

Physical exercises' mastering level in classification of motor preparedness of 11-13 years old boys

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Abstract

The purpose of the research is to determine features of motor preparedness' classification of 11-13 years old boys considering level of physical exercises' mastering.

Material and methods: in the research 11 years old boys (n=58), 12 years old boys (n=76) and 13 years old boys (n=93) participated. The following methods of a research have been applied to solve the tasks: analysis of scientific and methodical literature, pedagogical testing and methods of mathematical statistics. Testing program includes well known tests.

Results: Standardized coefficients of canonic discriminant function permit to determine correlation of variables' contribution to function's result. The first function explains variation of results by 80,1% ($p<0,001$), the second — by 19,9% ($p<0,001$). It witnesses that it is possible to classify age distinctions of 11-13 years old boys on the base of testing of their motor preparedness considering level of physical exercises' mastering. Discriminant analysis permitted to answer the question: how confidently it is possible to separate one class from the other by the set of offered variables; which of these variables influence the most substantially on specifying of forms; to which form the object belongs on the base of discriminant variables; in what correlation are the development process of motor ability and physical exercises' mastering of children and teenagers.

Conclusions: Structural coefficients of canonic discriminant function witness that the essential difference is observed between boys of 11 and 12-13 years old in the level of physical development, speed-, dynamic and static strength, physical exercises' mastering. Structural coefficients of the second canonic discriminant function indicate that the essential difference between boys of 12 and 13 years is observed in the development of flexibility level and vault's mastering. Analysis of coefficients of canonic discriminant function witness that the obtained data characterize the communications of development and the system of children and teenagers' physical training has an hierarchical structure in which the development of motor abilities is subordinated to the process of motor skills' formation.

Keywords: motor ability, mastering, discriminant function, boys.

Introduction

Problem of children and teenagers' physical training optimization is relevant for the last decades. It is developed the methodological approaches to the planning of educational process in consideration of pupils' adaptation opportunities (Krucevich, Trachuk, & Napadij, 2016). It is pointed out the practicability of pupils' integrative physical training of different medical groups (Bodnar, 2014). It is considered the theoretical aspects and conditions of introduction in the educational process of such modern innovative approaches as: culturological, competency-based, synergetic, axiological, acmeological, etc. (Vas'kov, 2016).

In physical training of pupils is also distinguished the directions of research connected with studying of development features of 11-13 years old pupils' power abilities (Ivashchenko, Mushketa, Khudolii, & Iermakov, 2014; Ivashchenko, Ceslicka, Khudolii, & Iermakov, 2014), the functional and coordination preparedness of pupils (Ivashchenko, Pashkevych, & Krinin, 2014) and the process of gymnastic exercises mastering of primary school children (Chernenko, 2015), the gymnastic and track and field athletics exercises of secondary school children (Ivashchenko, & Kapkan, 2015; Khudolii, Ivashchenko, & Chernenko, 2015). It is determined the features of functional, coordination and strength-building activities of children and teenagers (Ivashchenko, & Shepelenko, 2014; Khudolii, & Ivashchenko, 2014), it is determined the dependence of training effects of physical loads on the mode of performing exercises and rest (Ciešlicka & Ivashchenko, 2017; Ivashchenko & Ciešlicka, 2017).

Process of motor skills' mastering was studied from the point of view of intersubject communications, it is determined the influence of methods application on the formation of learning skills with use of intersubject communications on the level of motor preparedness of high school pupils (Al-Ravashdeh, Kozina, Bazilyuk, & Ilnickaya, 2015a; Al-Ravashdeh, Kozina, Bazilyuk, & Ilnickaya, 2015b), features of verbal information influence on the formation of children's motor skills (Altunsoz & Goodway, 2016), formations of motor

competence (Arziutov, Iermakov, Bartik, Nosko, & Cynarski, 2016; Kriventsova, Iermakov, Bartik, Nosko, & Cynarski, 2017), formation of metacognitive behavior (Chatzipanteli, Digelidis, Karatzoglidis, & Dean, 2016), verbal perception, in the course of sports motors' mastering (Darnis & Lafont, 2015), optimization of the modes of repetition of exercises and intervals of rest, in the course of motor skills' formation of children and teenagers (Ivashchenko et al., 2015; Kapkan, 2015; Khudolii et al., 2015).

It is defined that increase of physical activity scope depends on motor experience and efficiency of motor skills formation (Bouffard, Watkinson, & Thompson, 1996; Barnett, Van Beurden, Morgan, Brooks, & Beard, 2009; Van Niekerk, du Toit, & Pienaar, 2016). Children with low level of motor skills are not self-assured and inclined to avoid physical activity (Chen & Housner, 2013; Nosko, Razumeyko, Iermakov, & Yermakova, 2016). Modeling is one of the methods of studying of physical training process efficiency. The modeling as an effective method of studying of physical training process regularities is the main subject of works written by Vlasov et al. (2016), Lopatiev et al. (2016). However, in available scientific literature there are not enough data on integrity of motor abilities development and mastering of children and teenagers (Khudolii, 2011; Khudolii, Ivashchenko, Iermakov, & Rumba, 2016). Thus, studying of classification' possibility of 11-13 years old boys' motor preparedness considering level of physical exercises' mastering is relevant.

The purpose of the research is to determine features of motor preparedness' classification of 11-13 years old boys considering level of physical exercises' mastering.

Materials and methods

Participants. In the research 11 years old boys (n=58), 12 years old boys (n=76) and 13 years old boys (n=93) participated.

Organization of research. The following methods of a research have been applied to solve the tasks: analysis of scientific and methodical literature, pedagogical testing and methods of mathematical statistics. Testing program includes well known tests. In the course of the research were registered: body height, body mass, vital capacity of lungs, right and left hand dynamometry. Results of the following tests were registered: "Pressing ups in lying position, times", "Chin ups in lying position, times", "Legs' rising on wall bars, times", "Angle, resting on parallel bars, sec", "Torso rising in sitting position from lying position during 1 min., times", "Forward torso bending from sitting position with legs apart, cm", "Hanging on bent arms, sec", "Torso rising from lying on abdomen position during 30 sec., times", "Long jumps from the spot, cm", "Throw of filled ball (1 kg) from sitting position, cm", "Shuttle run 4x9 m, sec" (Ivashchenko & Kapkan, 2016).

Mastering level of gymnastic exercises was found with the following: "Forward roll", "Backward roll", "Vault", "Rope climbing, three times", "Bridge", "Stance on shoulder blades" (Khudolii et al., 2015).

Statistic analysis. Processing of the research material was carried out with the help of IBM SPSS 20 program. Discriminant analysis helped to create prognostic model of belonging to group. This model builds discriminant function (or set of discriminant functions, if they are more than two) in the form of predictors-variables linear combination. It ensures the best groups' distribution. These functions are built basing on set of observations, belonging to groups of which is known. Further, these functions can be applied to new observations with known predictors-variables and unknown group belonging. For every canonic discriminant function we calculated own value, dispersion percentage, canonic correlation, Wilks' Lambda, χ^2 - Chi-square.

Results

Results of the research are presented in tables 1-5.

The first canonic function explains variation of results by 80,1%; the second – by 19,9%. It witnesses about high informational potential of first and second canonic functions ($r_1 = 0,859$; $r_2 = 0,641$) (see table 1). In table 2 we give material of canonic functions' analysis. The first line contains value $\lambda=0,155$ and statistical significance $p=0.001$ for all set of canonic functions. The second line contains the data after excluding first function ($\lambda=0.589$; $p=0.001$). The first and the second functions have high discriminant potential and meaning in interpretation in respect to general communality.

Table 1. Canonic discriminant functions. Own values

Function	Own values	% of dispersion	explained	Cumulative %	Canonic correlation
1	2,806 ^a	80,1		80,1	,859
2	,699 ^a	19,9		100,0	,641

Table 2. Canonic discriminant function. Wilks' Lambda

Functions' check up	Wilks' Lambda	Chi-square	Degrees of freedom	p
from 1 to 2	,155	398,574	44	,000
2	,589	113,190	21	,000

In table 3 normalized coefficients of canonic discriminant function are given. In the first canonic function with the highest contribution variables, which characterize physical condition, dynamic and static strength, are included. In the second canonic function with the highest contribution variables, which characterize mastering level of vault, rope climbing, speed-, dynamic and static strength.

Structural coefficients of first discriminant function (coefficients of variables' correlation with function) witness that this function is most of all connected with the following variables: physical condition; speed-, dynamic and static strength; level of physical exercises' mastering. Structural coefficients of second discriminant function points that this function is mostly connected with flexibility and level of vault mastering (see table 4).

Table 3. Normalized coefficients of canonic discriminant function. Unnormalized coefficients of canonic discriminant function

№	Variables	Normalized coefficients		Unnormalized coefficient	
		Function 1	Function 2	function 1	function 2
1	Body height, cm	,134	,084	,019	,012
2	Body mass, kg	-,025	,173	-,003	,019
3	Vital capacity of lungs (VCL) cm ³	,263	,230	,001	,001
4	Right hand dynamometry, kg	,213	,534	,039	,097
5	Left t hand dynamometry, kg	-,132	-,372	-,022	-,062
6	Pressing ups in lying position, times	-,354	,218	-,047	,029
7	Chin ups in lying position, times	,349	-,442	,156	-,197
8	Legs' rising on wall bars, times	-,122	-,092	-,033	-,025
9	Angle, resting on parallel bars, sec	-,333	-,171	-,197	-,101
10	Torso rising in sitting position from lying on back position during 1 minute, times	,238	-,318	,041	-,054
11	Forward torso bending from sitting position with feet apart, cm	,220	,476	,080	,172
12	Hanging on bent arms, sec	-,615	,470	-,080	,061
13	Torso rising from lying on abdomen position during 30 sec., times	,662	-,462	,155	-,108
14	Long jump from the spot, cm	,312	-,408	,021	-,027
15	Throw of filled ball (1kg) from sitting position, cm	,819	-,114	,018	-,002
16	Shuttle run 4x9 m, sec	-,029	,001	-,005	,000
17	Forward roll, mastering level	-,250	,028	-,016	,002
18	Backward roll, mastering level	,315	,158	,014	,007
19	Vault, mastering level	-,023	1,015	-,001	,058
20	Rope climbing three times, mastering level	,025	,505	,001	,021
21	Bridge, mastering level	,125	,107	,006	,005
22	Stance on shoulder blades, mastering level	-,515	-,552	-,030	-,032
	Constant			-14,164	-1,257

Table 4. Structural coefficients of canonic discriminant function

№	Variables	Structural coefficients	
		Function 1	Function 2
1	Throw of filled ball (1 kg) from sitting position, cm	,671*	,015
2	Body height, cm	,408*	,132
3	Torso rising from lying on abdomen position during 30 sec., times	,391*	-,144
4	Vital capacity of lungs (VCL) cm ³	,383*	,064
5	Long jump from the spot, cm	,373*	-,164
6	Right hand dynamometry, kg	,321*	,025
7	Body mass, kg	,284*	,114
8	Left hand dynamometry, kg	,280*	-,063
9	Backward roll, mastering level	,254*	,091
10	Legs' rising on wall bars, times	,207*	-,183
11	Chin ups in lying position, times	,204*	-,088
12	Forward roll, mastering level	,184*	,123
13	Pressing ups in lying position, times	,147*	-,024
14	Hanging on bent arms, sec	,136*	-,016
15	Stance on shoulder blades, mastering level	,103*	-,009
16	Angle, resting on parallel bars, sec	,096*	-,090
17	Shuttle run 4x9 m, sec	-,010*	-,002
18	Forward torso bending from sitting position with feet apart, cm	-,106	,361*
19	Vault, mastering level	,241	,326*
20	Torso rising in sitting position from lying on back position during 1 minute, times	,215	-,248*
21	Bridge, mastering level	,074*	,233
22	Rope climbing three times, mastering level	,154*	,195

* maximal by absolute value correlation between variables and discriminant functions. Variables are ranged by absolute value correlation inside the function.

In table 3 are given unnormalized coefficients of canonic discriminant function for 11-13 years old boys. On the basis of the given equations can be carried out classification of pupils by the level of motor

preparedness. For this purpose is necessary to hold testing, to calculate value of function and to compare to results of function in groups' centred (table 6). Results of classification are basis for development of mastering programs for boys with the different level of preparedness. In table 5 are presented results of classification of motor preparedness of 11-13 years old boys considering level of physical exercises' mastering: 87,2% of outcome grouped observations are classified correctly. Thus, canonic discriminant function can be used for determination of special aspects of control over mastering and development process of children's and teenagers' motor skills.

Table 5. Results of classification

	Age	Predicted belonging to group			Total	
		11,00	12,00	13,00		
Outcome data	Frequency	11,00	50	8	0	58
		12,00	3	59	14	76
		13,00	0	4	89	93
	%	11,00	86,2	13,8	,0	100,0
		12,00	3,9	77,6	18,4	100,0
		13,00	,0	4,3	95,7	100,0

Table 6. Results of function in groups' centred

Age, boys	Function	
	1	2
11,00	-2,291	-,838
12,00	-,476	1,147
13,00	1,817	-,414

Discussion

In the present research we regarded assumption about wholeness of motor abilities' development and training from positions of systemic approach (Kozina, 2007; Vlasov et al., 2016).

The received results confirm data on integrity of motor abilities development and formation of motor skills. Thus, earlier was found that results' variation in total dispersion of 11-13 years old girls by 81,259%, 79.353%, and 71.019% depends on motor preparedness and level of physical exercises' mastering. In factorial structure level of physical exercises' mastering contributes 16.435% (11 years), 27.963% (12 years) and 17.010% (13 years). Analysis of communalities showed that in 11-13 years old girls development of motor abilities is effective if they are integrated part of adopted motor skills (Ivashchenko, 2017). Development of motor abilities of 11-13 years old boys is subordinated to motor skills formation of speed and strong exercises difficult by coordination.

The received data characterize connections of development and point that system of children's and teenagers' physical education has hierarchic structure. In this system motor abilities' development is subordinated to the process of motor skills' formation. The mentioned data supplement results of Xu X. and Ke F. (2014), Repko E., Kozin S., & Kostyrko A. (2016) about influence of physical characteristics on motor skills' formation in primary school children, Khudolii et al. (2015) about facts which influenced on effectiveness gymnastics exercises mastering.

The fulfilled discriminant analysis permitted to regard the processes of motor abilities' development and mastering as one unit. It supplements the data of Ivashchenko O. et al. (2016a), Ivashchenko O. et al. (2016b) about effectiveness of multi-dimension analysis application in physical education. Analysis of canonic discriminant function's normalized and structural coefficients permitted to find the role of one or another indicator in the structure of the process. It points at necessity in application of multi-dimensional methods of mathematical statistic in studying regularities of children's and teenagers' physical education (Ivashchenko, 2016a, 2016b; Ivashchenko et al., 2016; Ivashchenko et al., 2017). Analysis of first and second canonic functions demonstrates that in classification of 11-13 years old boys' motor preparedness is necessary to consider the level of physical exercises' mastering. In table 6 we present results of classification of 11-13 years old boys' motor preparedness. These data witness that 87,2% of outcome grouped observations were classified correctly. So, discriminant analysis permitted to answer the question: how confidently it is possible to separate one class from other basing on set of offered variables; which of these variables influence the most substantially on recognition of classes; to which class object belongs on the base of discriminant variable, in what correlations are process of motor abilities' development and physical exercises' mastering in children and teenagers.

Conclusions

Normalized coefficients of canonic discriminant function permit to find correlation of variables' contribution in function's result. The first function explains results' variation by 80,1% ($p < 0.001$), the second – by 19,9% ($p < 0.001$). It proves that it is possible to classify age distinctions of 11-13 years old boys, basing on motor preparedness testing, considering level of physical exercises' mastering.

Structural coefficients of first canonic discriminant function point that significant difference between 11 and 12-13 years old boys is observed in the following: physical development level, speed-, dynamic and static strength; physical exercises mastering. Structural coefficients of second canonic discriminant function point that substantial difference between 12 and 13 years old boys is observed in flexibility and "vault" mastering level.

Analysis of canonic discriminant functions' coefficients demonstrates that the received data characterize development connections. System of children's and teenagers' physical education has hierarchic structure, in which development of motor abilities is subordinated to motor skills' formation.

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Conflict of interests

The author declares that there is no conflict of interests.

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