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Analyis of quantitative changes in explosive strenth under the influence of elementary water games

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Abstract
The goal of this research is to determine are any positive quantitative changes in the structure and the manifestation of explosive strength caused by the application of elementary school of swimming containing elementary water, applied on primary school students (control and experimental group). Sample variables used for the assessment of explosive strength contained five variables/tests (throwing medicine from lying on back – MESBML, long jump from place – MESSD, Running from a high start 20M – MBR20M, High jump from place – MESVM, High jump – MESVZ). For the development or advancement of expressing explosive strength, elementary swimming school was used in duration of ten days with a frequency of two school lessons per day. Overall research lasted for two week (ten working days). The final quantitative change in the structure and manifestation of explosive strength was determined by applying discriminative analysis. The obtained results show the following: after the final measurement, an expected higher positive change in expressing and manifesting explosive strength in the experimental group, in relation to the final group.

Key words: **Explosive strength, water games, quantitative changes**

Sažetak
Cilj ovog istraživanja je da se kod učenika u osnovnoj školi (kontrolna i eksperimentalna grupa) utvrdi da li efekti primjene elementarne škole plivanja sa sadržajem elementarnih igara u vodi uzrokuju pozitivne kvantitativne promjene u strukturi i mogučnosti ispoljavanja eksplozivne snage. Uzorak varijabli za procjenu eksplozivne snage sastojao se od pet varijabli/testa (Bacanje medicinke iz ležanja na leđima - MESBML, Skok u dalj iz mjesta - MESSD, Trčanje iz visokog starta 20M - MBR20M, Skok u vis iz mjesta - MESVM, Skok u vis iz zaleta - MESVZ). Za razvoj ili unaprijeđenje ispoljavanja eksplozivne snage, korištena je elementarna škola plivanja u trajanju deset dana sa po dva školska časa dnevno. Cjelokupno provođenje istraživanja trajalo je dvije nedelje (deset radnih dana). Konačna kvantitativna razlika u strukturi i manifestaciji eksplozivne snage utvrđena je primjenom diskriminativne analize. Dobijeni rezultati pokazuju slijedeće: nakon finalnog mjerenja, kod eksperimentalne grupe, u odnosu na kontrolnu grupu pojavila se očekivana veća pozitivna promjena u ispoljavanju i manifestaciji eksplozivne snage.

Ključne riječi: **Eksplozivna snaga, igre u vodi, kvantitativne promjene**

Introduction

Nowadays, in all spheres of human lives, most tend to a faster and bigger change/transformation – high efficiency. Stated transfiguration can positively be defined as transformational process, in which an object or subject is exposed from the so-called entrance and exit. In such setting relationship and this particular case, the class of sports and physical education was observed a system in which a student enters with appropriate skills and thanks to whose influence, the stated positive change in students should be achieved (or at least, it should be like that, because of inadequate working conditions, substandard plans or working programs, not enough classes of physical activity, etc. we can get a suspended stagnation or even a decrease in student's skills) – Torlaković (2009). Moreover, an analysis was done on how much additional activity for students can cause quantitative changes in a particular segment of motor skills, specifically, explosive strength. The students of the experimental group were, in addition to their regular class of physical and medical education, subjected to additional activity (elementary swimming school containing elementary water games) in duration of two weeks, which is ten working days, with frequency of two classes per day. Apart from learning activities, extracurricular activities are known as other forms of work in school – Findak (2001), and if the stated additional activity in elementary school (swimming) shows any effect, "other forms of work" could be a way to increase organized/planned effect on students' motor skills. In order to prove that extracurricular activities are significant as an operator or something that should be done – make a change, in this research elementary school of swimming with elementary water games was applied, in consistent with the allegations, and the organization and differentiation of starters, according to Grcić – Zubčević and Mertinović method (2008). In this context, a working goal was set, that is, "to determine if the effect of applying elementary school of swimming containing elementary water games can cause positive quantitative changes in the structure and possibility of manifesting explosive strength in primary grade students" - Brackenridge, Fasting, Kirby, Leahu (2008).

Methods

Sample of the examines

The examinee sample is defined as a population of male students, attending primary school in Sarajevo, aged 11 and 12 years. Research included students which were healthy during the process of testing and measuring. The overall number of the control group examinees was 20, and of the experimental group 22. All examines had appropriate conditions for regular class of physical and medical education, but in addition to this class, the experimental group was allowed to a two-week long (10 working days) permission to use the pool, once a day, in duration of two class hours, None of the students, belonging to either group, was not involved in any physical activities of any sports club, which represented one of the basic conditions for enforcing research. The sample cannot be seen as selected by any criterion for entering primary school

Sample of variables

The selection of variables which would be used to define quantitative changes and manifestations of explosive strength in this research was done by the following:

1. Throwing medicine from lying on back (MESBML),
2. Long jump from place (MESSD),
3. Running from a high start 20M (MBR20M),
4. High jump from place (MESVM),
5. High jump (MESVZ).

Training Program

Elementary school of swimming training program lasted for 10 days, with a frequency of two school lessons daily (20 lessons in total). The program was performed in the Vogošća pool, on working days, in the afternoon (Table 1.). The program was conducted by educated swimming instructors, professors of sports and physical education, of which all had the University of Sports and Physical Education completed, and conducted similar programs in the past (education of non-swimmers) – Grcić-Zupčević (1996). All starter examinees of the elementary school of swimming were non-swimmers, therefore, the beginning of research did not require the statement of the initial state of examines. The initial state was not done for one more reason – the goal of research is the estimation of swimming starters' development and manifestation of explosive strength, not the improvement in swimming techniques. Nevertheless, variable and final testing were done during research among examinees in a way of checking the improvement in gaining swimming skills in order to secure another positive effect, that is improve swimming knowledge – Vojinović, Babaik, Strajnić, Kalentić (2011). After variable testing, homogenous groups of 5 to 7 students were formed, and during research, new groups were continually formed depending on students' improvement – Zenić (2010). For evaluating elementary swimming in the variable and final state, the following was used: Dive to a depth, diving out objects from the water, Jump on feet in shallow water, Jump on feet in deep water, chest floating (floating on the chest), and back floating (floating on back)

Data processing methods

Processing of data obtained was performed by a programming package, SPSS 12.0 for Windows. For determining the quantitative changes, Discriminative analysis was used – which represents a very suitable mathematical and statistical procedure in cases when it is necessary to distinguish the differences formed between initial and final measurement of the tested population.

Results

Control group: I and II measurement – difference noticed after the final measurement

After the application of discriminative analysis for experimental group's results, (the matrix previously stated that the initial state of the experimental group would be treated as one group, and the final state of the sample as another (second) group), by using Boks' test (Table 7.), it was proven that the difference between covariance matrix was statistically significant (,000), which met the requirements needed to continue the procedure. In table 8., a single isolated discriminated function can be observed, which significantly differs the initial and final state (coefficient of canonical correlation is ,779). A distinctive root for the discriminative function is also high (1,742), as is the level of coverage of the variance included in this discriminative function (100%). The significance of isolated functions is determined with Wilkson's lambda test (Table 9.), whose stated value is of high medium

Table 1. Training program

Content *of days*	1 th	2 nd	3 rd	4 th	5 th	6 th	7 th	8 th	9 th	10 th
Initial measurement of motor skills	*									
Games and exercises for adapting on water	*	*								
Games and exercises for adapting on water	*	*	*	*	*	*	*	*	*	
Games and exercises for breathing while moving		*	*							
Floating			*	*						
Slip into the water after pushing				*	*	*	*	*	*	
Elements of hops (the head - on your feet)		*	*		*	*				
Crawl technique – arms, legs, coordination			*	* *	* * *	* *	* *	* *	*	
Back technique – legs, arms, coordination			*	*	*	* *	* * *	* * *	* *	*
Checkup of initial state		*	*	*	*	*	*	*	*	
Final measurement of motor skills										*

significance (,455), which indicated on a conclusion that there is an existant difference between the initial and final state, that is, that the „groups" have a significantly different arithmetic environment.The overall claim is postitively surrounded by a significance level of significante (,000). The groups' centroids defined in table 10. determine a group's sign, resulting in a negative coefficient predetermined for the initial and positive for the final state. Structural coefficients of discrimnative functions, shown in table 11., are a more reliable indicator of relative power of discriminative variables, explaining the reason why they were used for the analysis and explanation of discriminative function.The structure of coefficients' relations itself indicate that a bigger positive difference is present in the final measurement of the experimental group, in regard to the control group, specifically in variables of: throwing medicine from lying on back (MESBML ,601), long jump from place (MESSD ,578), high jump from place (MESVM ,478), high jump (MESVZ ,579) – Rađo (1997). The variable running from a high start 20M (MBR20M -,379), reacted the as in the previous case and has a negative sign, and the justification for this indication can be found in the analysis of interpretations of numerical indicators regarding speed characteristics.

Control group I and II measurements - the difference determined after the final measurement

Table 2. Box's Test

Box's M		297,333
F	Approx.	2,355
	Df 1	103
	Df 2	112432,8767
	Sig.	,00

Experimental group: I and II measurement – difference established after the final measurement

Based on the structure of the discriminative functions, it can be concluded that the control group's isolated coefficients are of low value, which indicate on the fact that there are smaller quantitative differences present between the initial and final measurement. In conclusion, the sports class however had a positive impact on the parameters which follow the development and expression of explosive strength. In the experimental group, based on the numeric values of coefficients present in the structure of discriminative function, we conclude that a more significant positive difference is present at the final measurement in regard to the initial, which shows that the program of elementary swimming school with the application of elementary water games within the training process, significantly positively affected the parameters which follow the development and expression of explosive strength (Božanić, Benić, and Mumanović, 2011).

In the final comment, the differences between the development of the control group and the development of the experimental group, we concluded that there are significant differences in research structure of the experimental group in regard to the control group. The obtained results proven the research goal – to concluded that the students which were a part of the elementary swimming school containing elementary games, had a positive quantitative change in the structure and possibilities in expressing explosive strength – Jurak, Kovač, and Strel (2007), which suggests the introduction of the previously mentioned activities to regular education process, in order to cause a more significant and effective change in students' motor skills, which are an equivalent to research population.

Table 3. Significance of isolated functions

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	1,830	100,0	100,0	,763

Table 4. Wilks' Lambda

Test of Function	Wilks' Lambda	Chi - square	df	sig
1	,377	193,189	13	,000

Table 5. Centroids

GROUP	Function
1	-1,235
2	1,235

Table 6. The structure of discriminative function

Function	
MESBML	,177
MESSD	,165
MBRVS20M	-,197
MESVM	,178
MESVZ	,279

Eksperimental group: I i II measurements - the difference determined after the final measurement

Tabela 7. Box's Test

Box's M		766,031
F	Approx.	5,114
	Df 1	128
	Df 2	130576,664
	Sig.	,000

Tabela 8. The significance of isolated functions

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	1,742	100,0	100,0	,779

Tabela 9. Wilks' Lambda

Test of Function	Wilks' Lambda	Chi - square	df	sig
1	,455	141,166	13	,000

Tabela 10. Centroids

GROUP	Function
1	-1,307
2	1,307

Tabela 11. The structure of discriminative function

Function	
	1
MESBML	,601
MESSD	,578
MBRVS20M	-,379
MESVM	,478
MESVZ	,579

Discussion

After the fact that the initial state of control group would be treated as one, and the final state as another group was indicated, by usine Boksov's test (Table 2.), a testing of the identity matrix was performed, which showed that the difference between covariance matrix was statistically significant (,000), which made it able to acquire the requirments for performing the further procedure of discriminative analysis. In table 3., an isolated discriminated functional group can be observed, that is a discriminational function which significantally differentiates initial and final state, which shows the coefficient of canonial correlation (,763). A distinctive root for discriminative function is also high (1,830) as is the level of coverage of the variance included in this discriminative function (100%). The significance of isolated functions is determined with Wilkson's lambda test (Table 4.), which is commonly used in discriminative analysis as F test's multilinear equivalent. Stated value is of low medium significance (,377), which indicated on a conclusion that there is an existant difference between the initial and final state, that is, that „groups" have significantly different arithmetic environment. The overall claim is postitively surrounded by a significance level of significante (,000). The groups' centroids defined in table 5. determine a group's sign, resulting in a negative coefficient predetermined for the initial and posotive for the final state. Structural coefficients shown in table 6., are a more reliable indicator of relative power of discriminative variables, explaining the reason why they were used for the analysis and creation of discriminative function. The structure of coefficients' relations itself indicate that a smaller positive difference is present in the final measurement, specifically in variables of: throwing medicine from lying on back (MESBML ,177), long jump from place (MESSD ,165), high jump from place (MESVM 1,78), high jump (MESVZ ,279). There is a specific reaction of the variable running from a high start 20M (MBR20M -,197), that has a negative sign, which leads to a thought that the expression of speed characteristics was higher at the initial measurement. The justification for this indication can be found in the analysis of interpretations of numerical indicators regarding speed characteristics which decreases when there is an increase in expression quality (inversely proportional).

Conclusion

The effect elementary swimming school, as an extracurricular activity, with the application of elementary water games has on the development and manifestation of explosive strength, in the conducted research, was checked by using discriminative analysis. The control group sample was represented by 20 primary school students, and the experimental group by 22. The experimental group was, in addition to their regular class of sports and physical education, subjected to swimming lesson, in duration of ten work days, two lessons daily. The goal of this research was formulated in a manner that it was necessary to conclude are there any effects present on the students of primary school which were subjected to elementary swimming school containing elementary water games (extracurricular activities), and if this program cause positive quantitative changes in the structure and possibility of expressing explosive strength. The goal of this research was not directed to prove the effect swimming school had on improving swimming skills. By applying discriminative analysis, there was a statistically concluded difference between the development and expression of explosive strength at the beginning and the end of the program, that is, between the initial and final measurement, in favor of the final measurement in both groups (control and experimental). The structure of change of the control group's discriminative function was significantly lower in regard to the experimental group, for which we can conclude to have bigger quantitative positive changes present in the final measurement in relation to the initial measurement. Therefore, the program of elementary swimming school which included elementary water games in the overall process, had a positive effect on parameters which are used to follow the development and expression of explosive strength – Horvatin-Fučkar, Hečimović, and Rađenović (2011). This statement suggest the introduction of previously mentioned activities in the education proves in order to cause more significant and effective changes in students' motor skills, who are an equivalent to research group.

References

Božanić, A., Benić, J. and Mumanović, D. (2011). *Overweight and obesity as limitation factors of agility and strength development*. 6th International Scientific Conference on Kinesiology (pp 207-210). Opatija, Croatia.

Brackenridge, C., Fasting, K., Kirby, S., Leahu, T. (2008). *Preventing global violence to children in sport: Research from*

UNICEF. Book of Abstracts of the 13th Annual Congres, (pp 14). Estoril – Portugal.

Findak, V. (2001). *Methodology of physical education.* School books. Zagreb.

Grcić-Zupčević, N. (1996). *The efficiency of various programs and possible factors of successful learning of swimming*. Ph. D. thesis, FFK, Zagreb.

Grcić-Zubčević, N and Marinović, V. (2008). *300 water games for preschool children.* Intergrafika-Zagreb. Zagreb.

Horvatin-Fučkar, M., Hečimović, I. and Rađenović, O. (2011). *Differences in the explosive jumping strength of different generations of female students at the faculty of kinesiology.* 6th International Scientific Conference on Kinesiology (pp 682-686). Opatija, Croatia.

Jurak, G., Kovač, M., Strel, J. (2007). *Impact of the additional physical education lessons programme on the physical and motor development of 7 to 10 year old children*. Kinesiology, Vol 38, No 2., (pp105-115). Zagreb

Rađo, I. (1997). *Transformational processes of motor and functional skills and various aspects in swimming*. Ph. D. thesis, FFK, Sarajevo.

Torlaković, A. (2009). *The effects of intensive learning the basic elements of swimming within the frame of ex-curriculum activities upon the elementary school children*. Homo Sporticus, Volume 11-Issue 2 (pp 14-18). Faculty of sports and physical education University of Sarajevo. Sarajevo.

Vojinović, J., Babiak, J., Strajnić, B and Kalentić, Ž. (2011). *Extroversion of young swimmers and their sport success*. 6th International Scientific Conference on Kinesiology (pp 756-759). Opatija, Croatia.

Zenić, N., Grcić-Zubčević, N. (2010). *Ability grouping-Advances in a swimming curriculum. Kinesiology*, Vol. 37, No 2., (pp 173-181). Zagreb.

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