

CONTRIBUTION OF THE EXPERIMENTAL PROGRAMME OF PHYSICAL EDUCATION CURRICULUM TO THE DEVELOPMENT OF MOTOR ABILITIES

(Original scientific paper)

Nevenka Zrnzević¹, Ljubiša Lilić² and Jovana Zrnzević³

¹University of Priština, Teacher Training Faculty in Prizren - Leposavić, Kosovo i Metohija

²University of Priština, Faculty of Sport and Physical Education, Leposavić, Kosovo i Metodija

³University of Niš, Faculty of Sport and Physical Education, student, Niš, Serbia

Abstract

The main purpose of this research was to determine the influence of the suggested experimental program of physical education of motor abilities of the experimental group of pupils. The research purpose was also to determine the influence of the current curriculum concerning teaching physical education of motor abilities of the control group of pupils. The experimental program was carried out on the sample of 185 first-grade pupils of the elementary school, age of 7 years ± 6 months. The applied experimental program was composed of athletics exercises, sports games, exercises on the pieces of equipment and on the floor, rhythmic and dancing exercises and some additional exercises. The control group was taught according to the current curriculum. 12 metrical instruments were used to estimate motor abilities. In order to evaluate the influence of the experimental programme on motor abilities of the pupils it is necessary to determine if there are possible differences between the abilities of the pupils of the experimental and control groups in the initial measurement, therefore a multivariate analysis of variance (MANOVA) was applied, and univariate analysis of variance (ANOVA) was applied. The multi variant analysis of covariance (MANCOVA) and univariate analysis of covariance (ANCOVA) were applied in order to determine the effects of the experimental program. On the basis of the results and discussion, it can be concluded that the experimental program has significant influence on the changes all of the motor abilities. Comparing the influence of the two programs, it was concluded that both of them caused the change in motor abilities, but the experimental program had more significant contribution.

Keywords: elementary schools, male, female, kinesiological experiment, experimental group, control group, motor tests, initial measurements final measurements, additional exercises, multivariate analysis of variance, multivariate analysis of covariance

INTRODUCTION

If one does not know the possibilities of school-children and if curricula is not organised according to the principles implying the specificum of the young children's age a lot of problems can occur and not only educational but malfunctional ones for the children's health, growth and development altogether. Solving of complex tasks in the process of education and formal instruction calls for expert knowledge of the age characteristics. Having it means knowing how to design exercises, how to dose the overload, which working methods to use and how to execute the overall organisation. However, expert knowledge of aged characteristics does not mean all children should be requested to achieve the same results because it is widely known that there are individual differences between them and that physiological and chronological age are not always compatible which

is of course the main concern of the PE teacher. Child's development is a continuous process without any hard and fast time rules and limitations so it should be taken as a whole regardless of the faster or slower development of particular systems in certain periods. In this way physical education curricula should attend to the set requirements and achieve results that are well expected. This should be accompanied with the great efforts and motivation on the part of schoolchildren and PE teachers as well who will by means of their expertise and application of scientific findings and by using educational technology, requisites and equipment enable complete administering of physical education curricula contents in practice as planned to the fullest.

The issue of the research is to investigate the influence of the experimental programme of physical education curriculum spanning one school year, and some

supplement exercises, on first grade elementary pupils motor abilities. The influence of the experimental programme were monitored on the basis of the comparison of the initial and final measurement results and the measurement of the status of individual indicators of motor abilities.

Basic research aim was to determine if by means of the application of the recommended experimental programme of physical education curriculum one can achieve positive influence on the changes in motor abilities of the elementary pupils. Basic research aim was also to determine the influence of the current curriculum of physical education on the changes in motor abilities of the control group subjects.

METHODS

Sample of the subjects

Number of pupils - subjects comprised by this research is 185. The sample is divided into two groups: experimental group 106 and control one 79 pupils.

Sample of the variables

When selecting tests for the estimation of motor abilities it was accounted for balanced coverage of all areas of latent motor abilities, that is mechanisms responsible for the solution of certain motor tasks.

On the basis of the hierarchical structure of the motor area the following tests were applied:

a. for the estimation of the mechanism for the movement structuring

- hand tapping (MTAP) number of correct trials;
- backwards field (MPOL) in sec;
- slalom with two medicine balls (2 kg) (MS2M) in sec;

b. for the estimation of the mechanism for the tonus regulation and sinergy regulation

- low bend on the bench (MDPR) in cm;
- standing on one leg (MBAS) in sec;
- coordination with the baton (MKOP) in sec;

c. for the estimation of the mechanism for the excitation intensity regulation

- standing long jump (MSDM) in cm;
- running 30 m high start (M30V) in sec;
- medicine ball throwing (of 1 kg) (MBMD) in cm;

d. for the estimation of the mechanism for the excitation duration regulation

- hanging squirt (MVIS) in sec;
- leg lifting while lying on back (MDNO) number of correct trials
- trunk lifting while lying on back (MDTR) number of correct trials

Testing of motor abilities was administered at the beginning and at the end of school year in a gym and in sporting facilities of the school as well.

This research has a longitudinal character. Experimental programme was realized in the experimental group during regular physical education classes, in the course of one school year lasting 36 weeks with 3

classes a week. Teaching process in control group was realized in the same period according to the regular curriculum for the physical education of the Republic of Serbia by the pre-school teachers.

RESULTS AND DISCUSSION

Differences between the schoolboys of the experimental and control groups in the initial measurement

In order to evaluate the effects of the experimental programme on motor abilities of the schoolboys it is necessary to determine if there are possible differences between the abilities of the schoolboys of the experimental and control groups in the initial measurement, therefore a multivariate analysis of variance (MANOVA) was applied, and to obtain the data in which variables possible differences occur a univariate analysis of variance (ANOVA) was applied.

On the basis of the results of the multivariate analysis of the variance for the motor abilities between the schoolboys of the experimental and control groups in the initial measurements (table 1.), it can be stated that there is statistically significant intergroup difference ($p = .046$) and that groups before the experiment were not homogenized which entails in later mathematical-statistical procedures a compulsory partialisation and neutralisation of the differences between the groups which had occurred in the initial measurement.

Table 1. Multivariate differences of the motor abilities between the schoolboys of the experimental and control groups in the initial measurement (MANOVA)

Wilk's Lambda	F	Effect df	Error df	p
.766	1.91	12	75	.046

Table 2., shows the results of the univariate analysis of the variance in the applied variables of the motor abilities of the schoolboys in the initial measurement. It can be noticed that the occurrence of the difference at the multivariate level can be attributed to the difference occurring in the variable for the estimation of the mechanism for the tonus and sinergy regulation, standing on one leg (MBAS). Better results on this test were achieved by the schoolboys of the experimental group, whose mean value reads 19.93, and control group reads 11.67

In all the other variables there were not registered statistically significant differences but the schoolboys of the experimental group had achieved numerically better results in all measured variables when compared to the schoolboys of the control group, except for the variable for the estimation of the movement structuring mechanism: backwards field (MPOL) and two medicine ball slalom (MS2M), in variable for the estimation of tonus and sinergy regulation mechanism, low bending (MDPR) and variable for the estimation of the mechanism

Table 2. Univariate differences in motor abilities between the schoolboys of the experimental and control group in the initial measurement (ANOVA)

Test	Mean E	Mean K	F (1,86)	p
MTAP	10.06	9.66	1.51	.223
MPOL	25.65	25.30	.09	.769
MS2M	36.19	34.63	1.25	.266
MDPR	31.06	31.53	.70	.404
MBAS	19.93	11.67	10.74	.002
MKOP	5.55	5.75	.76	.387
MSDM	116.00	113.84	.40	.528
M30V	6.98	7.05	.31	.578
MBMD	325.00	308.95	1.68	.198
MVIS	12.63	9.91	2.31	.133
MDNO	11.78	12.00	.04	.844
MDTR	9.02	8.42	.24	.628

for the excitation duration regulation, leg lifting from back lying position (MDNO), where the numerically better results were achieved by the schoolboys of the control group.

It can be concluded that the schoolboys in experimental and control group differ in their motor abilities in the initial measurement.

Differences between the schoolgirls of the experimental and control groups in the initial measurement

On the basis of the results of the multivariate analysis of the variance for the motor abilities between the schoolgirls of the experimental and control groups in the initial measurements (table 3.), it can be stated that there is not statistically significant intergroup difference ($p = .153$) and that groups before the experiment were not homogenized.

Table 3. Multivariate differences of the motor abilities between the schoolgirls of the experimental and control groups in the initial measurement (MANOVA)

Wilk's Lambda	F	Effect df	Error df	p
.872	1.47	12	84	.153

Table 4. shows the results of the univariate analysis of the variance in the applied variables of the motor abilities of the schoolgirls in the initial measurement. It can be noticed in the variable for the estimation of the mechanism for the tonus and sinergy regulation, standing on one leg (MBAS) better results on this test were achieved by the schoolgirls of the experimental group, whose mean value reads 23.65, and control group reads 16.83.

In all the other variables there were not registered statistically significant differences but the schoolgirls the experimental group had achieved numerically better results in all measured variables when compared to the schoolgirls of the control group, except for the variable for the estimation of the movement structuring mechanism: hand tapping (MTAP) and two medicine ball slalom (MS2M); in variable for the estimation of

tonus and sinergy regulation mechanism, coordination with the baton (MKOP); in variable for the estimation of the mechanism for the excitation intensity regulation: standing long jump (MSDM) and medicine ball throwing (MBMD); and variable for the estimation of the mechanism for the excitation duration regulation: leg lifting from back lying position (MDNO) and trunk lifting while lying on back (MDTR); where the numerically better results were achieved by the schoolgirls of the control group.

It can be concluded that the schoolgirls in experimental and control group are no differ in their motor abilities in the initial measurement.

Effects of the experimental programme on the motor abilities

Pursuing the research aim to determine the effect of the applied experimental programme, we have analysed possible intergroup differences in a final measurement by means of the multivariate analysis of covariance (MANCOVA), while the differences between the groups in individual variables were determined by means of the univariate analysis of the covariance (ANCOVA). These analyses are meant to neutralise registered differences in the initial measurement between the groups, and determination of the differences is conducted by partialised adjusted mean values (Adj. Means) in a final measurement.

Table 5, shows the results of the multivariate analysis of co-variance of the applied variables for the motor abilities between the experimental and control group of schoolboys in a final measurement. It can be concluded that there have occurred statistically significant intergroup differences on a level $p = .000$.

Table 6, shows the results of the univariate analysis of co-variance of the applied variables for the motor abilities between the experimental and control groups of schoolboys in a final measurement. There have been registered statistically significant differences in all 12 variables of motor abilities to the advantage of the experimental group schoolboys on a level $p = .000$.

The most remarkable differences were noted in the variables: trunk lifting while lying on back (MDTR), hand tapping (MTAP) and standing long jump (MSDM,

Table 4. Univariate differences in motor abilities between the schoolgirls of the experimental and control group in the initial measurement (ANOVA)

Test	Mean E	Mean K	F (1,95)	p
MTAP	9.73	9.90	.44	.509
MPOL	27.31	28.50	1.32	.253
MS2M	38.80	37.34	1.66	.201
MDPR	30.77	30.66	.04	.841
MBAS	23.65	16.83	5.36	.023
MKOP	6.11	5.90	1.20	.276
MSDM	106.86	109.22	.49	.487
M30V	7.09	7.12	.06	.810
MBMD	236.43	250.61	2.83	.096
MVIS	11.02	10.46	.19	.663
MDNO	9.59	10.98	2.60	.110
MDTR	6.46	8.10	2.84	.095

Table 5. Multivariate differences in motor abilities between the experimental and control groups of SCHOOLBOYS in final measurement with the neutralisation of differences in the initial measurement (MANCOVA)

Wilk's Lambda	F	Effect df	Error df	p
.147	30.38	12	63	.000

leg lifting while lying on back (MDNO), 30m high start running (M30V), low bending (MDPR), coordination with the baton (MKOP), and backwards field (MPOL).

The biggest difference was registered in the variable trunk lifting while lying on back (MDTR), whose value of F test is 74.59, and this points to the fact that the experimental group schoolboys have significantly improved the result in repetitive power after the experimental treatment.

Very high values of F test (69.16), in the test for the estimation of the segmentary speed hand tapping speed (MTAP), indicate that the experimental group schoolboys are much better in segmentary speed in comparison to the control group schoolboys. Regardless of the fact that in the development of speed the most important factor is a genetic factor, well selected exercises performed with the greater speed, with greater number of repetitions and corroborated with supplementary exercises can improve significantly the speed of movements.

On a test for the estimation of speed, 30m high start running (M30V), the experimental group schoolboys have statistically significantly improved running speed when compared to the control group schoolboys.

Developing speed influences development of other abilities, foremost power (power of the lower limbs), agility, flexibility and endurance. Speed is in correlation with other abilities, thus by developing speed and coordination one can improve speed to a great extent. According to the previous research (Krsmanović, 1985), it was found that in short sprints power is represented three times more than the speed.

On the tests of coordination with baton (MKOP), two medicine balls slalom (MS2M) and backwards field (MPOL) the experimental group schoolboys have

statistically significantly improved their results on a final measurement when compared to the control group schoolboys. This of course, shows that the experimental programme had an immense impact on the coordination improvement. The up-to-now body of research has indicated the fact that coordination is genetically conditioned with over 80%. Development of coordination depends mainly on the previous experience and the richer the skills fund the easier it is to master new movements. Process of learning new skills and habits should be a continuous one and each exercise must be mastered to a certain level, so as to present a stimulus for the formation of new coordination abilities. Children of this age are prone to develop great ability for a quick adoption of new complex movements.

The least but yet statistically significant effect of the experimental treatment is realised in balance test, standing on one leg (MBAS). Having in mind that balance reaching and keeping is of great importance process of developing balance should be started as early as possible because balance development is sequential and mostly genetically conditioned but environment plays its role as well. The most optimal way to improve it is to implement it through the curriculum implementation using the following: apparatus and floor exercises, walking in different ways on a narrow surface, field exercises, elementary games that trigger imbalance. Children actually do not possess great ability of balance keeping in static position, which has brought about the achievement of bad results on the initial and smaller effect on a final measurement.

Table 7. shows the results of the multivariate analysis of co-variance of the applied variables for the motor abilities between the experimental and control group of schoolgirls in a final measurement. It can be concluded that there have occurred statistically significant inter-group differences on a level $p = .000$.

Table 8. shows the results of the univariate analysis of co-variance of the applied variables for the motor abilities between the experimental and control groups of schoolgirls in a final measurement. There have been registered statistically significant differences in all 12 variables of motor abilities to the advantage of the

Table 6. Univariate differences in motor abilities between the experimental and control groups of SCHOOLBOYS in the final measurement with the neutralisation of differences in the initial measurement (ANCOVA)

Test	Adj. Mean E (50)	Adj. Mean K (38)	F (1,74)	p
MTAP	15.47	13.04	69.16	.000
MPOL	18.94	23.19	29.85	.000
MS2M	26.49	31.80	33.64	.000
MDPR	33.73	31.61	43.78	.000
MBAS	27.84	19.13	13.16	.001
MKOP	4.40	5.51	38.25	.000
MSDM	132.85	121.76	59.63	.000
M30V	6.20	6.73	44.31	.000
MBMD	362.90	334.89	14.64	.000
MVIS	24.70	17.62	13.83	.000
MDNO	21.19	14.13	44.38	.000
MDTR	17.16	8.85	74.59	.000

Table 7. Multivariate differences in motor abilities between the experimental and control groups of SCHOOLGIRLS in final measurement with the neutralisation of differences in the initial measurement (MANCOVA)

Wilk's Lambda	F	Effect df	Error df	p
.117	45.18	12	72	.000

experimental group schoolgirls on a level $p = .000$

The most remarkable differences were noted in the variables: trunk lifting while lying on back (MDTR), standing long jump (MSDM), leg lifting while lying on back (MDNO), hand tapping (MTAP), 30m high start running (M30V), standing on one leg (MBAS), hanging squirt (MVIS) and two medicine balls slalom (MS2M).

The biggest difference was registered in the variable trunk lifting while lying on back (MDTR), whose value of F test is 119.10, and in the variable leg lifting while lying on back (MDNO), whose value of F test is 81.09, this points to the fact that the experimental group schoolgirls have significantly improved the result in re-

petitive power after the experimental treatment.

In repetitive power test – trunk lifting while lying on back (MDTR), there was a decrease in mean values on the final measurement in relation to the initial one. Exercises of static and repetitive power are rarely realized in everyday spontaneous activities so they should be programmed and included into a process of physical exercising. Time extensions when performing these exercises can cause respiratory disorders, inhibited supply of oxygen to the body, which in turn brings about serious consequences. However, one should not go to the other extreme, namely, one should occasionally use these forms of exercises to develop this type of power and children should be taught to breath in a proper manner. Taking into account that these exercises are strenuous we should make them interesting so children would be motivated to perform them.

Results obtained by the pupils in the experimental and control group during the final measurements are completely in agreement with the obtained results reported in the previous research conducted on the same population (Krsmanović, 1985; Ivanić, 1998; Babin et al, 1999; Zrnzević, 2003).

Table 8. Univariate differences in motor abilities between the experimental and control groups of SCHOOLGIRLS in the final measurement with the neutralisation of differences in the initial measurement (ANCOVA)

Test	Adj. Mean E (56)	Adj. Mean K (41)	F (1,83)	p
MTAP	15.06	12.80	78.04	.000
MPOL	21.37	26.45	27.15	.000
MS2M	29.65	34.79	35.92	.000
MDPR	33.97	31.73	24.71	.000
MBAS	35.76	17.01	63.62	.000
MKOP	4.90	5.76	28.92	.000
MSDM	126.59	114.17	107.18	.000
M30V	6.28	6.85	64.38	.000
MBMD	291.70	263.54	23.14	.000
MVIS	21.60	11.40	40.97	.000
MDNO	19.74	11.54	81.09	.000
MDTR	15.85	6.88	119.10	.000

CONCLUSION

After the performed analyses and on the basis of the obtained results it can be concluded that the experimental program of physical education with the emphasis on the athletics, sports games, requisite games and floor exercises, rhythmic and dance and some additional exercises during the main part of the class did statistically significantly influence and cause changes in the motor abilities of the experimental group pupils. In order to achieve positive results it was necessary to increase the demands and to increase the motivation for the work. Additional exercises had contributed to the density of the class, had increased the intensity of the exercises and had enhanced more substantial engagement and independence on the side of the pupils and more rational use of the requisites and apparatus in PE classes.

Improvement of the results is partly a consequence of the natural increase in motor abilities but to a greater extent it is a consequence of the bigger influence of the experimental programme.

REFERENCE

- Bala, G. (1981). *Struktura i razvoj morfoloških i motoričkih dimenzija dece SAP Vojvodine* [Structure and development of morphological and motor dimensions in children in SAP Vojvodina. In Serbian.] Novi Sad: Fakultet fizičke kulture.
- Babin, J., Katić, R., & Vlahović, L. (1999). Utjecaj posebnog programirane nastave tjelesne i zdravstvene kulture na motoričke sposobnosti sedmogodišnjih učenica [Influence of specially programmed physical and health education on motor abilities of 7 year old schoolgirls. In Croatian.] *U Zborniku, Druga međunarodna znanstvena konferencija »Dubrovnik 1999. Kineziologija za 21 stoljeće* (str. 115 -116). Zagreb: Fakultet za fizičku kulturu Sveučilišta u Zagrebu.
- Ivanić, S. (1988). Kriterijumi za procenu fizičkog razvoja i fizičkih sposobnosti dece i omladine uzrasta od 7 do 19 godina [Criteria for the estimation of physical development and physical abilities of children and youth aged 7 to 19. In Serbian.] *Fizička kultura*, (4), 233 – 239.
- Kosinac, Z., & Katić, R. (1999). Longitudinalna studija razvoja morfološko – motoričkih karakteristika dječaka i djevojčica od pete do sedme godinam [Longitudinal study of the development in morphological – motor characteristics of boys and girls from 5 to 7. In Serbian.] *U Zborniku, Druga međunarodna znanstvena konferencija »Dubrovnik 1999. Kineziologija za 21 stoljeće* (str.144–146). Zagreb: Fakultet za fizičku kulturu Sveučilišta u Zagrebu.
- Kragujević, G. (1985). *Metodika nastave fizičkog vaspitanja* [Methodics of physical education. In Serbian.] Beograd: Zavod za udžbenike i nastavna sredstva.
- Kragujević, G., & Rakić, I. (2004). *Fizičko i zdravstveno vaspitanje u prvom razredu osnovne škole: priručnik za učitelje* [Physical Education in the first grade of the elementary school: Manual for Teachers. In Serbian.] Beograd: Zavod za udžbenike i nastavna sredstva.
- Krsmanović, B. (1985). *Efikasnost nastave fizičkog vaspitanja u zavisnosti od modela nastavnih programa* [Efficiency of physical education curriculum depending on the model of teaching. Unpublished doctoral dissertation. In Serbian.] (Un published doctoral dissertation, University of Novi Sad) Novi Sad: Fakultet fizičke kulture.
- Martinović, D. (2003). *Postignuća u nastavi fizičkog vaspitanja: motoričke, morfološke i psihološke karakteristike* [Achievements in physical education curriculum: motor, morphological and psychological characteristics. In Serbian.] Beograd: Interprint GIP Beograd.
- Ničin, Đ. (2000). *Antropomotorika (teorija)* [Anthropomotorics (theory). In Serbian.] Novi Sad: Fakultet fizičke kulture.
- Stojiljković, S. (2003). *Osnove opšte antropomotorike* [Basics of general anthropomotorics. In Serbian.] Niš: Studentski kulturni centar.
- Strel, J. (1981). *Zanesljivost in struktura nekaterih motoričkih sposobnosti in morfoloških značilnosti šest in pol učencev i učenki* [Development and structure of some motor abilities and morphological characteristics of schoolboys and schoolgirls aged 6,5. In Slovenian.] Ljubljana: VŠTK, Institut za kineziologijo.
- Višnjić, D. (2004). *Metodika fizičkog vaspitanja* [Methodics of physical education. In Serbian.] Beograd: Fakultet sporta i fizičkog vaspitanja.
- Zdanski, I. (1984). *Metod dopunskog vežbanja i metod stanica kao mogućnost intenzifikacije nastave fizičkog vaspitanja* [Method of supplementary exercise and station method as a possible intensification of physical education. In Serbian.] Beograd: Zavod za unepređenje vaspitanja i obrazovanja grada Beograda.
- Zrnzević, N. (2003). *Efikasnost ostvarivanja programskih sadržaja u nastavi fizičkog vaspitanja u nižim razredima osnovne škole*. Efficiency of the realisation of programme contents in physical education curriculum in lower grades of elementary school. Unpublished Master's thesis, University of Novi Sad) Novi Sad: Fakultet fizičke kulture.
- Zrnzević, N., Lilić, Lj., & Zrnzević, J. (2013). Contribution of the experimental physical education curricula the functional abilities development. *Research in Kinesiology*, 41(1), 101-105.

Correspondence:

Nevenka Zrnzević
University of Priština - Kosovska Mitrovica
Faculty of Teacher's , Prizren – Leposavić
Str. Nemanjina bb., 38218 Leposavić
Kosovo and Metohija, Serbia
E- mail: nevenkazrnzevic@gmail.com