



## EFFECTS OF PLYOMETRIC TRAINING USED IN PHYSICAL EDUCATION CLASSES ON INTERMEDIATE LEVEL

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### Abstract

#### Purpose

Possessing a professional and scientific experience accumulated by associating the management of teaching-learning process specialised in physical education on intermediate level, with the design, organisation and completion of a thematic scientific research, I have performed an experimental research having as objective, target and work hypothesis the objectivation and assessment of the effects of using the plyometric exercises included in the syntagm known as "*plyometric training*", in the structure of the physical education classes of the didactic activity of two 6<sup>th</sup> form classes at school no. 1 from Braşov.

#### Methods

Observing the conditions related to the performance of an experimental research, for the organisation and development of the one designed and the evaluation of the registered results, the following methods were used: observation; experiment; conversation; questionnaire; explanation, demonstration and correction, using the verbal and non-verbal language; compared analyses of results; statistic processing of results.

#### Conclusions

The designing, organisation and development of the experimental research according to the topic determined were associated and included in the teaching-learning process specific to the didactic activity subordinated to the content and objectives of the physical education curriculum for intermediate level.

The results registered and their determining causes has validated the work hypothesis enounced and has objectivised the achievement of the purpose and targets of the research performed, being acknowledged the contributing potential to the improvement of the content of the applicative methodology used for the increase of the efficiency of the teaching-learning process specific to the physical education as didactic activity in the intermediate level.

#### Key words:

Plyometrics, Eccentric contraction, Concentric contraction, Work with force delivery, Muscular power.

### Purpose

Possessing a professional and scientific experience accumulated by associating the management of teaching-learning process specialised in physical education on intermediate level, with the design, organisation and completion of a thematic scientific research, I have performed an experimental research having as objective, target and work hypothesis the objectivation and assessment of the effects of using the plyometric exercises included in the syntagm known as "*plyometric training*", in the structure of the physical education classes of the didactic activity of two 6<sup>th</sup> form classes at school no. 1 from Braşov.

Establishing a verification system formed of 6 control tests for the evaluation of the level of manifestation of the physical capacities "speed" and "power" and a set of 12 plyometric exercises, I have configured the base of performing the experimental research, within which the experimental class performed, during 64 classes of physical education, a 10-minute program included in the structure of "*development of physical qualities*", when the rationalised and standardised plyometric exercises in

execution were used.

The plyometric training, in the current form, is synonym to what Verhoşanschi I. considered to be "the work with force delivery" (Verhoşanski I., 1972) pursuant to the research performed on the effect of different methods used for the development of the strength of athletes' feet in the jumping trials using three work possibilities: with their own body weight, with burdens, with depth jumps, from a platform with a height of 0,70 and 1,10m,

- in the first two situations, the exercises relied on concentric muscular contraction, whereas in the last situation, the muscular contraction was eccentric, by extension, thus, it was called "work with force delivery".

The grounding of different training methods used for the development of speed and power, belongs to Ruch T. and Fulton J (1963). who mentioned:

- Frick, who enunciated the concept of "concentric contraction" and "eccentric contraction", as expression of the "state of tension" of the execution muscularity;
- Fenn, who systematized the possibilities of the

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” state of tension” in the following illustrative

chart (Table 1):

**Table 1**

Kind of contraction	Function	External force which opposes the muscle	External mechanical work	Rhythm of power supply
• Isotonic shortening	• Acceleration	• Smaller	• Positive	• Increases
• Isometrically constant length	• Fixing	• Equal	• Of no kind	• -
• Extension	• Slowing	• Higher	• Negative	• Decreases

For the terminological universalisation of "eccentric contraction", respectively of the "muscle extension", by deceleration movement, it was adopted the "plyometric" concept which came from "plyo", synonym, among others, to bending, plying".

As opposed to the mistaken translation of "the work for development of power", as being for "development of force" (Zařorski , 2002), Nett T. and Ullrich ( 1961), Mollet R.(1961) or Urtebise (1994), I am exclusively and expressly using the concept of "power" since, in general, performance, in most of the sport branches, is determined by the level of manifestation of speed and power in the movement of the body and of its segments in horizontal or vertical plan, in direct relation to the specificity corresponding to each of these.

Considering this manner to achieve the development of the feet strength with significant effects in the increase of height jumps and of speed in movement, I have considered useful and necessary an experimental research focused on the topic of the "effects of using plyometric training in the classes of physical education of intermediate level".

The specialised literature does not contain any research related to the topic approached, thus, I have considered that the organisation and performance of an experimental research with the title mentioned may be included in the constant preoccupation and professional condition related to the la contribution that may be brought to the field of reference, obtaining thus the professional perfection of both the coordinator of the research, and of those who, appropriating it, will register an increased efficiency of physical education classes.

Observing the structural organisation and the relatively standardised algorithmic sequence of topics of the physical education classes, I have considered that:

- if it is introduced a constant demand in terms of the time of execution and standardisation of the subjects of performances,
- then the processing of the data registered during the initial and final verifications, their

compared analysis and the determining interpretation of systematised findings, - shall impose the emphasizing of the determining relations between the results obtained and the validation of the research hypothesis.

The design and performance of the experimental research proposed had as targets:

1. the selection and indexation of the works of reference in the specialised literature;
2. involvement in the performance of the envisaged research of the staff of physical education department of School No. 1 from Braşov;
3. determining the algorithm of research development;
4. determining the subjects, the place and the period of experimental research;
5. elaboration of the control tests of the verification system;
6. elaboration of the records of registration and processing the results of the investigations performed;
7. elaboration of a file on the general structure of research and the distribution of it to the subjects of the experimental class;
8. analysis, processing and interpretation of the results of the experiment performed with the subjects of each class involved in the research, with the staff of physical education department.

**Method**

Observing the conditions related to the performance of an experimental research, for the organisation and development of the one designed and the evaluation of the registered results, the following methods were used:

- observation;
- experiment;
- conversation;
- questionnaire;
- explanation,

- demonstration and correction,
- using the verbal and non-verbal language;
- compared analyses of results;
- statistic processing of results.

- first, in September 2010;
- second, in December 2010;
- third, in January 2011;
- fourth, in June 2011;

From designing to completion, the experiment included in its algorithmic development the following:

- presentation, discussion and consensual acceptance within the physical education department of the organisation and development of an experimental research, at the end of the school year 2009-2010, during the school year 2010 - 2011;
- designation of the future classes 4<sup>th</sup> A and 4<sup>th</sup> B as experimental class and class of control;
- elaboration of the structure of control tests to be used for the verification of the level of manifestation of the conditional qualities speed and power, presented in tabel no. 2;
- determining the sequence of verifications:

- rationalisation of the exercises to be used in the structure of plyometric training during the physical education lessons of the experimental class, presented in tabel No.3;
- use of plyometric exercises during each lesson of the experimental class in the structure of the "development of physical qualities within an interval of 10 minutes, observing the content and algorithm of development of each lesson;
- the content and development of the lessons of the class of control were conform to the syllabus for each semester, according to the requirements of the physical education curriculum for the 4<sup>th</sup> forms.

**Table 2**

*System of verification of the level of manifestation of speed and power in the execution of the following control tests:*

1) 6x5 m, running, with stopping and turning: • 3 times left, after stopping left-right and • 2 times on right, after stopping right-left	
2) 6x5 m, running, with stopping and turning: • 3 times right, after stopping right-left and • 2 times on left, after stopping left-right	
3) on spot, 3 long jumps in the following order: "left - right - left"	
4) on spot, 3 long jumps in the following order: "right - left - right"	
1) with 3 steps take off, vertical jump, from the left foot.	
2) with 3 steps take off, vertical jump, from the right foot.	

**Table 3**

*Plyometric exercises used for "development of physical qualities"*

1.	from the standing position with lateral support on fixed scale : • slow genuflexions, on the left leg;
2.	from the standing position with lateral support on fixed scale: • slow genuflexions, on the right leg;
3.	on fixed scale, with partner on the shoulders : • slow genuflexions on both legs;
4.	from the sitting position with support on legs : • passing on dorsal lying and return, with slow movements;
5.	from facial lying position : • flexions and stretching of arms, with slow movements;
6.	from the sitting position : • deep, slow genuflexions and vertical jumps;
7.	jumping step with landing in deep genuflexions on each leg;
8.	jumping step with deep genuflexions on each leg;

9.	jumps from gymnastic bench, from the left leg and landing with deep genuflexions on the left leg;
10.	jumps from gymnastic bench, from the right leg and landing with deep genuflexions on the right leg;
11.	jumps from gymnastic bench, from both legs, landing with deep genuflexions;
12.	deep jumps from platform of 0.75 m and landing in deep genuflexions.

**Results.**

In table no. 4, one presents the results registered on the control tests by the subjects of the experimental class and of the class of control, whereas

in table no. 5 one calculates the numeric and percentage differences registered during the verifications performed on Saturday and Sunday.

**Table 4**  
Results registered on control tests for the verification of the level of manifestation of speed and power

Checking	Class	Results on control tests					
		1	2	3	4	5	6
<b>1</b> 25-26.09.2010	VI A	12.34	12.58	3.38	3.19	0.34	0.32
	VI B	12.13	12.41	3.49	3.31	0.36	0.34
<b>2</b> 18-19.12.2010	VI A	11.21	11.39	3.89	3.72	0.43	0.41
	VI B	11.79	11.96	3.71	3.51	0.40	0.38
<b>3</b> 8-9.01.2011	VI A	11.48	11.67	3.64	3.54	0.41	0.40
	VI B	12.18	12.22	3.41	3.32	0.38	0.35
<b>4</b> 11-12.06.2011	VI A	10.85	11.12	4.21	4.02	0.48	0.46
	VI B	11.95	12.05	3.68	3.63	0.39	0.36

**Table 5**  
Numerical and percentage differences between the results registered on the verifications performed

Control test	The difference	Class	Differences between checks			
			V2-V1	V3-V2	V4-V3	V4-V1
<b>1</b>	d.c.	VI A	1.13	-0.27	0.63	1.49
		VI B	0.34	-0.39	0.23	0.18
	d.p.	VI A	9.15%	-2.40%	5.48%	12.07%
		VI B	2.80%	-3.30%	4.09%	1.48%
<b>2</b>	d.c.	VI A	1.19	-0.28	0.55	1.46
		VI B	0.45	-0.26	0.17	0.53
	d.p.	VI A	9.45%	-2.45%	4.71%	11.60%
		VI B	3.62%	-2.17%	1.39%	4.27%
<b>3</b>	d.c.	VI A	0.51	-0.25	0.57	0.83
		VI B	0.22	-0.30	0.27	0.30
	d.p.	VI A	15.08%	-6.42%	15.65%	24.55%
		VI B	6.30%	-7.71%	7.91%	8.59%
<b>4</b>	d.c.	VI A	0.53	-0.18	0.46	0.83
		VI B	0.20	0.19	0.31	0.44
	d.p.	VI A	16.6%	-4.83%	12.99%	26.01%
		VI B	6.04%	-5.41	9.33%	13.79%
<b>5</b>	d.c.	VI A	0.09	-0.02	0.07	0.14
		VI B	0.04	-0.02	0.01	0.03
	d.p.	VI A	26.47%	-4.87%	17.07%	41.17%
		VI B	11.11%	-5.00%	2.63%	8.33%
<b>6</b>	d.c.	VI A	0.09	-0.01	0.06	0.14
		VI B	0.04	-0.03	0.01	0.04
	d.p.	VI A	28.12%	-2.43%	15.00%	43.75%
		VI B	11.76%	-7.89%	2.85%	11.76%

### Discussion and conclusion

The compared analysis of the results registered reveals the following findings:

- the differences in x of the initial results certify a positive difference favourable for the class of control;
- in the sequence of the following verifications, the differences become significantly positive and favourable to the experimental class;
- between the results obtained on the tests 1 and 2, the differences registered both between the verifications and between the classes, reveal a better coordination and a more accurate technical execution of left-right stops unlike the execution of the same procedures in the right-left sequence;
- it is emphasized a certain natural predilection for the left leg, as "beating leg", opposite to the right one, on long jumps, by the jumps in the sequence "left-right-left" for both classes of the experiment on the tests no. 3 and no. 4;
- the differences registered on the tests no. 5 and 6, confirm the favourable difference of power on the left leg;
- the numerical and percentage values of the differences between the results registered on the verifications no. 2 and no. 3 emphasize a decrease of the value of the results registered on both classes:
  - which confirm the negative effect of the lack of continuity in the physical activity in general,
  - with a lower decrease of the value of the results of experimental class, as an effect of using a program, proposed and accepted and performed on its domicile by each subject of the experimental class.

The differences emphasized between the results registered in the sequence of the verification performed, confirm the efficiency of using plyometric exercise in the experimental class:

- in the 24 lessons, during the period 13.09.2010 – 20.12.2010;
- in the 40 lessons, during the period 10.01.2011 – 12.06.2011.

Pursuant to this research performed, it was acknowledged the possibility to associate the didactic activity specific to physical education on intermediate level to the performance of an experimental research.

The designing, organisation and development of the experimental research according to the topic determined were associated and included in the teaching-learning process specific to the didactic activity subordinated to the content and objectives of the physical education curriculum for intermediate level.

The results registered and their determining causes has validated the work hypothesis enounced and has objectivised the achievement of the purpose and targets of the research performed, being acknowledged the contributing potential to the improvement of the content of the applicative methodology used for the increase of the efficiency of the teaching-learning process specific to the physical education as didactic activity in the intermediate level.

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