum)			-.580				.457
8	Evaluation of the ability to differentiate movement speed (reproduction accuracy of running speed at 90% intensity of maximum)	.464	.487	-.388				.679
9	Static equilibrium evaluation by E. Ya. Bondarevsky's method						.875	.826
10	Evaluation of dynamic equilibrium by the BESS method	.816						.705
11	Evaluation of the ability for vestibular (statokinetic) stability. Running with turns		.377		-.331	-.606	.458	.884
12	Rhythmic hand tapping		-.713					.646
13	Rhythmic movements of upper and lower limbs			.645		.303		.645
14	Shuttle run (4x9 m)	-.415	-.411		.462		.315	.681
15	Tossing a ring over a peg	-.371		-.513	.331	.422		.700
16	Height (cm)	.868						.836
17	Body weight (kg)	.842		.318				.913
	% dispersion	16.582	13.975	12.199	10.944	9.470	8.173	71.344

The first factor has an informative value of 15.057% and characterizes the development of vestibular statokinetic stability and relative strength.

The second factor has an informative value of 13.950% and characterizes speed strength, the development of static equilibrium and differentiation of movement speed.

The third factor has an informative value of 11.850% and characterizes movement coordination in reproducing motor rhythm.

The fourth factor has an informative value of 10.744% and characterizes movement coordination of different parts of the body.

The fifth factor has an informative value of 10.630% and characterizes the girls' anthropometric data.

The sixth factor has an informative value of 10.532% and characterizes the girls' strength endurance.

The seventh factor has an informative value of 7.945% and characterizes dexterity.

The analysis of similarities shows that the most informative tests in the structure of motor preparedness

of the 5th grade girls are the following: test 11 "Evaluation of the ability for vestibular (statokinetic) stability. Running with turns" (.884), test 9 "Static equilibrium evaluation by E. Ya. Bondarevsky's method" (.826), test 6 "Evaluation of the sense of movement speed in sprinting" (.824).

By analyzing the results of the 6th grade girls, the study identified six factors explaining 71.344% of the dispersion (tabl. 2).

The first factor has an informative value of 16.582% and characterizes anthropometric data and the development of dynamic equilibrium.

The second factor has an informative value of 13.975% and characterizes the development of dexterity and movement coordination.

The third factor has an informative value of 12.199% and characterizes the development of speed strength and movement coordination of different parts of the body.

The fourth factor has an informative value of 10.944% and characterizes endurance and the sense of movement speed in sprinting.

The fifth factor has an informative value of 9.470% and characterizes the development of relative strength.

The sixth factor has an informative value of 8.173% and characterizes the development of static equilibrium.

The analysis of similarities shows that the most informative tests in the structure of motor preparedness of the 6th grade girls are the following: test 11 "Evaluation of the ability for vestibular (statokinetic) stability. Running with turns" (0.884), test 9 "Static equilibrium evaluation by E. Ya. Bondarevsky's method" (.826), test 6 "Evaluation of the sense of movement speed in sprinting" (.824).

By analyzing the results of the 7th grade girls, the study identified seven factors explaining 80.339% of the dispersion (tabl. 3).

The first factor has an informative value of 15.206% and characterizes the development of dynamic equilibrium and dexterity in the girls.

The second factor has an informative value of 13.424% and characterizes the ability to differentiate movement speed.

The third factor has an informative value of 12.025% and characterizes the development of speed strength and the ability for vestibular (statokinetic) stability.

The fourth factor has an informative value of 11.477% and characterizes the development of movement coordination.

The fifth factor has an informative value of 9.825% and characterizes the development of motor rhythm.

The sixth factor has an informative value of 9.599% and characterizes the sense of movement speed in sprinting.

The seventh factor has an informative value of 8.784% and characterizes the ability for vestibular (statokinetic) stability.

The analysis of similarities shows that the most informative tests in the structure of motor preparedness of the 7th grade girls are the following: test 8 "Evaluation of the ability to differentiate movement speed (reproduction accuracy of running speed at 90% intensity of maximum)" (.902), test 11 "Evaluation of the ability for vestibular (statokinetic) stability. Running with turns" (.900), test 1 "30 m running (s)" (.869).

Thus, the structure of motor preparedness of the 5th-7th grade girls include:

sense of running speed;

differentiation of running speed;

vestibular stability in exercises that require static and dynamic equilibrium;

speed and relative strength.

Discussion

The obtained data supplement the results of the study on the dependence of coordination abilities development on individual characteristics, sensitive periods (Serhiienko, 2001; Liakh, 2000); age and gender-related differences of schoolchildren (Ilyin, 2003; Ivashchenko, 2016).

The works by Ivashchenko, Khudolii, Iermakov, Lochbaum, Cieślicka, Zukow, Nosko, and Yermakova, (2017), Ivashchenko, Khudolii, Yermakova, Pilewska, Muszkieta, and Stankiewicz, Błazej (2015) highlight the need for pedagogical control of the level of motor preparedness of schoolchildren; Ivashchenko, Yermakova, Cieślicka, and Śukowska (2015), Ivashchenko, and Cieślicka (2017) argue that the level of coordination abilities development influences the effectiveness of teaching children and adolescents; Ivashchenko, (2016, 2017) points out the need for programming the development of coordination abilities.

In previous works (Khudolii, Prykhodko, & Ivashchenko, 2017; Prykhodko, 2017), the researchers performed a comparative analysis of coordination abilities indicators of 5th-7th graders, which showed a positive dynamics in the results of 5th-7th grade girls in the following tests: "Standing long jump (cm)" (13.4%); "Pull-ups (number of times)" (94.3%); "Sit-ups in 30 seconds" (23.6%); "Evaluation of the ability to differentiate movement speed (reproduction accuracy of running speed at 90% intensity of maximum)" (17.9%); "Static equilibrium evaluation by E. Ya. Bondarevsky's method" (41.1%); "Height (cm)" (9.9%); "Body weight (kg)" (29.1%). Middle school age is sensitive to the development of coordination abilities. There is an increase in the results of the following tests: "Pull-ups (number of times)" by 53.8%, "Sit-ups in

Table 3. Factor structure of motor preparedness of the 7th grade girls. Method: principal component analysis. Rotation method: Varimax with Kaiser Normalization (n = 19)

No.	Test	Component							h2
		1	2	3	4	5	6	7	
1	30 m running (s)	-.773							.869
2	Standing long jump (cm)	.498		.599				.356	.823
3	Six standing accuracy ball handlings to a partner from a 7 m distance using one of the techniques learned				.807				.802
4	Pull-ups (number of times)	.488		.416	.393		.439		.803
5	Sit-ups in 30 seconds	.549				.308			.532
6	Evaluation of the sense of movement speed in sprinting		-.358	-.364			.505		.636
7	Evaluation of the ability to differentiate movement speed (reproduction accuracy of running speed at 80% intensity of maximum)		.750						.782
8	Evaluation of the ability to differentiate movement speed (reproduction accuracy of running speed at 90% intensity of maximum)	-.353			-.493	.523		.492	.902
9	Static equilibrium evaluation by E. Ya. Bondarevsky's method		-.443	.326		.360	.468		.822
10	Evaluation of dynamic equilibrium by the BESS method	-.774							.831
11	Evaluation of the ability for vestibular (statokinetic) stability. Running with turns			.592			-.406	-.525	.900
12	Rhythmic hand tapping			-.383		-.649	.341		.791
13	Rhythmic movements of upper and lower limbs	-.377	.612	.480					.789
14	Shuttle run (4x9 m)		.583	-.354		.320		-.426	.784
15	Tossing a ring over a peg	.332	-.482	-.450			-.307	.411	.851
16	Height (cm)	.564	.611	-.353					.848
17	Body weight (kg)	.615	.404			.345			.895
	% dispersion	15.206	13.424	12.025	11.477	9.825	9.599	8.784	80.339

30 seconds" by 23.6%, "Height (cm)" by 4.1% (5th-6th grades); "Standing long jump (cm)" by 10%; "Pull-ups (number of times)" by 28.7%; "Evaluation of the ability to differentiate movement speed (reproduction accuracy of running speed at 80% intensity of maximum)" by 23.3%; "Static equilibrium evaluation by E. Ya. Bondarevsky's method" by 27.2%; "Height (cm)" by 5.5%; "Body weight (kg)" by 17.2% (6th-7th grades).

It was previously found that the most informative component in the structure of coordination abilities of 5th-7th grade boys is vestibular stability. To carry out pedagogical control of motor preparedness of 5th-7th grade boys, it is advisable to use the following tests: test

2 "Standing long jump (cm), test 9 "Static equilibrium evaluation by E. Ya. Bondarevsky's method", test 10 "Evaluation of dynamic equilibrium by the BESS method" (Prykhodko, 2017). As opposed to boys, the most informative components in the structure of coordination abilities of 5th-7th grade girls are the sense and differentiation of running speed, vestibular stability in exercises that require static and dynamic equilibrium.

The obtained data of factor analysis show that it is necessary to focus on the development of the sense and differentiation of running speed, speed strength and vestibular stability in 5th-7th grade girls.

The above mentioned data supplement the results of the study on the peculiarities of motor preparedness of boys (Ivashchenko, Muszkieta, Khudolii, & Yermakov, 2014; Ivashchenko, Cieślicka, Khudolii, & Iermakov, 2014; Ivashchenko, & Shepelenko, 2014) and girls of middle school age (Ivashchenko, Pashkevych, & Krinin, 2014; Ivashchenko, & Makarova, 2013).

Conclusions

In the structure of coordination abilities of the 5th-7th grade girls, the most informative components are the sense and differentiation of running speed, vestibular stability in exercises that require static and dynamic equilibrium.

To carry out pedagogical control of coordination preparedness of 5th-7th grade girls, the study recommends using the following tests: test 11 "Evaluation of the ability for vestibular (statokinetic) stability. Running with turns", test 9 "Static equilibrium evaluation by E. Ya. Bondarevsky's method", test 6 "Evaluation of the sense of movement speed in sprinting".

The further exploration prospect is to study methodological approaches to pedagogical control in teaching physical exercises to middle school students.

Acknowledgement

The study was carried out within the topic 13.04 "Modeling of teaching and motor skills development in children and adolescents" (2013—2014) (state registration number 0113U002102).

Conflict of Interest

The authors declare no conflict of interest.

References

Balsevich, V.K. (2000). Ontokinesiology of man. M.: Theory and practice of physical culture, 275. (in Russian).

Vlasenko, S.O., & Nosko, M.O. (2000). Task of action and modes of alternation of work with rest as regulating parameters of a training lesson. *Pedagogics, Psychology, Medical-Biological Problems Of Physical Training And Sports,* (21), 18-21. (in Ukrainian).

Vlasov, A., Demichkovskyi, A., Ivashchenko, O., Lopatiev, A., Pityn, M., Pianylo, Ya., & Khudolii, O. (2016). Systemic approach and mathematical modeling of biological and natural objects and processes. *Fiziko-matematichne modeliuvannia ta informacijni tekhnologii,* (23), 17-28. (in Ukrainian)

Ilyin, E. P. (2003). Psychomotor organization of man: training. for universities. *St. Petersburg. : Peter,* 384. (in Russian)

Emeljanovas, A., Mieziene, B., & Putriute, V. (2015). The Relationship Between Physical Activity and Content of the Physical Education Classes in 11-12 Years Old Lithuanian Schoolchildren. The Pilot Study. *Croatian Journal of Education-Hrvatski Casopis Za Odgoj I Obrazovanje, 17*(1), 93–120. https://doi.org/10.15516/cje.v17i1.1143

Ivashchenko, O.V., & Makarova, O. A. (2013). Comparative description of motive preparedness of schoolchildren is 8—9 classes. *Teorìâ ta Metodika Fìzičnogo Vihovannâ,* (1), 40-46. (in Ukrainian). https://doi.org/10.17309/tmfv.2013.1.1009

Ivashchenko, O.V., Muszkieta, R., Khudolii, O.M., & Yermakov, S. S. (2014). Characteristic force preparedness boys 6-7 grades. *Teorìâ ta Metodika Fìzičnogo Vihovannâ,* (3), 17-24. (in Ukrainian) https://doi.org/10.17309/tmfv.2014.3.1104

Ivashchenko, O. V., Cieślicka, M., Khudolii, O. M., & Iermakov, S. S.(2014). Modeling power fitness girls grades 6—7. *Teorìâ ta Metodika Fìzičnogo Vihovannâ,* (3), 10-16. (in Ukrainian) https://doi.org/10.17309/tmfv.2014.3.1103

Ivashchenko, O.V. (2016). Modelling of physical education students: Monograph. *Kharkiv: OVS* (in Ukrainian)

Ivashchenko, O.V. (2017). Theoretical and methodological bases of modeling of learning process and development of motor abilities in children. *Dokt. Diss. Chernigov,* 40. (in Ukrainian)

Ivashchenko, O.V., & Shepelenko, H.P. (2014). Comparative characteristics of Coordination fitness and power of middle class.*Teorìâ ta Metodika Fìzičnogo Vihovannâ, 0*(2), 22-30. (in Ukrainian) https://doi.org/10.17309/tmfv.2014.2.1096

Ivashchenko, O.V., Pashkevych, S.A., & Krinin, Yu.V. (2014). Comparative characteristics of functional coordination and force readiness boys 8—9 grades. *Teorìâ ta Metodika Fìzičnogo Vihovannâ, 0*(2), 31-39. (in Ukrainian). https://doi.org/10.17309/tmfv.2014.2.1099

Ivashchenko, O.V., Khudolii, O.M., & Miroshnichenko, D.T. (2016). Structural model of the formation of motor function in girls of junior classes. *Visnyk Chernihivskoho natsionalnoho pedahohichnoho universytetu. Seriia: Pedahohichni nauky. Fizychne vykhovannia ta sport, 139*(1), 82-86. (in Ukrainian)

Krutsevych, T. Yu., & Bezverkhnia, H. V. (2010). Recreation in the physical culture of different population groups: teaching. manual. *K. : Olimpiiska literatura,* 248. (in Ukrainian)

Liakh, V. I. (2000). Driving abilities of schoolchildren: Fundamentals of theory and methods of development. *M.: Terra–Sport,* 192.

Miroshnychenko, D. T. (2007). Method of teaching acrobatic exercises of junior pupils. *Teorìâ ta Metodika Fìzičnogo Vihovannâ,* (12), 29–31.

Nosko, M.O. (2001). Problems of training and improvement of human motor function. *Pedagogics, Psychology, Medical-Biological Problems Of Physical Training And Sports,* (5), 18-25. (in Ukrainian)

Nosko, M.O., Kryvenko, A.P., & Manievych, O.R. (2001). Formation of motor skills in physical education and sports. *Pedagogics, Psychology, Medical-Biological Problems Of Physical Training And Sports,* (8), 7-9. (in Ukrainian)

Nosko, N.A., & Sumak, E.H. (2000). Influence of different motor regimes on physical development and cardiovascular system of boys 8-10 years. *Pedagogics, Psychology, Medical-Biological Problems Of Physical Training And Sports,* (15), 24-26. (in Ukrainian)

Prykhodko, V.V. (2017). Comparative Analysis of Indicators of Coordination Abilities Development in 5th-7th Graders.*Teorìâ ta Metodika Fìzičnogo Vihovannâ,17*(3), 148-156. (in Ukrainian) https://doi.org/10.17309/tmfv.2017.3.1199

Serhiienko, L. P. (2001). Testing of motor abilities of schoolchildren. *K.: Olimpiiska literatura,* 439. (in Ukrainian)

Serhiienko, L. P., Chekmarova, N. H., & Khadzhynov, V. A. (2012). Psychomotor: Monitoring and Evaluation of Development: [Tutorial]. *Kharkiv : OVS,* 270. (in Ukrainian)

Khudolii, O.M. (2008). General Fundamentals of Theory and Methodology of Physical Education: A Manual. Kharkiv : OVS. (in Ukrainian)

Khudolii, O.M., & Ivashchenko, O.V. (2014). Simulation of the learning process and development of motor abilities in children and adolescents: *Monograph. Kharkiv : OVS,* 320. (in Ukrainian)

Khudolii, O.M., Prykhodko, V.V., & Ivashchenko, O.V. (2017). Features of development of coordination characteristics the girls grades 5-7. *Visnyk Chernihivskoho natsionalnoho pedahohichnoho universytetu. Seriia: Pedahohichni nauky. Fizychne vykhovannia ta sport, 1*(147), 221-228. (in Ukrainian)

Drid, P., Vujkov, S., Jaksic, D., Trivic, T., Marinkovic, D., & Bala, G. (2013). Differences in Motor and Cognitive Abilities of Children Depending on Their Body Mass Index and Subcutaneous Adipose Tissue. *Collegium Antropologicum, 37*(Suppl. 2), 171-177.

Hadžić, R., Bjelica, D., Vujović, D., & Popović, S. (2015). Effects of high-low aerobic program on transformation of motor skills at high school students. *Sport Science, 8*(1), 79-84.

Iadreev, V., Cherkashin, I., Vujkov, S., & Drid, P. (2015). Differences in anthropometric, motoric and cognitive abilities between athletically trained and untrained girls. *Biomedical Human Kinetics, 7*(1), 73-77. https://doi.org/10.1515/bhk-2015-0012

Novak, D., Podnar, H., Emeljanovas, A., & Marttinen, R. (2015). Comparison of Fitness Levels between Croatian and Lithuanian Students. *Montenegrin Journal of Sports Science and Medicine, 4(1), 5–11.*

Ivashchenko, O. V. (2016). Methodic of pedagogic control of 16-17 years' age girls' motor fitness. *Pedagogics, psychology, medical-biological problems of physical training and sports, 20*(5), 26-32. https://doi.org/10.15561/18189172.2016.0504

Ivashchenko, O., & Cieślicka, M. (2017). Features of evaluations of power loadsin boys 7 years old. *Journal of Education, Health and Sport, 7*(1), 175-183. https://doi.org/10.5281/zenodo.249184

Ivashchenko, O., Khudolii, O., Iermakov, S., Lochbaum, M., Cieślicka, M., Zukow, W., Nosko, M., & Yermakova, T. (2017). Methodological approaches to pedagogical control of the functional and motor fitness of the girls from 7-9 grades. *Journal of Physical Education and Sport (JPES), 17*(1), 254-261. https://doi.org/10.7752/jpes.2017.01038

Ivashchenko, O., Khudolii, O., Iermakov, S., Lochbaum, M.R., Cieslicka, M., Zukow, W., Nosko, M. & Yermakova, T. (2016). Intra-group factorial model as the basis of pedagogical control over motor and functional fitness dynamic of 14-16 years old girls. *Journal of Physical Education and Sport, 16*(4), 1190–1201. https://doi.org/10.7752/jpes.2016.04190

Ivashchenko, O.V. (2017). Classification of 11-13 yrs girls' motor fitness, considering level of physical exercises' mastering. *Pedagogics, Psychology, Medical-Biological Problems Of Physical Training And Sports, 21*(2), 65-70. https://doi.org/10.15561/18189172.2017.0203

Ivashchenko, O.V. (2017). Special aspects of motor abilities development in 6-10 years' age girls. *Pedagogics, Psychology, Medical-Biological Problems Of Physical Training And Sports, 21*(3), 105-110. https://doi.org/10.15561/18189172.2017.0302

Ivashchenko, O.V., Khudolii, O.M., Yermakova, T.S., Pilewska, Wiesława, Muszkieta, Radosław, & Stankiewicz, Błazej (2015). Simulation as method of classification of 7-9th form boy pupils' motor fitness. *Journal of Physical Education and Sport (JPES), 15*(1), 142–147. https://doi.org/10.7752/jpes.2015.01023

Ivashchenko, O.V., Yermakova, T.S., Cieślicka, M., & Śukowska, H. (2015). Discriminant analysis in classification of motor fitness of 9-11 forms' juniors. *Journal of Physical Education and Sport (JPES), 15*(2), 238 244. https://doi.org/10.7752/jpes.2015.02037

Khudolii O.M., Iermakov S.S., & Prusik K. (2015). Classification of motor fitness of 7-9 years old boys. *Journal of Physical Education and Sport (JPES), 15*(2), 245–253. https://doi.org/10.7752/jpes.2015.02038

Lopatiev, A., Ivashchenko, O., Khudolii, O., Pjanylo, Y., Chernenko, S. & Yermakova, T. (2017). Systemic approach and mathematical modeling in physical education and sports. Journal of Physical Education and Sport (JPES), 17 (1), suplement, 146–155

Prykhodko, V.V. (2017). The Factor Structure of Coordination Abilities Development in 5th-7th Grade Boys. *Teorìâ ta Metodika Fìzičnogo Vihovannâ, 17*(4), 191-200. (in Ukrainian) https://doi.org/ 10.17309/tmfv.2017.4.1204

КООРДИНАЦІЯ РУХІВ: ФАКТОРНА СТРУКТУРА РОЗВИТКУ У ДІВЧАТ 5-7 КЛАСІВ

Іващенко Ольга[1], Приходько Володимир[2], Цеслицька Мирослава[3]
[1]Харківський національний педагогічний університет імені Г.С. Сковороди, УКРАЇНА
[2]НВК «Старт-школа», м. Харків, УКРАЇНА
[3]Університет Казимира Великого, Бидгощ, ПОЛЬЩА

Реферат. Стаття: 12 с., 40 джерел.

Мета роботи – визначити структуру розвитку координаційних здібностей у дівчат 5-7 класів.

Матеріал і методи. У дослідженні прийняли участь дівчата 5 класу (n=20), 6 класу (n=23), 7 класу (n=19). У роботі використані аналіз й узагальнення даних наукової та методичної літератури, загальнонаукові методи теоретичного рівня, такі, як аналогія, аналіз, синтез, абстрагування, індукція, а також загально-наукові методи емпіричного рівня: спостереження, тестування, експеримент. Для оцінки рухової підготовленості реєструвалися результати рухових тестів, зріст і маса тіла. Матеріали дослідження опрацьовані в програмі статистичного аналізу – IBM SPSS 20. Здійснений факторний аналіз. У факторному аналізі використана модель головних компонент з методом обертання: Варімакс з нормалізацією Кайзера.

Результати. Аналіз спільностей показує, що найбільш інформативними у структурі рухової підготовленості дівчат 5 класів є тест 11 "Оцінка здібності до вестибулярної (статокінетичної) стійкості. Біг з поворотами" (,884), тест 9 "Оцінка статичної рівноваги за методикою Е.Я. Бондаревського" (,826), тест 6 "Оцінка відчуття швидкості рухів в спринтерському бігу" (,824); дівчат 6 класів є тест 11 "Оцінка здібності до вестибулярної (статокінетичної) стійкості. Біг з поворотами" (0,884), тест 9 "Оцінка статичної рівноваги за методикою Е.Я. Бондаревського" (,826), тест 6 "Оцінка відчуття швидкості рухів в спринтерському бігу " (,824); дівчат 7 класів є тест 8 "Оцінка розвитку здібності до диференціювання швидкості рухів (точність відтворення швидкості бігу з інтенсивністю 90% від максимальної)" (,902), тест 11 "Оцінка здібності до вестибулярної (статокінетичної) стійкості. Біг з поворотами" (,900), тест 1 "Біг 30 м (с)" (,869).

Висновки. У структурі координаційних здібностей дівчат 5-7 класів найбільш інформативним є відчуття і диференціювання швидкості бігу, вестибулярна стійкість у вправах які вимагають статичної і динамічної рівноваги. Для педагогічного контролю координаційної підготовленості дівчат 5-7 класів можуть бути рекомендовані: тест 11 "Оцінка здібності до вестибулярної (статокінетичної) стійкості. Біг з поворотами", тест 9 "Оцінка статичної рівноваги за методикою Е.Я. Бондаревського", тест 6 "Оцінка відчуття швидкості рухів в спринтерському бігу ".

Ключові слова: дівчата; координаційні здібності; рухова підготовленість.

КООРДИНАЦИЯ ДВИЖЕНИЙ: ФАКТОРНАЯ СТРУКТУРА РАЗВИТИЯ У ДЕВОЧЕК 5-7 КЛАССОВ

Иващенко Ольга[1], Приходько Владимир[2], Цеслицка Мирослава[3]
[1]Харьковский национальный педагогический университет имени Г.С. Сковороды, УКРАИНА
[2]НВК «Старт-школа», Харьков, УКРАИНА
[3]Университет Казимира Великого, Быдгощ, ПОЛЬША

Реферат. Статья: 12 с., 40 источников.

Цель работы – определить структуру развития координационных способностей у девочек 5-7 классов.

Материал и методы. В исследовании приняли участие девочки 5 класса (n=20), 6 класса (n=23), 7 класса (n=19). В работе использованы анализ и обобщение данных научной и методической литературы, общенаучные методы теоретического уровня, такие, как аналогия, анализ, синтез, абстрагирование, индукция, а также общенаучные методы эмпирического уровня: наблюдение, тестирование, эксперимент. Для оценки двигательной подготовленности регистрировались результаты двигательных тестов, рост и масса тела. Материалы исследования обработаны в программе статистического анализа – IBM SPSS 20. Проведенный факторный анализ. В факторном анализе использована модель главных компонент с методом вращения: варимакс с нормализацией Кайзера.

Результаты. Анализ общностей показывает, что наиболее информативными в структуре двигательной подготовленности девочек 5 классов является тест 11 «Оценка способности к вестибулярной (статокинетического) устойчивости. Бег с поворотами» (,884), тест 9 «Оценка статического равновесия по методике Е.Я. Бондаревского» (,826), тест 6 «Оценка ощущение скорости движений в спринтерском беге» (,824); девочек 6 классов – тест 11 «Оценка способности к вестибулярной (статокинетического) устойчивости. Бег с поворотами» (0,884), тест 9 «Оценка статического равновесия по методике Е.Я. Бондаревского» (,826), тест 6 «Оценка ощущение скорости движений в спринтерском беге» (,824) девочек 7 классов является тест 8 «Оценка развития способности к дифференцировке скорости движений (точность воспроизведения скорости бега с интенсивностью 90% от максимальной)» (,902), тест 11 «Оценка способности к вестибулярной (статокинетического) устойчивости. Бег с поворотами» (,900), тест 1 «Бег 30 м (с)» (,869).

Выводы. В структуре координационных способностей девочек 5-7 классов наиболее информативным является ощущение и дифференцировка скорости бега, вестибулярная устойчивость в упражнениях которые требуют статического и динамического равновесия. Для педагогического контроля координационной подготовленности девочек 5-7 классов могут быть рекомендованы: тест 11 «Оценка способности к вестибулярной (статокинетического) устойчивости. Бег с поворотами», тест 9 «Оценка статического равновесия по методике Е.Я. Бондаревского», тест 6 «Оценка ощущение скорости движений в спринтерском беге».

Ключевые слова: девочки; координационные способности; двигательная подготовленность.

Інформація про авторів:

Іващенко Ольга
https://orcid.org/0000-0002-2708-5636
olga@tmfv.com.ua
Харківський національний педагогічний університет імені Г.С. Сковороди,
вул. Алчевських, 29, м. Харків, 61003, Україна.

Приходько Володимир
https://orcid.org/0000-0002-9095-0573
vladimir3733614@gmail.com
НВК «Старт-школа»,
вул. Садова, 20, м. Харків, 61000, Україна.

Цеслицька Мирослава
https://orcid.org/0000-0002-0407-2592
cudaki@op.pl
Інститут фізичної культури університету Казимира Великого,
вул. Яна Кароля Ходкевича, 30, м. Бидгощ, Польща.

Цитуйте статтю як: Ivashchenko, O., Prykhodko, V., & Cieslicka, M. (2018). Movement Coordination: Factor Structure of Development in 5th-7th Grade Girls. *Teorìâ ta Metodika Fizičnogo Vihovannâ [Theory and Methods of the Physical Education], 18*(1), 38–49.
https://doi.org/10.17309/tmfv.2018.1.05

Стаття надійшла до редакції: 15.02.2018 р. Прийнята: 15.03.2018 р. Надрукована: 30.03.2018 р.