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Long-Term Programs for Learning the Acrobatic Exercises on Floor in Women's Artistic Gymnastics

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Abstract

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The purpose of this paper is the development of both a long-term program for learning the acrobatic exercises and a logical-structural scheme for performing these floor exercises based on the interaction of algorithms of the main and concrete goals of sports training for junior gymnasts of 12 to 15 years old. The following methods have been used in this research: study of specialized literature; pedagogical observation method; video-computerized method of biomechanical analysis; pedagogical experiment; metoda statistical-mathematical method of data processing and interpretation. The results of the research highlight the content of the long-term program for learning the acrobatic exercises in the case of junior gymnasts aged 12 to 15. There are also given examples of active periods of acrobatic exercise performing and the entire logical and structural operational scheme of the macro-methods of acrobatic exercise learning consistent with the requirements of sports training classification program. The long-term programs, the examples of active periods for their achievement and also the processing of the logical-structural functioning scheme ensure the effectiveness of acrobatic exercise learning within the women's polyathlon of sports training in artistic gymnastics.

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Keywords: Gymnastics; floor; programmed learning; didactic technologies; performance.

1. Introduction

Currently, artistic gymnastics reached a really high level demonstrated by intensified sports mastery, by development and rivalry of competitive programs complexity; this sports mastery is based on improvement of the components specific to high classification gymnasts' training and turns into virtuosity. These outstanding progresses meet the trends of performance sport and its particular features, using new didactic technologies for directing the learning process (Vieru, 1997; Arkaev & Suchilin, 2004; Gaverdovskij, 2007; Potop, 2014: 20).



Floor is the longest event of high dynamism and spectacular character thanks to its extremely abundant and diverse content. The complexity of twisting somersaults is given by the full twists involved by this element: one twist around the transverse axis and the other executed simultaneously around the longitudinal axis, in different planes. At the present moment, in conformity with the Code of Points provisions, the content of floor routines is characterized by the high difficulty and complexity of the acrobatic connections. Gymnasts must execute a twist of minimum 360° in order to answer composition requirements for the execution of somersaults with longitudinal rotation (Vieru, 1997: 99).

With regard to the technology of guiding the learning process, Gavardovskij (2007: 762) highlights the basic principles, the types of didactic programming (linear, branched and adaptive), the technical means of learning; as for the problem of specificity and systematization of the didactic principles in sports, he presents the traditional teaching and learning in sport, the criteria of emphasizing the learning principle and the sports exercise learning principles as well (experience of differentiated didactics).

The review of specialized literature confirm how important is the research on gymnastics exercise technique and its learning, taking into consideration the postures and positions of the body. In this regard, Boloban and Biriuk (1979) recommend the use of the movement postural orientation method for studying gymnastics technique. The concept and methodology of using this method by studying the papers have been perfected during recent years (Boloban, 1988-2013; Sadovski et al., 2009; Potop, Grigore & Marinescu, 2012; Potop, Grad & Boloban, 2013; Potop, 2014; Potop et al., 2015).

The macro methods of learning difficult acrobatic and gymnastics exercises of coordination, also the logical-structural diagram for achievement in sports training are well presented by Boloban (1988). Structurally, the macro methods introduce the functional assembly of long-term programs for learning the exercises of "movement school", the basic level of specialization, of the arbitrary and final programs, also the development of physical qualities consistent with the technical training based on the influence of key concrete goals of gymnasts' sports training (Boloban, 2010, 2011, 2013).

The *purpose* of this paper is the establishment of a long-term program for acrobatic exercises learning associated with a logical-structural scheme for floor exercises performing based on the interaction of algorithms of the most important goals of sports training in the case of 12 to 15 years old gymnasts.

Hypothesis of the paper. We consider that the implementation of long-term programs, in compliance with the active periods of their fulfilment, and the processing of the operating logical-structural scheme will ensure the effectiveness of learning the acrobatic exercises on floor within women's polyathlon of sports training in artistic gymnastics.

2. Materials and methods

This research was conducted by means of the following methods: pedagogical observation method; literature review method; video computerized method, using "Kinovea" and "Physics ToolKit" programs; movement orientation postural method; method of pedagogical experiment, statistical method – "KyPlot" program and method of graphical representation. The research monitored junior

gymnasts' progresses in the execution of double back somersault in various acrobatic lines/ series during floor routines in three national competitions.

The biomechanical analysis was made by means of the movement postural orientation method (as per Boloban, 2013; Sadowski et al., 2009), adapted for floor in women's artistic gymnastics: body launching posture (LP) – toes in standing position with arms up before flipping off of the floor, multiplication of body posture (MP) – multiplication of body posture during the flight phase of double back somersault (tucked, pike and tucked with 360 degrees twist) and concluding posture (CP) of the body – landing.

For the development of long-term learning program on floor, it was necessary to assess the training level by means of 7 tests for physical training: *a) Strength-speed*: Test 1 – standing long jump, cm; Test 2 – standing high jump, cm; Test 3 – rope climb with no leg support, seconds; *b) Strength*: Test 4 – suspended on a fixed ladder, raising the legs up for 30 seconds, nb. of repeats; Test 5 – prone trunk extension for 30 seconds, nb. of repeats; Test 6 – jump to handstand on the beam, nb. of repeats; *c) Specific endurance*: Test 7 – handstand hold on the beam, seconds.

3. Results

Table 1 presents the results of 12 to 15 years old gymnasts' physical training, in terms of strength of arms, abdomen, back, lower limbs and sense of balance, etc.; it highlights the arithmetic mean, the standard error mean and the coefficient of comparison of the means between intermediate and final testing of Wilcoxon Singed Rank Test for Paired Data.

Table 1. Results of physical training of 12 to 15 years old gymnasts (n = 14)

Statistical indicators	Strength-speed training						Strength training						Specif. end.	
	Test 1 (cm)		Test 2 (cm)		Test 3 (sec)		Test 4 (Nb.-30'')		Test 5 (Nb.-30'')		Test 6 (Nb.)		Test 7 (sec)	
	I-M	Final	I-M	Final	I-M	Final	I-M	Final	I-M	Final	I-M	Final	I-M	Final
Mean	192.21	196.14	33.71	36.14	11.81	11.37	20.39	20.14	35.07	35.71	15.00	16.50	50.93	56.29
S.E.M.	2.19	2.27	0.71	0.52	0.54	0.48	0.25	0.23	0.19	0.24	0.69	0.68	5.26	5.27
t *	3.358; <0.001		3.319; <0.001		2.499; <0.05		1.497; >0.05		2.697; <0.01		3.305; <0.01		3.296; <0.001	

Note: t* - Wilcoxon Singed Rank Test for Paired Data

Diagram 1 presents a long-term program according to the components of the macro-method of learning gymnastics exercises on floor during the stage of basic specialization (12 to 15 years), in terms of specific physical training, psychological preparation and fundamental technical training consistent with the classification program provisions and the technical requirements of the International Code of Points for juniors (FIG).

Contents of training means	Stage of basic specialization training			
	12 yrs	13 yrs	14 yrs	15 yrs
Specific physical training				MP:
Velocity				
Coordination capacity – sensory-motor coordination				
Strength				
Strength – endurance				
Endurance				
Psychological training				
Components of training (psychological, intellectual, affective, volitional and development of personality components)				
Basic technical training (key elements, vaults):				
- Gymnastics leaps with anterior-posterior opening of legs at 180°, with different difficulty	I.L.	T.L.	I.P.	
- Pirouette of min. B	I.L.	T.L.	I.P.	
- Two different somersaults with direct or indirect connection	I.L.	T.L.	I.P.	
- Forward somersault (tuck, pike, layout) with or without twist (180°, 360°, 540°, 720°), in series or separately	I.L.	T.L.	I.P.	
- Back somersault (tuck, pike, layout) with or without twist (180°, 360°, 540°, 720°, 900°, 1080°) in series or separately	I.L.	T.L.	I.P.	
- Double somersault (tuck, pike, tucked with 360° twist) in series or separately	I.L.	T.L.	I.P.	
Test events / trials				
Competitions				
Sports categories	CP:	Jun. II	Jun. I	

Diagram 1. Long-term program according to the components of the macro-method of learning gymnastics exercises on floor during the stage of basic specialization (12 to 15 years)

Note: Main purposes (MP) – learning of highly difficult routines; meeting the requirements of Jun. I category; Concrete purposes of sports training (CP): learning the handspring routines according to the provisions of the classification program; fulfilment of sports categories requirements; Jun.– sports category Juniors; I.L. – initial learning; T.L.- thorough learning; I.P. – improvement and putting into practice.

Table 2. Results of performances achieved by junior gymnasts aged 12-14 during the competitions of 2013

Statistical indicators	C1 - JNTC Onești, 2013				C2 - MNC Bucharest, 2013				C3 - JNIC Onești, 2013				C4 - OJNIC Bucharest 2014	
	D	E	Pen.	FS	D	E	Pen.	FS	D	E	Pen.	FS	FS	
Mean	5.23	8.82	0.1	14.03	5.20	8.92	0.20	14.10	5.16	8.95	0.2	14.07	13.74	
N	8	8	1	8	13	13	1	13	10	10	2	10	10	

Note: Table 1; C1-4 – competition number; JNTC – Junior National Team Championship; JNIC – Junior National Individual Championship; MNC – Master National Championship; Open Junior National Championship, D – difficulty; E – execution; Pen.- penalty; FS – final score.

Table 2 shows the average performance results obtained by the junior gymnasts aged 12-15 in the 4 national competitions on floor, in terms of number of athletes participating in the competition, difficulty of the routine, execution score, final score and some penalties specific to this apparatus.

Table 3. Angular characteristics of sports technique key elements at double back somersault on floor executed by junior gymnasts 12-15 years old

Statistical indicators	LP, (degrees)			MP, FMH, (degrees)			CP, (degrees)		
	C1	C2	C3	C1	C2	C3	C1	C2	C3
Mean	87.4	86.2	88.0	69.6	65.4	60.3	90.1	90.1	102.3
SED	1.95	1.23	0.95	4.32	3.41	1.73	4.88	5.97	7.36
N	8	11	12	8	11	12	8	11	12

Note: LP – launching posture (angle between the lower horizontal floor - shoulders and shoulders – flipping angle), MP, FMH – multiplication of body posture – flight maximum height of GCG (angle between shoulders and lower limbs - legs), CP – concluding posture (landing) – angle between toes and shoulders, namely trunk bending.

Table 3 highlights the results of the angular measurements of sports technique key elements used in the double back somersault executed by junior gymnasts aged 12 to 15 in the three national competitions.

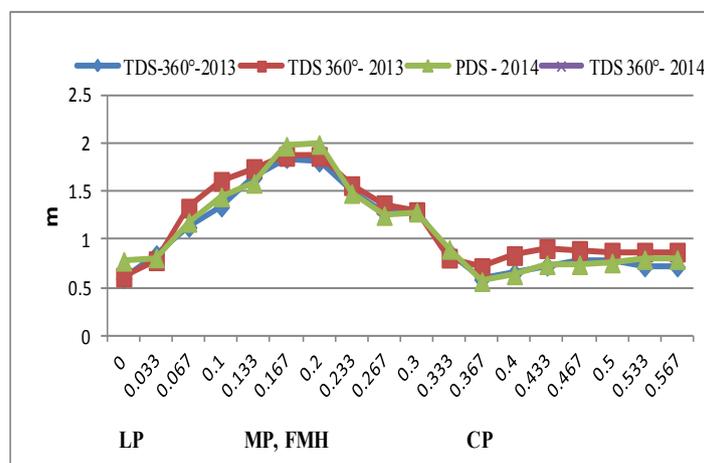


Fig. 1. Spatial characteristics of GCG vertical movement during double back somersault on floor (M.A.)

Note: TDS – tucked double back somersault; PDS – pike double back somersault ; TDS 360° - double back somersault tucked with 360° twist (in the first somersault)

Figure 1 shows the spatial characteristics of GCG vertical movement trajectory of the key elements of sports technique used in the double back somersault executed by junior gymnast (M.A.) in the two national competitions (2013 and 2014), as for the launching posture (LP), body multiplication posture in the flight maximum moment of GCG (MP, FMH) and concluding posture (CP) – landing. According to the teaching aids used in the learning process (Fig. 2), the coach complements the pedagogical functional equations that can improve the technological process in achieving the elements of didactical structure of the programmed learning (Boloban, 2013).



Fig. 2. Pedagogical functional equation of learning the double back somersault on floor

Note: P – purposes and tasks of learning; DP – didactical principles; DR – didactical rules; LM – learning methods; MeL – means learning; MFOL – methods and forms of organization of lessons; RC – regulation and control of learning process; RL – results of learning.

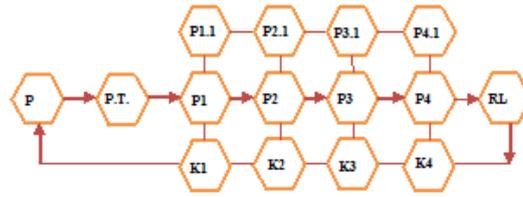


Fig. 3. Algorithms of linear-branched programming for learning the double back somersault on floor

Note: P – purpose of exercise learning; P.T. – pedagogical tasks; P1-4 – aiding / preparatory exercises; P1.1, 2.1, 3.1, 4.1 – supplementary exercises with aiding - preparatory character; K1, K2, K3, K4 – control, correction of learning process, RL – results of learning.

Figure 3 presents the diagram of the algorithms of linear-branched programming for acquiring the double back somersault on floor, regarding the purpose of learning, pedagogical tasks, aiding-preparatory exercises, supplementary exercises, verification and improvement of learning and results of learning.

4. Discussions and conclusions

The results on physical training level highlight the increase of the explosive strength of lower limbs and the increase of arms strength, abdominal and back strength, the improvement of the combined strength of the scapular belt, back and abdomen and especially the development of the sense of balance in handstand on beam.

The video biomechanical analysis using the method of movement postural orientation identified and analysed the progress of the kinematic and dynamic characteristics of sports technique key elements of the double back somersault. The recording of the performances obtained in competitions during the period 2013-2014 highlights the results of learning the acrobatic elements on floor and the effectiveness of using programmed learning didactical technologies.

The improvement of the physical training of the gymnasts aged 12 to 15 contributed to the improvement of sports technique key elements of the acrobatic exercises and getting better performances in competitions.

The realization of long-term programs (in compliance with the active periods of their fulfilment) and the processing of the operating logical-structural scheme lead to the effectiveness of learning the acrobatic exercises on floor within women's polyathlon structure of sports training in artistic gymnastics.

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