

**THE EFFECTS OF THE DEVELOPMENT GYMNASTICS ELEMENTS  
APPLICATION IN PE CLASSIS ON THE MORPHOLOGICAL  
CHARACTERISTICS TRANSFORMATION OF YOUNG  
ELEMENTARY SCHOOL GIRLS**

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**Abstract**

*The problem of this research is represented by analysis of the effects of gymnastic contents application in physical education teaching, and transformation of morphological characteristics in younger elementary-school female pupils. The main task of the research is to establish efficacy and nature of influences of certain exercising programs (experimental treatments) on transformation of certain anthropological dimensions represented in this research and according to statistic significance of the differences among experimental groups and a control group (the three experimental groups and one control group) in final state, and after correcting their differences in initial state. According to the aim of the research, a sample of minimally 212 examinees was proposed, and they were divided into four sub-samples which are relatively optimal for the planned research to be accepted. The estimation of morphological characteristics of the examinees was conducted with 13 anthropometrical measures chosen according to the International Biological Program (IBP), in order to cover the four-dimensional space defined as longitudinal dimensionality, transversal dimensionality, body volume and body mass, and body fat. In this research, multivariant procedures were used, i.e. multivariant analyses MANCOVA, and analyses ANCOVA, Student's t-test and interval of entrust of univariant procedures on the difference of corrected environments. It was determined that an experimental treatment had a statistically significant effect on a transformation of morphologic characteristics of younger elementary-school female pupils. It is very important to emphasize that, just like there is high possibility that morphological characteristics will influence the choice of an activity, there is also the possibility that every moving activity will in its way model a changeable of those morphological activities that allow to be modeled and which it is possible to influence.*

**Keywords:** *exspermental groups, control group, sports gymnastics, rhythmic gymnastics,*

**INTRODUCTION**

If one wants to significantly act on the anthropological status of younger elementary-school children, it is necessary to choose means of physical exercising of general character, and apply them with significantly higher intensity than it is already a practice. In other words, most of the principles and methods of sports training should be built in physical education and adapted to younger ele-

mentary-school children, influencing general motorics, i.e. their motoric behavior, and thus, other anthropological dimensions .

These considerations were the basis for this research with the intention to significantly intensify the influence on the anthropological status of third and fourth grade elementary-school pupils on regular physical education classes, by enriching the teaching with elements of rhythmic, artistic

and developmental gymnastics, as means in physical education teaching.

From the point of view of „Physical Education“ as a school subject, this research should contribute to throwing light to relations between body exercising and its influence on transformation of analyzed anthropological space of younger elementary-school female pupils.

From the point of view of gymnastics, rhythmic, artistic and developmental, this research should give data about the scope and way in which application of certain activities influences certain segments of anthropological space.

During the preparation for this kind of research, choice depended on facts which were supposed to be exact and confidential, because the treated area was confidential, not only in experimental researches, but also in researches of different character, with application of adequate technology and on far a bigger sample.

The problem of this research is represented by analysis of the effects of gymnastic contents application in physical education teaching, and transformation of morphological characteristics in younger elementary-school female pupils.

The subject of the research is represented by dimensions of anthropological status on one side, when morphological dimensions were treated, and on the other side, effects of different programs on transformation of the mentioned dimensions in younger elementary-school female pupils.

According to the given subject of the research, general aim of the research is defined by following:

- to establish the efficacy of the application of special programs from physical education teaching with emphasis on rhythmic, artistic and developmental gymnastics on transformation of morphological characteristics of younger elementary-school female pupils during one school year.

The main task of the research is to establish efficacy and nature of influences of certain exercising programs (experimental treatments) on transformation of certain anthropological dimensions represented in this research and according to statistic significance of the differences among experimental groups and a control group in final state, and after correcting their differences in initial state.

### **Hypotheses of the research**

Starting with the given problem and the defined subject, aims and tasks of the research, following hypotheses can be established:

H1-The experimental treatment has a statistically significant influence on the transformation of morphological characteristics of younger elementary-school female pupils.

### **METHODS OF THE RESEARCH**

Starting with the presumption that modern physical education teaching does not contribute enough to adequate transformation of anthropological dimensions of younger elementary-school female pupils, a longitudinal character research has been conducted during the period of 36 weeks (one school year) within which an exercising of higher intensity, was conducted twice a week of 45 minutes.

The population from which the sample of examinees has been taken is defined as the population of younger elementary-school female pupils, 9-10 years of age.

According to the aim of the research, a sample of minimally 150 examinees was proposed, and they were divided into three sub-samples which are relatively optimal for the planned research to be accepted.

The research has been carried out with third and fourth grade pupils of elementary schools „Vožd Karadorđe“, „Bubanjski heroji“ and „Radoje Domanović“ in Niš.

The examinees, who make the sample, must satisfy the following condition:

- to regularly attend physical education classes.

The estimation of morphological characteristics of the examinees was conducted with 13 anthropometrical measures chosen according to the International Biological Program (IBP), in order to cover the four-dimensional space defined as longitudinal dimensionality, transversal dimensionality, body volume and body mass, and body fat (Kurelić, 1975). The research especially tracked the characteristics which are susceptible to the greatest transformations under the influence of exogenous factors, such as body fat, where the coefficient of inheritance is .50.

The estimation of morphological characteristics was conducted by measuring the following anthropological measures:

*a) Longitudinal dimensionality of a skeleton*

1. Body height - AVIS
2. Arm length - ADRU
3. Leg length - ADNO

*b) Transversal dimensionality of a skeleton*

4. Biacrominal width - AŠIR
5. Wrist diameter - AŠRZ
6. Knee diameter - AŠZK

*c) Body volume and body mass*

7. Upper arm circumference - AONA
8. Forearm circumference - AOPO
9. Lower leg circumference - AOPT
10. Body weight - ATEŽ

*d) Body mass*

11. Upper arm skin fold - AKNN
12. Back skin fold - AKNL
13. Belly skin fold - AKNT

Data is processed by appropriate mathematical-statistical procedure. The applied procedures and their sequence of application have their place in scientific researches. Basic descriptive statistic parameters were established for all the variables which were subjects of the research. The applied methods which make possible getting the following information:

-information on distributions and distribution parameters for manifesting variable;

In this research, multivariate procedures were used, i.e. multivariate analyses MANCOVA, and analyses ANCOVA, Student's t-test and interval of entrust of univariate procedures on the difference of corrected environments.

## RESULTS AND DISCUSSION

According to the previously established draft of the research, in this part of work, the results of some anthropological characteristics of the examinees on final measuring, i.e. after the influence of the experimental treatment, were analyzed.

MANCOVA and ANCOVA analyses test the results on the final measuring, by equalizing the results from the initial measuring for each group, i.e. the analysis is done on corrected middle values of the final measuring in relation to the initial measuring. According to the previously established program, the final measuring was done immediately after finishing the experimental treatment, under exactly equal conditions as the initial measuring.

The results from the final measuring were processed in the same way, i.e. with the same

methods and procedures as the results of the initial measuring, which, even in this phase of data processing, made it possible to foresee the state and the differences in relation to the initial state, and in further proceedings even the effects of the experimental treatment.

It is well known that real effects of some treatment on different groups in space of  $n$ -structure of characteristics can be determined only when eventual differences previously neutralize, i.e. divide into parts on the initial state.

In this part, the persistence of the differences and the similarities among the three experimental and one control group of the examinees is shown, in relation to 13 variables for the estimation of morphological characteristics on the final measuring (Tables 1 - 5).

During the procedure of analyzing the final state by applying multivariate analysis of co variable (MANCOVA), it was determined that the analyzed groups of female pupils (the three experimental and one control group) statistically significantly differed among themselves in their morphological characteristics and that there was a clearly defined line among some groups of the examinees, which means that even after the neutralization of the differences in the initial state, there was a significant difference among the analyzed groups on the final measuring, which practically means that there was a significant difference in the contribution of the treatment.

According to the analysis of co variable (ANCOVA), it was noticed that there was the difference among the examinees of the experimental and the control group for six individual variable of morphological space in 8 of 13 characteristics, especially in longitudinal dimensionality of a skeleton (two out of three variables), transversal dimensionality of a skeleton, (two out of three variables), body mass and body fat. It has already been emphasized that the role of the inheritance is shown in dimensionality of a skeleton the most, and in body fat the least. For the noticed difference in transversal and longitudinal dimensionality of a skeleton, only natural development and genetic factor can be responsible. For the differences noticed in body weight and body fat, it can be said that experimental factor is responsible. When it came to the reduction of body fat, it came to the reduction of body weight. Big body mass and body volume is not necessarily a hindering factor in

*Table 1. The significance of the differences among all the groups of the examinees in relation to the final measuring of morphological characteristics*

	n	F	p
MANCOVA	13	3.689	.000

*Table 2. The significance of the difference among all the groups of the examinees in relation to the each individual variable of morphological space on the final measuring*

ANCOVA	F	p
Avis	.946	.421
Aadru	10.724	.000
Adno	3.900	.010
Aašir	7.017	.000
Ašrz	2.626	.051
Ažzk	.639	.594
Aopo	1.336	.263
Aona	.813	.491
Aopt	.714	.548
Ate□	2.346	.073
Aknn	14.517	.000
Aknl	13.919	.000
Aknt	18.766	.000

exercising in gymnastics if it is on account of useful muscular mass, because it represents a certain level of relative strength, which is certainly necessary for easy, expressive and regular exercising. It should be emphasized that all the experimental treatments which the examinees underwent, contained specific exercises for the development of certain motoric abilities, so it probably caused the reduction of body fat in the examinees of the experimental groups. It has already been emphasized that the influence of inheritance is the smallest in body fat, i.e. in this research with experimental treatments, the greatest contribution has been made to its reduction. Generally taken, body fat represents the hindering factor in doing gymnastic exercises (Aleksić, 2010).

With the first experimental group, the results of interval of entrust, which were found in the research, show that there was a difference in advantage to the experimental group in six out of 13 variables of morphological space, i.e. in one variable for the estimation of transversal dimensionality of a skeleton, two variables for the estimation of body fat. The first experimental group underwent the treatment with the elements of sports gymnastics which contributed to the reduction of

the scope of a body and fat tissue, while the reason for the change in arm length and shoulder width should be searched in natural development and genetic predispositions.

With the second experimental group, the results of interval of entrust, which were found in the research, show that there was a difference in advantage to the experimental group in six out of 13 variables of morphological space, i.e. in one variable for the estimation of longitudinal and transversal dimensionality of a skeleton and body volume and in all the variables for the estimation of body fat. The second experimental group underwent the treatment with the elements of rhythmic gymnastics which contributed, among other things, to the reduction of body fat, while the reason for the change in length of upper and lower extremities should be searched in natural development and genetic predispositions.

With the third experimental group, the results of interval of entrust, which were found in the research, show that there was a difference in advantage to the experimental group in only one of the variables of morphological space, i.e. in the one variable which estimates body volume. The third experimental group underwent the treatment with the elements of developmental gymnastics which did not give contribution to statistically significant change in the state of morphological characteristics of the examinees, except in upper arm circumference, so it can be concluded that changes occurred under the influence of natural development and other external factors.

The result of our research can be compared with results of similar researches on a similar sample, like, for example, researches carried out by Milenković (2001) and Kocić (2003).

The research carried out by Milenković (2001) with the intention to establish effects of a programmed teaching with elements of artistic gymnastics on a sample of girls of 13 years of age, showed that there are differences in morphological space among the pupils of an experimental and a control group, and those differences are determined by MANCOVA and ANCOVA analyses and interval of entrust. But out of the seven variables, only in two, upper arm circumference in flexion and forearm circumference, there were differences in advantage of the experimental group which is not enough to be ascribed to the influence of the experimental treatment.

*Table 3. The significance of the difference between the first experimental group and the control group according to the intervals of entrust of the examinees' corrected environments in measuring morphological characteristics - final*

Groups		Variable	Corrected environments		Interval of entrust	
I Experim.	Control	Avis	145.67	145.64	-1.07	1.13
I Experim.	Control	Adu	59.74	59.96	-1.01	.57
I Experim.	Control	Adno	85.06	85.08	-.59	.53
I Experim.	Control	Ašir	32.54	32.92	-.65	-.09
I Experim.	Control	Ašrz	5.08	5.15	-.15	.01
I Experim.	Control	Ažzk	8.54	8.54	-.05	.06
I Experim.	Control	Aopo	20.49	21.01	-.90	-.15
I Experim.	Control	Aona	21.58	22.05	-.87	-.06
I Experim.	Control	Aopt	30.07	30.26	-.59	.21
I Experim.	Control	Ate□	38.99	39.75	-1.67	.14
I Experim.	Control	Aknn	1.59	1.68	-.17	-.01
I Experim.	Control	Aknl	1.34	1.39	-.14	.02
I Experim.	Control	Aknt	1.60	1.74	-.23	-.05

*Table 4. The significance of the difference between the second experimental group and the control group according to the intervals of entrust of the examinees' corrected environments in measuring morphological characteristics - final*

Groups		Variable	Corrected environments		Interval of entrust	
II Experim.	Control	Avis	145.95	145.64	-.77	1.39
II Experim.	Control	Adu	61.78	59.96	1.02	2.61
II Experim.	Control	Adno	85.95	85.08	.28	1.45
II Experim.	Control	Ašir	32.85	32.92	-.35	.22
II Experim.	Control	Ašrz	5.08	5.15	-.15	.01
II Experim.	Control	Ažzk	8.51	8.54	-.08	.03
II Experim.	Control	Aopo	20.01	21.01	-1.38	-.61
II Experim.	Control	Aona	21.71	22.05	-.77	.09
II Experim.	Control	Aopt	30.04	30.26	-.64	.19
II Experim.	Control	Ate□	40.24	39.75	-.46	1.44
II Experim.	Control	Aknn	1.46	1.68	-.29	-.14
II Experim.	Control	Aknl	1.18	1.39	-.29	-.14
II Experim.	Control	Aknt	1.43	1.74	-.39	-.22

On a sample of girls of seven and eight years of age, Kocić (2003) carried out a research with the intention to determine the influence of experimental treatments with elements of rhythmic gymnastics and dances on the morphological characteristics and motoric abilities development. According to the results, it is concluded that the population from which the sample was taken had equal, or very similar characteristics, so the program of the experimental treatment, taking endogen and other

factors into account, made a series of effects which contributed to series of statistically significant differences in the examinees of the control, and in advantage of the experimental group at the end of the program of the experimental treatment. Differences in morphological characteristics of members of different moving activities did not occur only because of the adequate choice of an activity and its exemplary dosing, but also partly because of the influence of specific programs of exercising,

*Table 5. The significance of the difference between the third experimental group and the control group according to the intervals of entrust of the examinees' corrected environments in measuring morphological characteristics – final*

Groups		Variable	Corrected environments		Interval of entrust	
III Experim.	Control	Avis	145.64	145.64	-1.06	1.04
III Experim.	Control	Atru	60.01	59.96	-.74	.85
III Experim.	Control	Adno	84.92	85.08	-.74	.41
III Experim.	Control	Ašir	33.03	32.92	-.19	.42
III Experim.	Control	Ašrz	5.11	5.15	-.13	.04
III Experim.	Control	Aškz	8.54	8.54	-.05	.06
III Experim.	Control	Aopo	19.77	21.01	-1.63	-.84
III Experim.	Control	Aona	21.58	22.05	-.93	.00
III Experim.	Control	Aopt	30.17	30.26	-.55	.36
III Experim.	Control	Ate□	39.82	39.75	-1.13	1.26
III Experim.	Control	Aknn	1.70	1.68	-.05	.10
III Experim.	Control	Aknl	1.41	1.39	-.06	.10
III Experim.	Control	Aknt	1.73	1.74	-.09	.08

which those differences emphasized according to biomechanical demands which highly influenced a final sports success.

According to all that was shown, it is possible to make a conclusion that experimental treatments have achieved an appropriate effect on transformation of morphological characteristics of younger elementary-school female pupils. It must be pointed out that the examinees were at the age when the growth in height is determined by stabilization and certain slowness in relation to the previous period, and body mass is in a noticeable increase, so in professional literature, it is also called the age of the “second rounding”. In this period, it comes to a rapid growth of pelvis, a development of muscles is expressed and it noticeably starts to advance in the age of eight, and that intensity is maintained until the age of ten.

No matter of the natural influence and genetic factor, experimental programs gave a positive effect on the change of those dimensionalities which were at least influenced by genetic factor, and on which it can mostly be influenced by physical exercising.

This research was carried out on regular physical education classes during one school year, by applying artistic, rhythmic and developmental gymnastics as means of teaching, and with the intention to show new ideas and create new conditions for including positive changes in practice of physical education teaching.

It is certain that this research should initialize not only experts from the area of physical culture, but also others, to more complex and far wider researches on bigger populations and wider space areas, that would lead to more effective improvements of psychosomatic status of young people, motoric abilities, etc.

The results acquired by this research exactly show that the effectiveness of different program contents of physical education teaching was different. Namely, in relation to existing program contents, the experimental teaching with the emphasis on artistic, rhythmic and developmental gymnastics significantly contributed the transformation of certain dimensions of anthropological status of younger elementary-school female pupils.

This research is, according to its contents and work organization, original, and the acquired results showed that the suggested programs were more adequate and more acceptable, thus, it can be recommended for future application in practice. Beside the theoretical application, this research could have its practical application in practice, in the process of planning and programming physical education teaching, because according to the acquired results, it is not difficult to conclude that it is necessary to change the existing concept of teaching contents. Taking into consideration that the experimental programs of this research have shown a great advantage over the existing concept, we consider that they could find their place in

future teaching plan and program for elementary schools.

It surely initiates series of further researches on effects of different organizational teaching methods and programs, during this and other years of age. Also, one of the ideas for further researching projects would be on effects of such experimental program application within the period of time longer than a school year. The presented research is only a designation of positive tendencies within this area of research.

## CONCLUSION

The problem of this work was to determine how big the influence of the experimental treatment on transformations of morphological characteristics was and whether they differed from the characteristics of the sample of the examinees treated by classical ways of physical education teaching.

- With morphological characteristics, MANCOVA analysis (.000) showed the existence of statistically significant difference in advantage of the experimental groups by what the hypothesis H-1 becomes accepted, i.e. it was determined that an experimental treatment had a statistically significant effect on a transformation of morphologic characteristics of younger elementary-school female pupils.

Differences in morphological characteristics under the influence of different moving activities did not occur only because of the adequate choice of an activity and its exemplary dosing, but also partly because of the influence of specific programs of exercising, which those differences emphasized.

A child's growth is determined by different influences which we can divide into endogen, and exogenous. Endogen influences: inheritance (genetic factor), race, gender, endocrine glands.

Exogenous influences are the climate, seasons, diet, illness, physical activity, psychic factors, social-economic circumstances. Genetic factor is decisive for the growth, build and look of an individual. For the needs of this research, what was the most important was following the characteristics on which it is possible to conduct the biggest transformations under the influence of exogenous factors, such as body fat, where the coefficient of innateness is .50, and body volume, with the coefficient of inheritance .90.

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## ЕФЕКТИ НА ГИМНАСТИЧКИТЕ СОДРЖИНИ ВО НАСТАВАТА ПО ФИЗИЧКО ВОСПИТУВАЊЕ ВРЗ ТРАНСФОРМАЦИЈАТА НА МОРФОЛОШКИТЕ КАРАКТЕРИСТИКИ КАЈ УЧЕНИЧКИТЕ ОД ПОМЛАДАТА ВОЗРАСТ

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 (Оригинален научен труд)

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### Апстракт

Проблемот на истражувањето претставува анализа на ефектите од примената на гимнастичките содржини во наставата по физичко воспитување и трансформацијата на морфолошките карактеристики кај учениците од помладата училишна возраст. Основна цел на истражувањето беше да се утврди ефикасноста на влијанието на одделни програми на вежбање (експериментални прејмани) врз трансформацијата на 13 антропометриски мерки. Врз основа на целта на истражувањето, употребен е примерок од 212 ученици на возраст 9-10 години. Примерокот беше поделен во четири групи. Три од нив беа експериментални со различни програмски гимнастички содржини, а една контролна, без било какви наставни содржини. Антропометриските мерки беа применети (според Меѓународната биолошка програма - ИБП) за проценување на латентните морфолошки карактеристики: лонгитудинална димензионалност на скелето, трансферзална димензионалност на скелето, волумен и маса на телото, и постојано масно ткиво. Добиењето податоци од истражувањето се обработени со Мултиваријансана анализа на коваријанса (МАНКОВА), Униваријансана анализа на варијанса (АНКОВА) и Студентов  $t$ -тест. Утврдено е дека експерименталниот прејман има статистички значаен ефект врз трансформацијата на морфолошките карактеристики на учениците кои беа офатени во ова истражување. При тоа, е потребно да се истагне дека како што е висока веројатноста за влијанието на морфолошките карактеристики при изборот на секоја маторна активност, истото така е висока веројатноста дека секоја таква активност на свој начин може да влијае на оние морфолошки карактеристики кои се подложни на трансформационите процеси.

**Клучни зборови:** експериментални групи, контролна група,  
 спортска гимнастика, ритмичка гимнастика,  
 развојна гимнастика, МАНКОВА