ORIGINAL SCIENTIFIC ARTICLE

MOTOR SKILLS IN THE STRUCTURE OF PHYSICAL FITNESS OF 7-YEAR-OLD BOYS

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DOI: 10.17309/jltm.2020.1.02

Abstract

The purpose of this study was to determine the weight of motor skills in the structure of motor fitness of 7-year-old boys.

Materials and methods. The study participants were 38 7-year-old boys. The children and their parents were informed about all the features of the study and gave their consent to participate in the experiment. The research methods used in the study include analysis of scientific and methodological literature, pedagogical observations, testing of motor fitness, probabilistic approach to assessing the learning process, methods of mathematical statistics.

Results. The level of fitness of the 7-year-old boys is homogeneous by the development of "agility" and "movement coordination", inhomogeneous – by the development of arm strength and vestibular stability. The 7-year-old boys' motor fitness is determined by their physical development, the level of general physical fitness and the level of motor skills development. A graphic representation of a two-factor model of testing results shows that analysis identifies two sets of data with high correlation coefficients. The first set includes tests No. 2, 1, 4, and 5, which characterize physical development, agility and endurance; the second – the level of proficiency in exercises No. 14, 13, 12, and the result of test No. 7 "Mixed hang rope pull-ups".

Conclusions. Based on factor analysis, the study found that the level of proficiency in exercises determines the variation of testing results by 28.437%, and the development of motor skills is a priority in the educational process at primary school. The development of "agility" and "movement coordination" ensures the formation of motor skills, and the development of arm strength and vestibular stability is the reserve in training boys aged 7 which will make it possible to increase the effectiveness of the educational process.

Keywords: 7-year-old boys, level of proficiency, motor fitness, motor skills.

Introduction

The importance of a scientific organization of the educational process at school is pointed out by Krutsevich, Pengelova, and Trachuk (2019), Junger, Salonna, Bergier, Junger, Frömel, Ács, and Bergier (2019), Haverkamp, Wiersma, Vertessen, van Ewijk, Oosterlaan, and Hartman (2020).

Researchers pay special attention to:

- substantiating the amount of motor activity (Kondakov, Voloshina, Kopeikina, & Kadutskaya, 2020; Bueichekú, Ávila, Miró-Padilla, & Sepulcre, 2019; Lothmann, Holmes, Chan, & Lau, 2011);
- studying the influence of motor activity on cognitive functions (De Bruijn, Kostons, Van Der Fels, Visscher, Oosterlaan, Hartman, & Bosker, 2020; Haverkamp et al., 2020);
- learning technologies (Ivashchenko, Iermakov, Khudolii, Cretu, & Potop, 2017; Ivashchenko & Kapkan, 2015; Khudolii, Kapkan, Harkusha, Marchenko, & Veremeenko, 2020);
- technologies of motor abilities development (Iermakov, Ivashchenko, Khudolii, & Chernenko, 2020; Ivashchenko, Khudolii, Prusik, & Giovanis, 2020; Ivashchenko, Nosko, & Ferents, 2019).

The integrity of the educational process in physical education and sport was considered by Khudolii (2019), Ivashchenko (2020), Khudolii, Iermakov, and Bartik (2020). It was found that the positive effect of learning depends on consistent solving of learning problems and rational application of methods.

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However, further research is needed to determine the leading role of motor skills development in the educational environment at primary school.

The purpose of this study was to determine the weight of motor skills in the structure of motor fitness of 7-year-old boys.

Materials and Methods

Study Participants

The study participants were 38 7-year-old boys. The children and their parents were informed about all the features of the study and gave their consent to participate in the experiment.

Organization of the Study

The research methods used in the study include analysis of scientific and methodological literature, pedagogical observations, testing of motor fitness, probabilistic approach to assessing the learning process, methods of mathematical statistics.

The study recorded the indicators of height (cm), body weight (kg), as well as the results in tests No. 3 "Standing long jump (cm)", No. 4 "Middle- and long-distance running. 300 m running (s)", No. 5 "30 m sprint running from a standing start (s)", No. 6 "Seated forward bend (cm)", No. 7 "Mixed hang rope pull-ups (times)", No. 8 "Shuttle run 4×9 m (s)", No. 9 "Combined movements of arms, torso and legs (points)", No. 10 "Maintenance of stable posture – standing on one leg with closed eyes (s)", No. 11 "Walking along straight line after 5 rotations (deviations in cm)".

The study recorded the primary schoolchildren's level of proficiency in gymnastic exercises. The coefficient was determined by the formula: p = (m/n)*100, where p is the level of proficiency, m is the number of successfully performed exercises, n is the total number of attempts to perform the exercise. In the experiment, the study controlled the level of proficiency in the following exercises: forward roll; backward roll; shoulderstand with bent legs.

Statistical Analysis

The study materials were processed using IBM SPSS 20 statistical analysis software. Factor analysis was performed. In the factor analysis, the study used the model of principal components with the rotation method: Varimax with Kaiser Normalization.

The study protocol was approved by the Ethical Committee of the 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.

Results

Table 1 shows the results of testing the 7-year-old boys' motor fitness.

The analysis of the coefficients of variation of testing results showed that the 7-year-old boys' fitness is homogeneous by the following indicators: No. 1 "Height, cm" (3.66%); No. 5 "30 m running from a standing start, s" (5.51%); No. 8 "Shuttle run 4×9 m, s," (5.75%); No. 9 "Combined movements of arms, torso and legs, points" (7.4%).

Table 1. The results of testing the 7-year-old boys' motor fitness (n = 38)

No.	Indicator	X	s	V
1	Height, cm	123.74	4.53	3.66
2	Body weight, kg	23.72	4.56	19.21
3	Standing long jump, cm	129.11	15.64	12.11
4	300 m running, s	110.84	13.83	12.48
5	30 m running from a standing start, s	6.26	0.35	5.51
6	Seated forward bend, cm	4.08	4.07	99.77
7	Mixed hang rope pull-ups, times	4.24	1.98	46.70
8	Shuttle run 4×9 m, s	12.58	0.73	5.75
9	Combined movements of arms, torso and legs, points	9.33	0.69	7.40
10	Maintenance of stable posture – standing on one leg with closed eyes, s	19.75	12.95	65.58
11	Walking along straight line after 5 rotations deviations in cm	76.39	62.16	81.36
12	Forward roll, level of proficiency	76.84	15.09	19.63
13	Backward roll, level of proficiency	74.74	15.20	20.34
14	Shoulderstand with bent legs, level of proficiency	82.63	14.83	17.95

The level of the boys' fitness is inhomogeneous by the results of tests: No. 6 "Seated forward bend, cm" (99.77%); No. 7 "Mixed hang rope pull-ups, times" (46.7%); No. 10 "Maintenance of stable posture – standing on one leg with closed eyes, s" (65.58%); No. 11 "Walking along straight line after 5 rotations, deviations in cm" (81.36%).

The coefficient of variation in terms of the level of proficiency in the exercises "Forward roll"; "Backward roll"; "Shoulderstand with bent legs" varies between 17.95-20.34%.

Thus, the level of fitness of the 7-year-old boys is homogeneous by the development of "agility" and "movement coordination", inhomogeneus – by the development of arm strength and vestibular stability.

Table 2 shows the results of factor analysis. The analysis identified four factors that explain 68.01% of the variation of results.

The first factor has a weight of 28.437%. With the factor, the greatest correlation is in the level of proficiency in exercises: No. 12 "Forward roll, level of proficiency" (r = 0.905); No. 13 "Backward roll, level of proficiency" (r = 0.853); No. 14 "Shoulderstand with bent legs, level of proficiency" (r = 0.825). The factor is called the level of proficiency in gymnastic exercises.

The second factor has a weight of 16.082%. With the factor, the greatest correlation is in: No. 3 "Standing long jump, cm" (r = 0.783); No. 4 "300 m running, s" (r = -0.763); No. 7 "Mixed hang rope pull-ups, times" (r = 0.826). The factor is called the level of general physical fitness.

Table 2. The results of factor analysis. Boys aged 7 (n = 38)

No	Indicator	Component				h^2
		1	2	3	4	
1	Height, cm			0.872		0.782
2	Body weight, kg			0.930		0.873
3	Standing long jump, cm		0.783			0.654
4	300 m running, s	0.320	-0.763			0.691
5	30 m running from a standing start, s				0.777	0.629
6	Seated forward bend, cm				0.770	0.602
7	Mixed hang rope pull-ups, times		0.826			0.742
8	Shuttle run 4×9 m, s				0.764	0.688
9	Combined movements of arms, torso and legs, points	0.632				0.430
10	Maintenance of stable posture – standing on one leg with closed eyes, s			0.607		0.417
11	Walking along straight line after 5 rotations, deviations in cm	-0.628	0.334			0.584
12	Forward roll, level of proficiency	0.905				0.848
13	Backward roll, level of proficiency	0.853				0.774
14	Shoulderstand with bent legs, level of proficiency	0.825				0.809
	%	28.437	16.082	12.336	11.155	68.010

The third factor has a weight of 12.336%. With the factor, the greatest correlation is in: No. 1 "Height, cm" (r = 0.872); No. 2 "Body weight, kg" (r = 0.930); No. 10 "Maintenance of stable posture – standing on one leg with closed eyes, s" (r = 0.607). The factor is called physical development.

The fourth factor has a weight of 11.155%. With the factor, the greatest correlation is in: No. 5 "30 m running from a standing start, s" (r = 0.777); No. 6 "Seated forward bend, cm" (r = 0.770); No. 8 "Shuttle run 4×9 m, s" (r = 0.764). The factor complements the second one and characterizes general physical fitness.

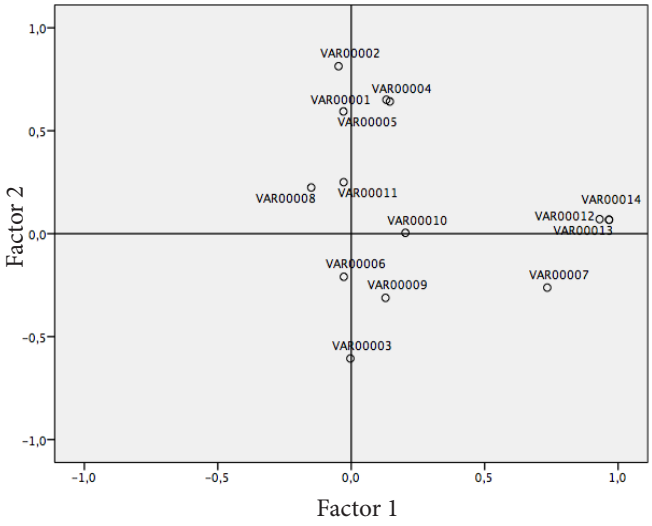

Fig. 1. The graphic representation of a two-factor model of testing results: 1 – height (cm), 2 – body weight (kg), 3 – "Standing long jump (cm)", 4 – "Middle- and long-distance running. 300 m running (s)", 5 – "30 m sprint running from a standing start (s)", 6 – "Seated forward bend (cm)", 7 – "Mixed hang rope pull-ups (times)", 8 – "Shuttle run 4×9 m (s)", 9 – "Combined movements of arms, torso and legs (points)", 10 – "Maintenance of stable posture – standing on one leg with closed eyes (s)", 11 – "Walking along straight line after 5 rotations (deviations in cm)", 12 – forward roll, 13 – backward roll, 14 – shoulderstand with bent legs.

The analysis of similarities made it possible to identify the most informative indicators that determine the level of motor fitness of the 7-year-old boys:

- No. 2 "Body weight, kg" (r = 0.873);
- No. 12 "Forward roll, level of proficiency" (r = 0.848);
- No. 14 "Shoulderstand with bent legs, level of proficiency" (r = 0.809);
- No. 1 "Height, cm" (r = 0.782);
- No. 13 "Backward roll, level of proficiency" (r = 0.774).

A graphic representation of a two-factor model of testing results shows that analysis identifies two sets of data with high correlation coefficients. The first set includes tests No. 2, 1, 4, and 5, which characterize physical development, agility and endurance; the second – the level of proficiency in exercises No. 14, 13, 12, and the result of test No. 7 "Mixed hang rope pull-ups" (see Fig. 1).

Thus, the 7-year-old boys' motor fitness is determined by physical development and the level of motor skills development.

Discussion

The paper assumed that motor skills occupy a prominent place in the structure of motor fitness of 7-year-old boys. The level of proficiency in exercises determines the variation of testing results by 28.437%. Thus, the study's findings make it possible to accept the research hypothesis on the leading role of motor skills development in the educational environment at primary school.

The analysis of the coefficients of variation points to heterochrony in the development of the 7-year-old boys' motor abilities. Based on the data analysis, it can be argued that the development of "agility" and "movement coordination" ensures the formation of motor skills, and the development

of arm strength and vestibular stability is the reserve in training boys aged 7 which will make it possible to increase the effectiveness of the educational process.

The results of the study corroborate the data of Ivashchenko, Nosko, M., Nosko, Y., and Chernenko (2019), Kapkan, Khudolii, and Bartik (2019a), Kapkan, Khudolii, and Bartik (2019b) on the need to select learning technologies taking into account the peculiarities of motor abilities development.

One of such technologies is programmed learning. The feasibility of its use is indicated in the papers by Ivashchenko et al. (2017), Ivashchenko and Kapkan (2015), Khudolii et al. (2020).

The results of factor analysis point to the need to consider the processes of motor skills and motor abilities development as a whole, which confirms the data on the following:

- role of motor activity in the development of cognitive skills (Haverkamp et al., 2020; Schembri, Quinto, Aiello, Pignato, & Sgrò, 2019; Syväoja, Kankaanpää, Joensuu, Kallio, Hakonen, Hillman, & Tammelin, 2019);
- role of organization of the educational process in motor skills development (Hellin, Gar cia-Jimenez, & Garcia-Pellicer, 2019a; Hellin, Garcia-Jimenez, & Garcia-Pellicer, 2019b; Groffik, Mitáš, Jakubec, Svozil, & Frömel, 2020);
- development of specific motor skills in children (Cojanu, & Visan, 2019; Basman, 2019; Albers & Lewis, 2020);
- development of motor abilities (Iermakov et al., 2020; Ivashchenko et al., 2020; Ivashchenko et al., 2019).

Thus, 7-year-old boys' motor fitness is determined by physical development, the level of general physical fitness, and the level of motor skills development.

Conclusions

Based on factor analysis, the study found that the level of proficiency in exercises determines the variation of testing results by 28.437%, and the development of motor skills is a priority in the educational process at primary school.

The development of "agility" and "movement coordination" ensures the formation of motor skills, and the development of arm strength and vestibular stability is the reserve in training boys aged 7 which will make it possible to increase the effectiveness of the educational process.

Acknowledgements

The study was carried out in accordance with the plan of research work of the Department of Theory and Methodology of Physical Education of H. S. Skovoroda Kharkiv National Pedagogical University.

Conflict of Interests

The authors declare that there is no conflict of interest.

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РУХОВІ НАВИЧКИ У СТРУКТУРІ ФІЗИЧНОЇ ПІДГОТОВЛЕНОСТІ ХЛОПЧИКІВ 7 РОКІВ

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Авторський вклад: A – дизайн дослідження; B – збір даних; C – статаналіз; D – підготовка рукопису; E – збір коштів

Реферат. Стаття: 6 с., 2 табл., 27 джерел.

Мета дослідження – визначити вагу рухових навичок у структурі рухової підготовленості хлопчиків 7 років.

Матеріали і методи. У дослідженні прийняли участь 38 хлопчиків 7 років. Діти та їхні батьки були інформовані про всі особливості дослідження і дали згоду на участь в експерименті. У дослідженні використані такі методи дослідження як аналіз наукової та методичної літератури, педагогічні спостереження, тестування рухової підготовленості, ймовірнісний підхід до оцінки процесу навчання, методи математичної статистики.

Результати. За рівнем підготовленості хлопчики 7 років є однорідними за розвитком «прудкості» і «координації рухів», неоднорідними – за розвитком сили рук і вестибулярної стійкості. Рухову підготовленість хлопчиків 7 років визначає фізичний розвиток, рівень загальної фізичної підготовленості і рівень сформованості рухових навичок. Графічне відображення двох факторної моделі результатів тестування дає уявлення про те, що в аналізі виділяються з високими коефіцієнтами кореляції дві плеяди даних. У першу плеяду включені тести No 2, 1, 4 і 5, які характери-

зують фізичний розвиток, прудкість і витривалість; у другу – рівень навченості вправам No 14, 13, 12 і результат тесту No 7 «Згинання й розгинання рук у змішаному висі на канаті».

Висновки. На основі факторного аналізу встановлено, що рівень навченості вправам на 28,437% визначає варіацію результатів тестування, а формування рухових навичок має пріорітет в освітньому процесі у молодшій школі. Розвиток «прудкості» і «координації рухів» забезпечує формування рухових навчок, а розвиток сили рук і вестибулярної стійкості є тим резервом у підготовці хлопчиків 7 років який дозволить підвищити ефективність навчального процесу.

Ключові слова: хлопчики 7 років, рівень навченості, рухова підготовленість, рухові навички.

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Cite this article as: Ivashchenko, O., Berezhna, H., & Cieślicka, M. (2020). Motor Skills in the Structure of Physical Fitness of 7-Year-Old Boys. *Journal of Learning Theory and Methodology, 1*(1), 14-19. https://doi.org/10.17309/jltm.2020.1.02

Received: 27.05.2020. Accepted: 20.06.2020. Published: 30.06.2020