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DIDACTICS: PECULIARITIES OF MOTOR SKILLS DEVELOPMENT IN BOYS AGED 14-15

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Abstract

The purpose of the study was to determine the peculiarities of motor skills development in boys aged 14-15.

Materials and methods. The study participants were boys aged 14 (n = 20) and 15 (n = 20). The children and their parents were fully informed about all the features of the study and gave their consent to participate in the experiment. To solve the tasks set, the following research methods were used: study and analysis of scientific and methodological literature; pedagogical observation, timing of training tasks; pedagogical experiment, methods of mathematical statistics, discriminant analysis, nearest neighbor analysis.

Results. The study made an assumption about a significant influence of the modes of alternating exercise repetitions and the rest interval on the effectiveness of motor skills development in boys aged 14 and 15. The standardized canonical discriminant function coefficients helped to determine age peculiarities and the peculiarities of influence of exercise modes on the effectiveness of motor skills development. They showed that the components of motor fitness are a priority in developing motor skills. The structure canonical discriminant function coefficients indicate the importance of movement control skills for mastering the entire exercise.

Conclusions. Discriminant analysis revealed the peculiarities of motor skills development in boys aged 14 and 15, depending on age and exercise modes. With the first exercise mode, boys aged 15 master the first, second, and fourth series of training tasks more quickly. Boys aged 14 – the sixth series (exercise mode: 6 repetitions, rest interval of 60 s). With the second exercise mode, boys aged 14 master the first and fourth series of training tasks more quickly. Boys aged 15 – the second series (exercise mode: 12 repetitions, rest interval of 60 s).

The coordinates of centroids for four groups indicate a significant difference in the influence of exercise repetition modes on the number of repetitions required for motor skills development in boys aged 14-15 during physical education classes. The results of group classification show that 87.5% of the original grouped cases were classified correctly.

Keywords: discriminant analysis, boys, acrobatic exercises, exercise mode, training.

Introduction

Physical education of schoolchildren is considered as a factor of children's health protection (Krutsevich, Marchenko, Trachuk, Panhelova, Napadij, & Dovgal, 2021; Prystynskyi, Babych, Zaytsev, Boychuk, & Taymasov, 2020; Freitas, Lausen, Maia, Gouveia, Antunes, Thomis, Lefevre, & Malina, 2018). In all regions of the world, attention is given to motor activity of children and improvement of physical education at school (Gastin, Tangalos, Torres, & Robertson, 2017; Lopes, Saraiva, Gonçalves, & Rodrigues, 2018; Famelia, Tsuda, Bakhtiar, & Goodway, 2018).

Studies aimed at substantiating fundamental movement skills stand out (Klingberg, Schranz, Barnett, Booth, & Ferrar, 2019; Newell, 2020; Nobre, Valentini, & Rusidill, 2020). Fundamental movement skills are a prototype of skills such as posture, locomotor and object control skills, and appear in childhood. The development of fundamental movement skills is associated with motor learning and motor control (Newell, 2020). The Functional Movement Screen includes the assessment of seven movements, namely: deep squat, hurdle step, in-line lunge, shoulder mobility, active straight leg raise, push-up, and rotary stability (Cook, Burton, Hoogenboom, & Voight, 2014ab).

In the context of developing fundamental movement skills, the process of teaching physical exercises at school

is a priority task. The studies by Samsudin, Setiawan, Taufik, and Solahuddin (2021); Listyarini, Alim, Oktaviani, Putro, Kristiyanto, Margono, and Pratama (2021); Abhaydev, Bhukar, and Thapa (2020) focus on the patterns of motor skills development. Research revealed the influence of exercise modes and rest intervals on the effectiveness of teaching (Ivashchenko, 2020; Kapkan, Khudolii, & Bartik, 2019; Marchenko, Jagiello, Iermakov, Ivashchenko, & Khudolii, 2021). Therefore, it is relevant to study the peculiarities of motor skills development in boys aged 14-15, depending on age and exercise modes.

The purpose of the study was to determine the peculiarities of motor skills development in boys aged 14-15.

Material and methods

Study participants

The study participants were 40 boys aged 14-15 (20 boys – 14 years, 20 boys – 15 years). The children and their parents were fully informed about all the features of the study and gave their consent to participate in the experiment.

Organization of the study

To solve the tasks set, the following research methods were used: study and analysis of scientific and methodological literature; pedagogical observation, timing of training tasks; pedagogical experiment, methods of mathematical statistics, discriminant analysis, nearest neighbor analysis.

The pedagogical experiment examined the influence of 6 and 12 repetitions with a 60-second rest interval during a physical education class on the number of repetitions of training tasks to the 100% level of proficiency. In the first and third groups (10 boys – 14 years, 10 boys – 15 years), the boys repeated the tasks 6 sets 1 time each with a rest interval of 60 s, in the second and fourth groups (10 boys – 14 years, 10 boys – 15 years) – 6 sets 2 times each with a rest interval of 60 s.

During teaching, the method of algorithmic instructions was used (Shlemin, 1973). The program of teaching the cartwheel was developed based on the data of Shlemin (1973), Khudolii (2008) and included the following training tasks:

The first series of training tasks – exercises to develop motor abilities

1. From normal standing position, lean forward, touch the floor with the hands and, moving the hands forward on the floor, adopt a push-up position, return to starting position in the same way

2. Perform push-ups as quickly as possible (5 times in 3-4 s)

The second series of training tasks – exercises to master starting and ending positions

1. From standing position with raised arms, step forward and perform a switch leg handstand with assistance

2. Handstand with legs apart with assistance

The third series of training tasks – actions without which it is impossible to perform the target exercise

1. Standing on hands with legs apart with assistance, shift the body weight from one hand to the other

The fourth series of training tasks – teaching the ability to assess movements in space, by time and muscular effort

1. Arriving to handstand quickly with assistance

2. Arriving to handstand slowly with assistance

The fifth series of training tasks – preliminary exercises

1. Arriving to handstand quickly with the wall support

2. Handstand with legs apart with 90-degree rotation with assistance

The sixth series of training tasks – the entire exercise

1. Cartwheel with assistance

2. Cartwheel without assistance

The next exercise started on condition of correct performance of the previous exercise on three consecutive attempts. The number of repetitions required for correct performance on three consecutive attempts was recorded. The level of proficiency in the exercises was determined by the alternative method: "performed" or "failed". A technically correct performance of the exercise gave the students "1" point; a failure to perform the exercise gave them "0" entered in the protocol.

Statistical analysis

The study materials were processed using the IBM SPSS 20 statistical analysis program. Discriminant analysis was conducted. For each canonical discriminant function, the study calculated the following: eigenvalue, variance percentage, canonical correlation, Wilks' lambda, Chi-square. For each step: prior probabilities, Fisher's function coefficients, unstandardized function coefficients, Wilks' lambda for each canonical function.

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

A comparative analysis of learning outcomes revealed the peculiarities in mastering series of training tasks by boys aged 14-15. With the first mode of training (6 repetitions, rest interval of 60 s), boys aged 15 master the first, second, and fourth series of training tasks more quickly. Boys aged 14 – the sixth series. With the second mode of training (12 repetitions, rest interval of 60 s), boys aged 14 master the first and fourth series of training tasks more quickly. Boys aged 15 – the second series (Table 1).

To determine the peculiarities of motor skills development, discriminant analysis was performed.

The first canonical function explains 60.2% ($r_1 = 0.929$) of the variation of results, the second function – 36.8% ($r_2 = 0.892$), the third function – 3% ($r_3 = 0.892$), which indicates their high informativity (see Table 2). The analysis of the canonical functions shows their statistical significance ($\lambda_1 = 0.021$; $p_1 = 0.001$; $\lambda_2 = 0.156$; $p_2 = 0.001$; $\lambda_3 = 0.759$; $p_1 = 0.052$). These functions have a high discriminative ability and value in interpretation of the general population (Table 3).

The analysis of standardized canonical discriminant function coefficients showed that the results of the fourth, sixth, third, and first series of training tasks make the largest contribution to the first canonical function. The results of the fourth, first, and second series of training tasks – to the

Table 1. Group Statistics

Series of tasks	Exercise Mode	Age	N	Mean	SD	t-test for Equality of Means					
						t	Sig. (2-tailed)	MD	SED	95% Confidence Interval of the Difference	
										Lower	Upper
1 series	6 repetitions, rest interval of 60 s	14	10	13.9	2.33	8.217	0.000	7.6	0.924	5.657	9.543
		15	10	6.3	1.767						
	12 repetitions, rest interval of 60 s	14	10	8.0	2.44	-2.046	0.056	-2.0	0.977	-4.053	0.053
		15	10	10.0	1.88						
2 series	6 repetitions, rest interval of 60 s	14	10	10.5	2.718	7.039	0.000	6.3	0.895	4.419	8.180
		15	10	4.2	0.788						
	12 repetitions, rest interval of 60 s	14	10	6.6	2.83	2.088	0.051	1.9	0.909	-0.011	3.811
		15	10	4.7	0.48						
3 series	6 repetitions, rest interval of 60 s	14	10	6.2	1.813	-0.379	0.709	-0.4	1.054	-2.614	1.814
		15	10	6.6	2.796						
	12 repetitions, rest interval of 60 s	14	10	7.9	3.54	1.315	0.205	1.7	1.293	-1.016	4.416
		15	10	6.2	2.04						
4 series	6 repetitions, rest interval of 60 s	14	10	9.9	1.663	6.947	0.000	5.1	0.734	3.557	6.642
		15	10	4.8	1.619						
	12 repetitions, rest interval of 60 s	14	10	4.8	1.61	-8.421	0.000	-8.5	1.009	-10.620	-6.379
		15	10	13.3	2.75						
5 series	6 repetitions, rest interval of 60 s	14	10	5.8	1.135	1.018	0.322	0.8	0.785	-0.851	2.451
		15	10	5.0	2.211						
	12 repetitions, rest interval of 60 s	14	10	7.7	1.25	1.109	0.282	1.1	0.991	-0.983	3.183
		15	10	6.6	2.87						
6 series	6 repetitions, rest interval of 60 s	14	10	6.0	0.666	-7.829	0.000	-3.7	0.472	-4.692	-2.707
		15	10	9.7	1.337						
	12 repetitions, rest interval of 60 s	14	10	9.4	2.67	1.221	0.238	1.4	1.146	-1.009	3.809
		15	10	8.0	2.44						

Table 2. Eigenvalues for Developing Discriminant Model (Canonical Correlation). Boys Aged 14-15

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	6.349	60.2	60.2	0.929
2	3.877	36.8	97.0	0.892
3	0.318	3.0	100.0	0.491

Table 3. Outcomes of Calculated Wilks' Lambda of Discriminant Function. Boys Aged 14-15

Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
1 through 3	0.021	131.075	18	0.000
2 through 3	0.156	63.260	10	0.000
3	0.759	9.389	4	0.052

second canonical function. The results of the fifth series of training tasks – to the third canonical function (Table 4).

The analysis of structure canonical discriminant function coefficients shows that the first function is most closely connected with the number of repetitions of exercises of the fourth, first, and sixth series of training tasks (r_{14} = 0.696; r_{11} = 0.494; r_{16} = -0.284). The second function – with the number of repetitions of exercises of the second series of training tasks (r_{22} = 0.558). The third function – with the number of repetitions of exercises of the fifth and third series of training tasks (r_{35} = 0.929; r_{33} = 0.307) (Table 5).

The coordinates of centroids for four groups make it possible to interpret the canonical function in relation to the role in classification. At the positive pole of the first

Table 4. Standardized Canonical Discriminant Function Coefficients. Boys Aged 14-15

Series of tasks	Function		
	1	2	3
1 series	0.465	0.828	-0.292
2 series	0.157	0.626	0.203
3 series	-0.484	-0.092	0.278
4 series	0.777	-0.912	0.130
5 series	-0.262	0.025	0.955
6 series	-0.504	-0.185	-0.146

Table 5. Structure Matrix. Boys Aged 14-15

Series of tasks	Function		
	1	2	3
4 series	0.696*	-0.391	0.361
1 series	0.494*	0.322	0.219
6 series	-0.284*	-0.163	0.063
2 series	0.265	0.558*	0.263
5 series	-0.019	-0.002	0.929*
3 series	-0.082	0.034	0.307*

discriminant function are centroids for the exercise mode of 6 repetitions (boys aged 14) and 12 repetitions (boys aged 15), at the negative — centroids for the exercise mode of 6 repetitions (boys aged 15) and 12 repetitions (boys aged 14) (see Table 6, Fig. 1). This indicates a significant difference in the influence of exercise repetition modes on the number of repetitions required for motor skills development in boys

Table 6. Functions at Group Centroids. Boys Aged 14-15

Exercise Mode	Age	Function		
		1	2	3
6 repetitions, rest interval of 60 s	14	2.673	2.376	-0.194
12 repetitions, rest interval of 60 s	14	-2.360	0.870	0.719
6 repetitions, rest interval of 60 s	15	-2.403	-0.553	-0.738
12 repetitions, rest interval of 60 s	15	2.090	-2.692	0.213

Table 8. Analysis Results. Nearest Neighbor Analysis

		N	Percent
Sample	Training	32	97.0%
	Holdout	1	3.0%
Valid		33	100.0%
Excluded		7	
Total		40	

Table 9. Analysis Results. Nearest Neighbor Analysis

		N	Percent
Sample	Training	27	69.2%
	Holdout	12	30.8%
Valid		39	100.0%
Excluded		1	
Total		40	

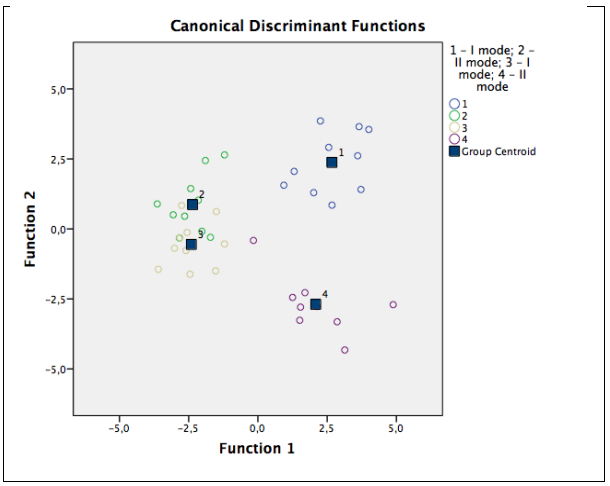

Fig. 1. Graphic representation of classification results. Boys aged 14: 1 – 6 repetitions, rest interval of 60 s; 2 – 12 repetitions, rest interval of 60 s. Boys aged 15: 3 – 6 repetitions, rest interval of 60 s; 4 – 12 repetitions, rest interval of 60 s

Table 7. Classification Resultsa

		Exercise Mode	Age	Predicted Group Membership				Total
				1	2	3	4	
Original	Count	1 – 6 repetitions, rest interval of 60 s	14	10	0	0	0	10
		2 – 12 repetitions, rest interval of 60 s	14	0	7	3	0	10
		3 – 6 repetitions, rest interval of 60 s	15	0	1	9	0	10
		4 – 12 repetitions, rest interval of 60 s	15	0	0	1	9	10
	%	1 – 6 repetitions, rest interval of 60 s	14	100.0	.0	.0	.0	100.0
		2 – 12 repetitions, rest interval of 60 s	14	.0	70.0	30.0	.0	100.0
		3 – 6 repetitions, rest interval of 60 s	15	.0	10.0	90.0	.0	100.0
		4 – 12 repetitions, rest interval of 60 s	15	.0	.0	10.0	90.0	100.0

a. 87.5% of original grouped cases correctly classified.

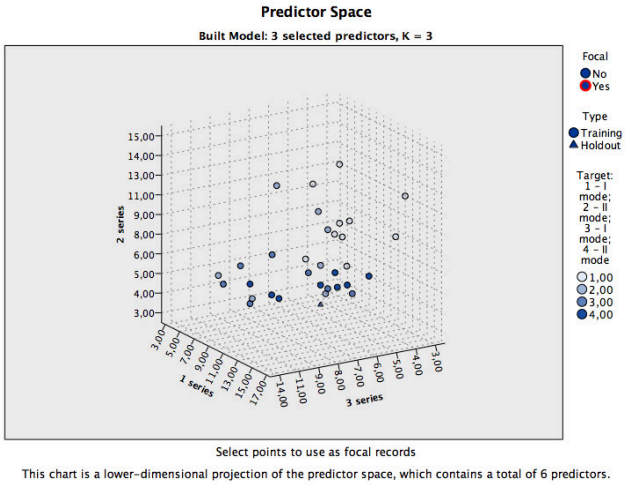

Fig. 2. Analysis Results. Nearest Neighbor Analysis

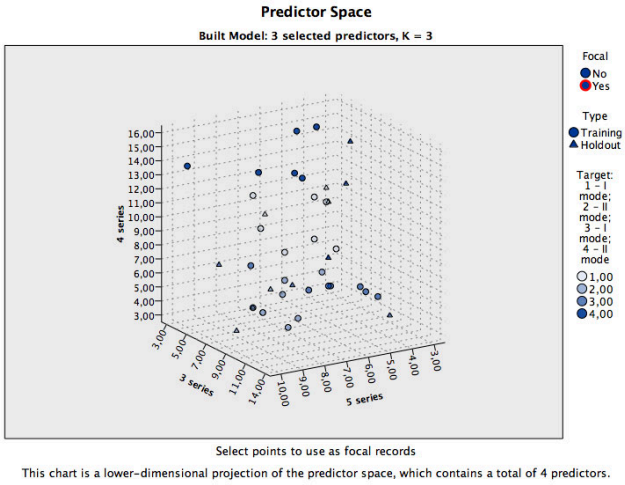

Fig. 3. Analysis Results. Nearest Neighbor Analysis

aged 14-15 during physical education classes. The results of group classification show that 87.5 % of the original grouped cases were classified correctly (Table 7).

The analysis of learning outcomes of boys aged 14-15 under the conditions of two exercise modes, using the nearest neighbor analysis showed that learning outcomes of the tasks of series 1, 2, and 3 are 97% similar (Table 8, Fig. 2), and the tasks of series 3, 4, and 5 – 69.2% (Table 9, Fig. 3).

Discussion

The study made an assumption that the process of motor skills development in boys aged 14 and 15 had its own peculiarities. The study found that the peculiarity of learning is the speed of mastering the exercises of different series of training tasks, as well as the influence of the mode of physical exercises on motor skills development in boys aged 14 and 15. The obtained data supplement the information about motor skills development in schoolchildren (Samsudin, Setiawan, Taufik, & Solahuddin, 2021; Listyarini, Alim, Oktaviani, Putro, Kristiyanto, Margono, & Pratama, 2021; Abhaydev, Bhukar, & Thapa, 2020), about the influence of exercise modes on the effectiveness of teaching (Ivashchenko, 2020; Kapkan, Khudolii, & Bartik, 2019; Marchenko, Jagiello, Iermakov, Ivashchenko, & Khudolii, 2021).

The study performed a discriminant analysis of the learning outcomes of six series of training tasks in four groups of boys aged 14-15. The influence of two exercise modes was studied. Eigenvalues indicate the predictive value of the discriminant model. Wilks' lambda values confirm a high discriminative ability of the canonical functions and their value in interpretation of the general population. The obtained data complement the results of studies on the use of discriminant analysis in the learning process (Khudolii, Ivashchenko, Iermakov, Veremeenko, & Lopatiev, 2019; Kapkan, Khudolii, & Bartik, 2019; Marchenko, Jagiello, Iermakov, Ivashchenko, & Khudolii, 2021) and motor abilities development (Ivashchenko, Khudolii, & Jagiello, 2021; Iermakov, Ivashchenko, & Khudolii, 2021).

The standardized canonical discriminant function coefficients helped to determine age peculiarities and the peculiarities of influence of exercise modes on the effectiveness of motor skills development. They showed that the components of motor fitness are a priority in developing motor skills. The data presented supplement the results of studies on the peculiarities of the learning process (Ivashchenko, Iermakov, & Khudolii, 2021; Hakman, Nakonechniy, Moseychuk, Liasota, Palichuk, & Vaskan, 2017; Hulteen, Morgan, Barnett, Stodden, & Lubans, 2018) and the development of motor function in children (Rudd, Barnett, Farrow, Berry, Borkoles, & Polman, 2017; Kavanagh, Issartel, & Moran, 2020).

The structure canonical discriminant function coefficients indicate the importance of movement control skills for mastering the entire exercise. The findings supplement the results of research on the structure of the learning process (Slade, Martin, & Watson, 2019; D'elia, Tortella, Sannicandro, & D'isanto, 2020; dos Santos, Nevill, Buranarugsa, Pereira, Gomes, Reyes, Barnett, & Maia, 2018) and the peculiarities of developing the system of movements in children (Barnett, Lubans, Timperio, Salmon, & Ridgers, 2018; Barnett, Telford, Strugnell, Rudd, Olive, & Telford, 2019; Bolger et al., 2021).

The centroids for four groups show the age peculiarities of motor skills development in boys aged 14-15. They indicate the difference in the impact of exercise modes, depending on age. The obtained data supplement the information about the age peculiarities of the learning process at school (Krutsevich, Marchenko, Trachuk, Panhelova, Napadij, & Dovgal, 2021; Prystynskyi, Babych, Zaytsev, Boychuk, & Taymasov, 2020; Tkachenko, 2020).

The nearest neighbor analysis provided data on the structure of training tasks, identified the tasks that have the same speed of mastering. This is of practical importance for the organization and planning of the learning process during physical education lessons, when children with a 1-year age gap study in the class.

Conclusions

Discriminant analysis revealed the peculiarities of motor skills development in boys aged 14 and 15, depending on age and exercise modes. With the first exercise mode, boys aged 15 master the first, second, and fourth series of training tasks more quickly. Boys aged 14 – the sixth series (exercise mode: 6 repetitions, rest interval of 60 s). With the second

exercise mode, boys aged 14 master the first and fourth series of training tasks more quickly. Boys aged 15 – the second series (exercise mode: 12 repetitions, rest interval of 60 s).

The coordinates of centroids for four groups indicate a significant difference in the influence of exercise repetition modes on the number of repetitions required for motor skills development in boys aged 14-15 during physical education classes. The results of group classification show that 87.5% of the original grouped cases were classified correctly.

Acknowledgment

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Conflict of interest

The authors declare that there is no conflict of interest.

References

Krutsevich, T., Marchenko, O., Trachuk, S., Panhelova, N., Napadij, A., & Dovgal, V. (2021). The Configuration of Educational Factors in the Family in Terms of their Impact on the Formation of Interest in Sports in Middle School Children. *Teorìâ ta Metodika Fìzičnogo Vihovannâ, 21*(2), 101-106. https://doi.org/10.17309/tmfv.2021.2.01

Prystynskyi, V., Babych, V., Zaytsev, V., Boychuk, Y., & Taymasov, Y. (2020). Impact of Updated Curriculum Content on 6th-7th Graders' Motivation in Physical Education. *Teorìâ ta Metodika Fìzičnogo Vihovannâ, 20*(2), 117-123. https://doi.org/10.17309/tmfv.2020.2.08

Freitas, D. L., Lausen, B., Maia, J. A., Gouveia, É. R., Antunes, A. M., Thomis, M., Lefevre, J., & Malina, R. M. (2018). Skeletal maturation, fundamental motor skills, and motor performance in preschool children. *Scandinavian Journal of Medicine and Science in Sports, 28*(11), 2358-2368. https://doi.org/10.1111/sms.13233

Gastin, P. B., Tangalos, C., Torres, L., & Robertson, S. (2017). Match running performance and skill execution improves with age but not the number of disposals in young Australian footballers. *Journal of Sports Sciences, 35*(24), 2397–2404. https://doi.org/10.1080/02640414.2016.1271137

Lopes, V. P., Saraiva, L., Gonçalves, C., & Rodrigues, L. P. (2018). Association between perceived and actual motor competence in Portuguese children. *Journal of Motor Learning and Development,* 6, S366-S377. https://doi.org/10.1123/jmld.2016-0059

Famelia, R., Tsuda, E., Bakhtiar, S., & Goodway, J. D. (2018). Relationships among perceived and actual motor skill competence and physical activity in Indonesian preschoolers. *Journal of Motor Learning and Development,* 6, S403-S423. https://doi.org/10.1123/jmld.2016-0072

Klingberg, B., Schranz, N., Barnett, L. M., Booth, V., & Ferrar, K. (2019). The feasibility of fundamental movement skill assessments for pre-school aged children. *Journal of Sports Sciences, 37*(4), 378-386. https://doi.org/10.1080/02640414.2018.1504603

Newell, K. M. (2020). What are Fundamental Motor Skills and What is Fundamental about Them? *Journal of Motor Learning and Development, 8*(2), 280-314. https://doi.org/10.1123/JMLD.2020-0013

Nobre, F. S. S., Valentini, N. C., & Rusidill, M. E. (2020). Applying the bioecological theory to the study of fundamental motor skills. *Physical Education and Sport Pedagogy, 25*(1), 29-48. https://doi.org/10.1080/17408989.2019.1688772

Cook, G., Burton, L., Hoogenboom, B.J., & Voight, M. (2014a). Functional movement screen: The use of fundamental movements as an assessment of function – part 1. *International Journal of Sports Physical Therapy, 9*(3), 396-409.

Cook, G., Burton, L., Hoogenboom, B.J., & Voight, M. (2014b). Functional movement screen: The use of fundamental movements as an assessment of function – part 2. *International Journal of Sports Physical Therapy, 9*(4), 549-563.

Samsudin, S., Setiawan, I., Taufik, M., & Solahuddin, S. (2021). Volleyball Fundamental Movement Learning Model in Primary School. *Teorìâ ta Metodika Fìzičnogo Vihovannâ, 21*(3), 194-199. https://doi.org/10.17309/tmfv.2021.3.02

Listyarini, A., Alim, A., Oktaviani, A., Putro, K., Kristiyanto, A., Margono, A., & Pratama, K. (2021). The Relations of Using Digital Media and Physical Activity with the Physical Fitness of 4th and 5th Grade Primary School Students. *Teorìâ ta Metodika Fìzičnogo Vihovannâ, 21*(3), 281-287. https://doi.org/10.17309/tmfv.2021.3.12

Abhaydev, C. S., Bhukar, J., & Thapa, R. (2020). Effects of IAAF Kid's Athletics Programme on Psychological and Motor Abilities of Sedentary School Going Children. *Teorìâ Ta Metodika Fìzičnogo Vihovannâ, 20*(4), 234-241. https://doi.org/10.17309/tmfv.2020.4.06

Ivashchenko, O. (2020). Research Program: Modeling of Motor Abilities Development and Teaching of Schoolchildren. *Teorìâ ta Metodika Fìzičnogo Vihovannâ, 20*(1), 32-41. https://doi.org/10.17309/tmfv.2020.1.05

Kapkan, O., Khudolii, O., & Bartik, P. (2019). Motor Skills Development: Optimization of Teaching Boys Aged 14. *Teorìâ ta Metodika Fìzičnogo Vihovannâ, 19*(3), 148-155. https://doi.org/10.17309/tmfv.2019.3.06

Marchenko, S., Jagiello, W., Iermakov, S., Ivashchenko, O., & Khudolii, O. (2021). Pattern recognition: modes of teaching boys aged 10 mae-geri (front kick) technique in kyokushin karate. *Archives of Budo,* 17, 253-261. https://archbudo.com/view/abstract/id/14538

Shlemin, A.M. (1973). *Iunyi gimnast.* M.: Fizkultura i sport, 376.

Khudolii, O.M. (2008). *Osnovy metodyky vykladannia himnastyky: Navch. posibnyk.* U 2-kh tomakh. 4-e vyd., vypr. i dop. Kharkiv: "OVS", T. 1, 408.

Khudolii, O., Ivashchenko, O., Iermakov, S., Veremeenko, V., & Lopatiev, A. (2019). Motor Abilities: Identification of Development Level in Boys Aged 12-14. *Teorìâ ta*

Metodika Fizičnogo Vihovannâ, 19(3), 139-147. https://doi.org/10.17309/tmfv.2019.3.05

Ivashchenko, O., Khudolii, O., & Jagiello, W. (2021). Strength abilities: pattern recognition method in the management of the cumulative effect of strength loads in 8-year-old boys. *Pedagogy of Physical Culture and Sports, 25*(4), 253-260. https://doi.org/10.15561/26649837.2021.0407

Iermakov, S., Ivashchenko, O., & Khudolii, O. (2021). Strength abilities: Assessment of cumulative training effects of strength loads of a series of classes in 8 years old boys. *Journal of Physical Education and Sport, 21*(s2), 1242-1250. https://doi.org/10.7752/jpes.2021.s2158

Ivashchenko, O., Iermakov, S., & Khudolii, O. (2021). Modeling: ratio between means of teaching and motor training in junior school physical education classes. *Pedagogy of Physical Culture and Sports, 25*(3), 194-201. https://doi.org/10.15561/26649837.2021.0308

Hakman, A., Nakonechniy, I., Moseychuk, Y., Liasota, T., Palichuk, Y., & Vaskan, I. (2017). Training methodology and didactic bases of technical movements of 9-11-year-old volleyball players. *Journal of Physical Education and Sport, 17*(4), 2638-2642. https://doi.org/10.7752/jpes.2017.04302

Hulteen, R. M., Morgan, P. J., Barnett, L. M., Stodden, D. F., & Lubans, D. R. (2018). Development of Foundational Movement Skills: A Conceptual Model for Physical Activity Across the Lifespan. *Sports Medicine, 48*(7), 1533-1540. https://doi.org/10.1007/s40279-018-0892-6

Rudd, J. R., Barnett, L. M., Farrow, D., Berry, J., Borkoles, E., & Polman, R. (2017). Effectiveness of a 16 week gymnastics curriculum at developing movement competence in children. *Journal of Science and Medicine in Sport, 20*(2), 164-169. https://doi.org/10.1016/j.jsams.2016.06.013

Kavanagh, J. A., Issartel, J., & Moran, K. (2020). Quantifying cycling as a foundational movement skill in early childhood. *Journal of Science and Medicine in Sport, 23*(2), 171-175. https://doi.org/10.1016/j.jsams.2019.08.020

Slade, D. G., Martin, A. J., & Watson, G. (2019). Developing a game and learning-centred flexible teaching model for transforming play. *Physical Education and Sport Pedagogy, 24*(5), 434-446. https://doi.org/10.1080/17408989.2019.1616684

D'elia, F., Tortella, P., Sannicandro, I., & D'isanto, T. (2020). Design and teaching of physical education for children and youth. *Journal of Human Sport and Exercise, 15*(4), S1527-S1533. https://doi.org/10.14198/jhse.2020.15.Proc4.48

dos Santos, M. A. M., Nevill, A. M., Buranarugsa, R., Pereira, S., Gomes, T. N. Q. F., Reyes, A., Barnett, L. M., & Maia, J. A. R. (2018). Modeling children's development in gross motor coordination reveals key modifiable determinants. An allometric approach. *Scandinavian Journal of Medicine and Science in Sports, 28*(5), 1594-1603. https://doi.org/10.1111/sms.13061

Barnett, L. M., Lubans, D. R., Timperio, A., Salmon, J., & Ridgers, N. D. (2018). What is the contribution of actual motor skill, fitness, and physical activity to children's self-perception of Motor Competence? *Journal of Motor Learning and Development,* 6, S461-S473. https://doi.org/10.1123/jmld.2016-0076

Barnett, L. M., Telford, R. M., Strugnell, C., Rudd, J., Olive, L. S., & Telford, R. D. (2019). Impact of cultural background on fundamental movement skill and its correlates. *Journal of Sports Sciences, 37*(5), 492-499. https://doi.org/10.1080/02640414.2018.1508399

Bolger, L. E., Bolger, L. A., O'Neill, C., Coughlan, E., O'Brien, W., Lacey, S., Burns, C., & Bardid, F. (2021). Global levels of fundamental motor skills in children: A systematic review. *Journal of Sports Sciences, 39*(7), 717-753. https://doi.org/10.1080/02640414.2020.1841405

Tkachenko, M. (2020). Peculiarities of Motor Fitness Dynamics of 5th-6th Grade Students During a School Year. *Teorìâ ta Metodika Fizičnogo Vihovannâ, 20*(1), 49-55. https://doi.org/10.17309/tmfv.2020.1.07

ДИДАКТИКА: ОСОБЛИВОСТІ ФОРМУВАННЯ РУХОВИХ НАВИЧОК У ХЛОПЦІВ 14-15 РОКІВ

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

Реферат. Стаття: 8 с., 9 табл., 3 рис., 34 джерела.

Мета дослідження – визначити особливості формування рухових навичок у хлопців 14-15 років.

Матеріали і методи. У дослідженні прийняли участь хлопці 14 (n = 20) та 15 (n = 20) років. Діти та їхні батьки були інформовані про всі особливості дослідження і дали згоду на участь в експерименті. Для вирішення поставлених завдань були використані методи дослідження: вивчення та аналіз науково-методичної літератури; педагогічне спостереження, хронометраж навчальних завдань; педагогічний експеримент, методи математичної статистики, дискримінантний аналіз, метод найближчих сусідів.

Результати. Приймається припущення про суттєвий вплив режимів чергування повторень вправ та інтервалу відпочинку на ефективність формування рухових навичок у хлопців 14 та 15 років. Нормовані коефіцієнти канонічної дискримінантної функції дозволили встановити вікові

особливості та особливості впливу режимів виконання фізичних вправ на ефективність формування рухових навичок. Визначити, що компоненти рухової підготовленості є пріоритетними у формуванні рухових навичок. Структурні коефіцієнти канонічної дискримінантної функції вказують на важливість умінь управляти рухами для оволодіння вправою в цілому.

Висновки. Дискримінантний аналіз дозволив виявити особливості формування рухових навичок у хлопців 14 та 15 років у залежності від віку та режимів виконання вправ. При першому режимі виконання вправ хлопці 15 років швидше оволодівють першою, другою і четвертою серією навчальних завдань. Хлопці 14 років – шостою серією (режим вправи: 6 повторень, інтервал відпочинку 60 с). При другому режимі виконання вправ хлопці 14 років швидше оволодівають першою і четвертою серією навчальних завдань. Хлопці 15 років – другою серією (режим вправи: 12 повторень, інтервал відпочинку 60 с).

Координати центроїдів для чотирьох груп свідчать про суттєву різницю впливу режимів повторення вправ на кількість повторень необхідних для формування рухових навичок на уроках фізичної культури у хлопців 14 та 15 років. Результати класифікації груп показують, що 87,5 % вихідних згрупованих спостережень класифіковано правильно.

Ключові слова: дискримінантний аналіз, хлопці, акробатичні вправи, режим виконання вправ, навчання.

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