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ORGINAL SCIENTIFIC PAPER

Borislav Cicović¹, Ognjen Prica²
¹ Faculty of Physical Education and Sport, Pale
² Karate klub „Partizan“ Apatin

ABSTRACT

The research is done on the sample of 70 elementary school pupils, aged 10 and 11 ± 6 months, who are enrolled in regular physical education classes and karate trainings in sports clubs of East Sarajevo. The main problem of this article is to find statistically significant relations between single latent dimensions of the corresponding morphological characteristics and repetitive strength of the young players. Finding out about this relation is very important for certain sports activities so that, on one hand, wanted anthropological harmony could be checked and kept and, on the other hand, so that wanted training technology and actualization of the programme contents could be realized. The aim of this research is to determine the statistically significant relations between the system of anthropometric measures and longitudinal dimensionality of the body, circular dimensionality and body weight and underskin fat, on one hand, and variables of repetitive strength, on the other hand, among young karate players, so that the functionality of their development could be checked and, if possible, so that valuable and appropriate projections of their wanted development could be determined. Seven anthropometric measures of morphological dimensions that define longitudinal skeletal dimensionality, transversal skeletal dimensionality and body weight were used. Repetitive strength was assessed by use of three tests. The results of canonical correlational analysis showed that there is one significant canonical factor and a high level of connectedness between morphological dimensions (as a predicatory system) and explosive strength (as a criteria system).

Key words: Young karate players, morphological dimensions, repetitive strength, cannonical correlation analysis

1. Introduction

In karate there is a need for a well-organized and well-led process of training. In order to organize a sports training in such a way one needs to base it on the latest scientific results as well as to use a contemporary and efficient methodological procedure. The research on the influence and relationship of morphological characteristics with other dimensions of the anthropological sphere, and through this on the achievement of higher sports results as well, is one of the primary goals.
Karate players are usually taller, of a strong and proportional build and with a very small amount of underskin fat. Their long limbs make it possible to hit at a larger distance, and at the same time they provide bigger distance from the opponent while in the main posture and therefore they also provide a relative protection from his hits. The importance of long limbs becomes even bigger if we have in mind the fact that the basic and most effective techniques of hitting are, actually, two direct hits (zuki and maye geri), which are performed from the biggest allowed distance from which hitting the aim is still possible. Karate players have got long and elastic musculature which allows for fast and explosive movements with a big amplitude. Bigger amounts of underskin fat are a burden for karate players, they slow down their movements and therefore they are not characteristic for them (Kuleš, 1985; Bratiæ, 2005; Vidranski i sar., 2007).

There is no doubt that getting a deeper insight into the relation between anthropometric measures and sports results and dimensions of the motoric abilities would make the process of selecting people who would be talented for karate more efficient which would considerably improve the development of this sport and, at the same time, improve the achievement of higher results.

In scientific and specialized literature (Kurelić, Momirović, Stojanović, Šturm, Radojević, Viskić-Štalec, 1975; Pržulj, 2006) repetitive strength is most often represented as the ability for a long-lasting work out based on the alternation of contractions and relaxation of arm, leg and torso muscles, long performance of a particular movement without lowering the efficiency – namely, longer performance with the same intensity. Since the coefficient of the inborn repetitive strength is (H2 = .50), there is a big possibility for its development, therefore it is suggested that it should be developed separately, but also together with other motoric tests, which means as early as in childhood (Bompa, 2006; Milanović, 2007).

The main problem of this article is to find statistically significant relations between single latent dimensions of the corresponding morphological characteristics and repetitive strength of the young players. Finding out about this relation is very important for certain sports activities so that, on one hand, wanted anthropological harmony could be checked and kept and, on the other hand, so that wanted training technology and actualization of the programme contents could be realized.

The aim of this research is to determine the statistically significant relations between the system of anthropometric measures and longitudinal dimensionality of the body, circular dimensionality and body weight and underskin fat, on one hand, and variables of repetitive strength, on the other hand, among young karate players, so that the functionality of their development could be checked and, if possible, so that valuable and appropriate projections of their wanted development could be determined.

2. Method

The research is done on the sample of 70 elementary school pupils, aged 10 and 11 ± 6 months, who are enrolled in regular physical education classes and karate trainings in sports clubs of East Sarajevo.

Seven anthropometric measurements of morphological dimensions were used in order to diagnose anthropological dimensions of young karate players.1. longitudinal
skeletal dimensionality: body height (BODHIG) and arm length (ARMLEN); 2. circular dimensionality and body weight: average bust measurement (MEABUST), shin measurement (MESHIN) and body weight (BODWEI); 3. underskin fat: stomach skin folds (FOLSTOM) shin skin folds (FOLSHI). The suggested model sample of anthropometric measures for the assessment of the morphological characteristics is used at the suggestion of the International biological programme (Lohman et al., 1988). Repetitive strength is tested by the following tests: lifting up the torso on the Swedish bench (MLTSB), mixed push-ups (MPUU) and squats (MSQT). Measuring instruments for the repetitive strength assessment are taken form the research done by Kurelić et al., 1975.

In order to determine the relationship between two different multidimensional anthropomorphological manifest variables, where the anthropometric measurements are the first and the tests of repetitive strength the second system, the method of canonical correlation analysis was used. In order to determine their interrelation programme SPSS 12.0 and statistics 7.0. were used.

3. Results

Table 1. Canonical correlation analysis of morphological characteristics and repetitive trentght at multivariant level

<table>
<thead>
<tr>
<th>Can R</th>
<th>Can R²</th>
<th>Chi-sqr.</th>
<th>df</th>
<th>p</th>
</tr>
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<tr>
<td>.68</td>
<td>.47</td>
<td>56.32</td>
<td>70</td>
<td>.00</td>
</tr>
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</table>

**Legenda:** coefficient of canonical correlation (R), coefficient of determination (R²), Chi-square test (Chi-sqr.), degree of freedom(df.), significance (p)

The results of canonical correlation analysis show (table 1) that in the relationship between the system of a predicator, which consists of the anthropometric measurement for the assessment of the morphological characteristics and criteria, that, in turn, consists of variables for the repetitive strength assessment, one statistically significant factor Can R, which with the percentage of 68% considerably explains the level of connectedness between the set of predicative variables and criteria. The coefficient of determination (Can R2) indicates that the percentage of the common variance for both sets of variables is 47%. Canonical factor is statistically significant at level P = .00, which is confirmed by Chi-square tests (Chi-sqr.) with a high coefficient (56.32).

*Having in mind the coefficient of canonical correlation and common variance, it can be concluded that the repetitive strength of the tested ones will be strongly correlated with their morphological characteristics.*

Table 2. Canonical factors predicatory antrophotomtoric measurements

<table>
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<tr>
<th>Anthropometric measurers</th>
<th>Root 1</th>
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<tr>
<td>BODHIG</td>
<td>0.24</td>
</tr>
<tr>
<td>ARMLEN</td>
<td>0.20</td>
</tr>
<tr>
<td>MEABUST</td>
<td>0.62</td>
</tr>
<tr>
<td>MESHIN</td>
<td>0.48</td>
</tr>
<tr>
<td>BODWEI</td>
<td>0.39</td>
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Table 2 shows that the following anthropometric measurements of the circular skeletal dimensionality and body weight have the biggest projection on the canonical factor: bust measurement \( r = 0.62 \), shin measurement \( r = 0.48 \) and body weight \( r = 0.39 \), and therefore they condition considerably the results in all the tests of repetitive strength. The measurements of longitudinal skeletal dimensionality and underskin fat have the smallest and the least significant projection on the canonical factor.

**Table 3.** Canonical factors of repetitive strength criteria variables

<table>
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<th>Variables</th>
<th>Root 1</th>
</tr>
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<tr>
<td>MLTSB</td>
<td>0.52</td>
</tr>
<tr>
<td>MPUU</td>
<td>0.43</td>
</tr>
<tr>
<td>MSQT</td>
<td>0.36</td>
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Results in table 3 show torso lifting on a Swedish bench have got the biggest projection on the canonical factor \( r = 0.52 \), mixed push-ups less so \( r = 0.43 \) while squats have got the smallest projection \( r = 0.36 \).

### 4. Discussion

Canonical correlation analysis in tables 1 to 3 show that anthropometric measures (body height, leg length, arm length, average bust measurement, shin measurement and body weight), as predicatory system, have got statistically significant relationship with the results achieved in relation to repetitive strength achieved (torso lifting on a Swedish bench, mixed push-ups, and squats, as a system of criteria, among the young karate players.

In both, scientific and specialized literature (Kurelić et al. 1975; Malacko and Rađo, 2004) morphological characteristics are defined as a set of manifest anthropometric measures that are relevant for research in physical culture transformed, by way of factor procedures into latent morphological dimensions.

On the basis of the results of anthropometric measurements that were diagnosed with sports players of both sexes, the aims and tasks of the training work can be set and programmes for activities management can be planned for certain training cycles in order to raise the level of anthropometric measure that we want to influence in the training process.

Since the coefficient of the inborn longitudinal skeletal dimensionality ranges from .98 - 100 %, there is a possibility for development, but to a lesser degree, therefore it is suggested that it should be developed together with other morphological characteristics, which means, as early as in childhood (Malacko, 2002). Underskin fat, with regard to almost all the sports activities, represents the parasite factor with the possibility of transformation of 50%.

Repetitive strength can be defined as the ability of muscles to exert power in a training regime (Malacko and Rađo, 2004). For this kind of strength the ability of long-lasting work that is based on alternating contractions and relaxation of the torso muscles is
characteristic, almost in all the sports activities, depending on age and/or sex, but it is most often used for long-lasting athletic running and walking, since those represent typical training and competition programme.

In relation to this, it can be concluded that because of earlier sexual development in comparison to girls, differential repetitive strength is not well-developed, however it is comprised in the complexity of morphological characteristics, which means that, they realise repetitive strength thanks to higher values of anthropometric measures and repetitive strength (in regulation of the intensity and excitation).

According to some researches (Kurelić et al. 1975; Bompa, 2006; Milanović, 2007) the factor that regulates the intensity of excitation, most probably, depends on the device for excitation control in the primary motor and in those subcortical cores which have got the role of amplifiers and modulators. Some other researches agree with this as well (Kurelić et al., 1975; Bompa, 2006; Milanović, 2007). In their researches they emphasized the same parameters for more efficient realization of repetitive strength, but here we should keep in mind the fact that this dimension is also, in large measure, influenced by flexibility, the quality of sports technique and bio-chemical situation at the periphery of the locomotor system.

5. Conclusion

The results of this research show that between anthropomotoric measures as a predicatory system and repetitive strength, as a criterion, there is a systematic connectedness, which is indicated by height projection of morphological dimensions measures and tests of the influence of repetitive strength on a canonical factor.

The achieved results will contribute to rationalization of work with young karate players from East Sarajevo, elementary school pupils, aged 10 and 11, because, during the training process, special attention will be paid to the development of those morphological dimensions (circular skeletal dimensionality and body weight) which best explains the achieved results in repetitive strength and at the same time the achievement of higher sports results.

Apart from this, the results of morphological dimensions and repetitive strength will contribute to individualization of the training process since planning, programming, realization and control of the training process will be adjusted to the individual abilities and characteristics of young karate players.

6. References


Abstract

In recent years the population of students is increasingly subject of study of a number of subsystems in which the subsystem of motor skills has a significant position, especially when it comes to the structure of the motor space. In the different age periods we record significant changes in motor skills. On the basis of their structure, we can conclude the level of development of certain motor skills, that is of those skills which in the greatest extent determine the certain population. The study sample consisted of 200 students of both sexes, aged 15-16 years. The main objective was to identify the latent dimensions of the motor space applied on the basis of a set of manifest variables. The factor analysis obtained results showed that in the students exist eight latent dimensions of the motor space defined by the phenomenological model.

Key words: motor skills, latent dimensions, students, factor analysis.

INTRODUCTION

Interest in the study of motor skills began at the beginning of the twentieth century, although more intensive attention to this kind of research was devoted only in the forties of the last century, and studies based on scientific knowledge and experiences of other sciences (psychology, sociology, biomechanics, physiology, anatomy, etc.) occur in the period after World War II. First, so far registered, the motor space research was carried out by D. A. Sargent, in 1902. He designed the first battery of six tests under the title Universal test of strength, speed and endurance of the human body (Kurelić et all.1975). Studies of the factor structure of motor abilities, dating, by Gredelj et all. (1975), starting around 1934, when Mc Cloy analyzed situational motor tests battery and determined factors: strength, speed and coordination.

Larson (1941) with identical motor tests as Mc Cloy performed factor analysis and also isolated three factors, but those factors differentiated on dynamic and static power, he defined speed as motor explosiveness, and coordination he differentiates on coordination with agility of the whole body and motor educational function. Fleishman (1964) conducted a very extensive and important research in the field of motor skills. The study was conducted on a sample of 2000 students of both sexes aged 12-18 years from 45 U.S. cities. The study applied the 30 measurement tests to assess areas of strength and 30 measurement tests for assessing the speed, agility, balance and coordination. Motor space research was conducted on different populations with different age. At first it was a fundamental research
on the population of young people aged 19 to 27 years. Among them are very important researches of Kurelića et all. 1975 who proposed and defined a hypothetical model of latent structure of basic motor dimensions, which Gredelj and assoc. (1975) verified by the application of battery of 110 motor tests on a sample of 693 male respondents. The results showed that the structure of this model has three levels (primary, secondary and tertiary factors). Tertiary factors on the second and third levels, are defined as the neuro-physiological mechanisms that are mutually arranged hierarchically. Factors of the second order form mechanisms for structuring movement, synergistic regulation and the regulation of tone, excitation intensity and duration of the excitation control, while the third row factors are the mechanism for the regulation of movement and the mechanism of energy regulation. Hoffman (1980) explores the structure of psychomotor speed in order to isolate the primary factors of speed and determine their relation, and the relation of measures to assess the speed of movement with other measures of motor skills. The study was conducted on 674 male subjects. It was applied 13 variables to assess the speed and 7 to estimate the speed of simple movements and 6 to assess the frequency of movements. Other motor area that is defined by 21 hypothetical factor was estimated from the 97 motor tests. At the end of verified canonical analysis the author concludes that the structure of the first pair of canonical factors indicates the importance of the general factor of speed of movement in the realization of other motor skills.

Initially, the entire motor area was studied with a view to its reduction to a smaller number of latent dimensions that characterize it (Zara, 1972; Opavsky, 1975; Zaciorski, 1975), and very often only one segment of the motor space (for example, strength, endurance, speed, etc.). Very often the subject of motor space encompassing a population of students (Hosek and Metikoš 1972, and Mraković Metikoš 1976, Jankovic, 1981; Milanovic, 1981; Metikoš, Prot, Hofman, 1982). Certain studies have studied the motor area of physical education students (Furjan, 1987; Pavlovic, 2004; Trivun and Pavlovic, 2004; Pavlovic, 2005). All these studies were conducted in order to enable the existence of primary motor factors that characterize a defined population. Differences were observed in terms of gender, activities involving subjects, etc… Based on these results we can with some certainty define the primary motor factors for a population. The interesting and very important researches, which are closely tied to the survey, that were conducted on a population of students. As a fundamental research is the study Kurelića and assoc. (1975) in a sample of 3423 respondents of both sexes from 11, 13, 15 and 17 years, performed factor analysis of 37 motor tests and the final results were published 1975 in the monograph, “The Structure and Development of morphological and motor dimensions of youth.” The assumed hierarchical model in the first level was based on phenomenological studies of the factor structure of motor abilities of Fleishman and Ismailia. The primary factors were not isolated, at least not such that would have a logical significance of latent dimensions of the first order. In the space of second-order factors were obtained as defined in Gredelj et all. Connection of isolated factors in the space of a higher order factor indicates the existence of central control of movement, while the third and fourth correlation factor indicates that there are factors of the movement of energy regulation comprising of the third kind order. For the variability of motor manifest abilities responsible are four factors mentioned in whose grounds are the physiological mechanisms. Interesting research conducted Sturm (1970), with measurements carried out in 28 tests of physical abilities of students of both sexes of 8 and 12 years of age from Ljubljana elementary schools, and report on the reliability and factor analysis of these tests he published in 1970. Factor analysis extracted four factors in
all groups of respondents: explosive strength, repetitive strength, repetitive strength of the body, speed. In addition to these factors in a 12-year-old boy appeared the primary factor that the author called factor OF „sprint“, and IN the 8-year old boys and girls appeared a special factor of balance. Malacko and Ropert (1977) examined the latent motor structure on a sample of 312 boys age between 10-12 years. With the method of factor analysis they condensed the latent dimensions as a three-dimensional model of speed power, speed of reaction and speed of individual movements without much load, based on which the common variance was explained of the applied motor variables.

Some authors have studied the younger school years. Babic (1985) investigated the factor structure of motor abilities of students aged 10 years, where the application of 15 motor tests, using factor analysis for the goal of the explication of the common variability of motor abilities, latent dimensions were extracted and interpreted as a two-dimensional model of explosive power and flexibility. Malacko (1991) investigated the factor structure of motor space on a sample of 103 boys aged 11 years. Using the battery of 18 motor tests, factor analysis condensed latent dimensions were interpreted as six dimensional model of repetitive strength, frequency of movement, speed of alternative movements, speed of the hands and feet, body coordination and explosive strength with which was explained the mutual variance of manifest variables. Wolf-Cvitak and Furjan-Mandic (1999) tested 32 girls, aged 10-12 years with 9 composite motor tests in order to determine the structure of the motor space, with isolated and defined 3 factors: agility, balance and coordination. The obtained factors, the authors argue, are saturated by the explosive force, as found by other researchers using a sample of this age. Kukolj et all. (2001) for the purpose of longitudinal studies had interconnectedness of motor abilities during sensible periods. This study included 235 students and 214 students from first to third grade of elementary school. The authors come to the conclusion that the development of motor skills of students tends to constant improvement. The results of this study can serve as an objective basis for selection of specific content of training in the absence of functional tests (running from 1500 to 5000m).

Samardzic (2009) on a sample of 124 students aged 7 years in Novi Sad, conducted a research with the aim of determining the hierarchical structure of the motor dimensions and their relationships. Applied are a total of 17 variables on a functional model, by application of factor analysis were extracted five factors, which are defined as latent dimensions. Interesting researches are of motor area in secondary school age who were of interest to some authors. Gajic et all. 1981st on a sample of 608 students and 670 female students aged 11-15 years of age with 30 motor tests were analyzed the explosive force of the lower extremities, with eight latent dimensions identified for all ages: ability to manifest power with explosive movements of the body and projecting of the body into the distance, explosive flexor muscle strength of legs, ability to perform frequent movements with lower extremities, the explosive force of impact character, ability to rapidly develop force for movement of the lower extremities, the ability to perform upper limb movements, structuring the movement of explosive character, the ability to sprint. The authors concluded that there are specific differences of these factors in relation to age and sex of respondents. Doder (1998) investigated the factor structure of motor space on a sample of 177 students, aged 11-14 years. Using the system of 12 motor measuring instruments using factor analysis were extracted the four basic factors: coordination, repetitive static strength, explosive strength and flexibility. Dragaš (1998) in a sample of 153 students, aged 15-16 years examined the factor structure of motor abilities. Using the battery of 19 motor tests the
existence of five latent dimensions was determined, defined as a five dimensional general model of coordination, explosive strength, frequency of movement, precision shooting and precision targeting.

Based on the results of previous studies was defined the scope of this study which included motor skills of older pupils of school age in order to determine and establish a model of latent motor dimensions that determines the best-defined population of students.

**METHOD OF WORK**

**The sample respondents**

The population from which is the sample of respondents, was defined as the population of high school students from Prijedor, Prnjavor, Banja Luka and Doboj ages 15-16 years. The total sample size was 200 students, a sixth of the sample consisted of female respondents.

**The sample of measuring instruments**

In the selection of measurement instruments it was taken into account their reliability, objectivity and validity. For the purposes of this study a sample of 32 motor variables was identified:

**Variables for assessing explosive strength**: The long jump from standing point - MSDM, Triple jump from standing point-MTRS, Sargent jump-MSAR, throwing medicine balls lying on back (2kg)-MBMD;

**Variables for assessing repetitive strength**: push ups- MSKL, raising body-MDTK, Pushing up rear on horizontal bar -MZGV, deep squat (20kg against the wall at 30")-MDCO;

**Variables to assess the static strength**: hold in knuckle the- MVIS, flexing with hands (20kg)-MFLE, hold in half squat (20kg)-MPOČ, hold abs-MDTI;

**The variables for the estimation of the velocity**: 20 m flying-M20L, hand tapping-MTAP, foot tapping- MTAN, a 20m high start-M20V;

**Variables for assessing the flexibility**: depth reach on bench-MDPK, flex stick-MISP, lateral split-MSPA, forward bend in sitting position feet apart-MRAS;

**Variables for evaluation of coordination**: keeping the ball around the stands-MVLS, agility in the air-MOZ, dribbling around the stalks with MVLSN, Coordination with stick-MKOP;

**Variables for estimation of endurance**: run 100m-M100, run 400m-M400 run, run 800m-M800, run 1000m-M1000;

**Variables to assess the factors of balance**: standing on one leg on the longitudinal beam MSUOO-open eyes, standing on one foot on the beam cross-MSPOO eyes open, standing on one foot transversely to the beam-closed eyes MSPZO, flamingo-MFLA. The applied set of motor variables are taken from research Kurelić, Momirović, Stojanovic, and Sturm-Viskić Stalec, 1975; Ivanić i Ivanić, 1999.

**RESULTS AND DISCUSSION**

In factor analysis of a set of motor skills was applied GK normalization procedure, with the selected method of principal components (Varimax normalization). All the
obtained latent dimensions are defined by the principle of the phenomenological model (Table 1, 2). A set of 32 manifest motor skills was explained with 51.26% of common variance. Eight factors has been identified, defined as latent dimensions that determine the total variance of the motor system of the analyzed subjects.

**Table 1. Eigenvalues; Extraction: Principal components**

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<tr>
<th>Factor</th>
<th>Eigenval</th>
<th>% total Variance</th>
<th>Cumul. Eigenval</th>
<th>Cumul. %</th>
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<td>4.84</td>
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<td>Factor 8</td>
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<td>3.95</td>
<td>16.40</td>
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</table>

*Legend: Eigenvalues-typical root; %total Variance-variance single factor; Cumul.Eigenval-sum root; Cumul.%-of the total variance*

**Table 2. Load factor (Varimax normalized)**

<table>
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<tr>
<th>Factor 1</th>
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<th>Factor 3</th>
<th>Factor 4</th>
<th>Factor 5</th>
<th>Factor 6</th>
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The largest contribution to the saturation of the first factor have made the running variables (100m, 400m, 800m, 1000m) defined as variables of aerobic and anaerobic endurance with total 16 per cent in the explanation of mutual system variance with eigenval. 5.10, which indicates a high saturation of the vector in the coordinate system. In addition to endurance variables contribution to the total variance of the first isolation of factors also enabled the variables of the explosive power, jump out from the spot and the triple jump from the spot with a slightly smaller impact. Such saturation of the first factor that plays a key role in explaining the common variance of the system lies in the fact that the isolated variables are dominant in endurance activities that respondents exercise, running, jumping in athletics and also in sports and some individual sports. These variables are controlled by mechanisms of energy and central regulation and movement and partly genetically predetermined and some are not particularly on longer routes, where have some influence physiological mechanisms. However, variables that are most responsible for the extraction of the first factor are responsible for the aerobic-anaerobic endurance. There fore, this factor can be interpreted as a latent dimension of *aerobic and anaerobic endurance* of the respondent.

Another factor in the Varimax rotation define the variables of balance which showed a high homogeneity of the group: transverse standing on a bench with eyes open (MSPOO .83), standing along the bench with open eyes (MSUOO .76), standing cross-bench with eyes closed (MSPZO .74), flamingo (MFLA -.48) with a smaller projection which is the smallest holder of the variability. This factor is exhausted 6.73% of common variance of the system with eigen value (2.15) that is greater than zero, and reserves the right to extraction. The values of the factor determination and communality values are of high projections. It is obvious that this set is positioned close to the largest number of manifest variables which passes next to his stack. Such is the position of the coordinate system and the behavior of this factor as a secondary what in relation to the first determines the highest measure of common variability of the extracted factors (latent dimensions). Other variables in the defined area made insignificant vector strengths and they and their values are small and almost zero which further positions the value of the extracted variables balance. Regarding that in other factor were isolated variables by which the balance of the body was estimated, the second extracted factor can be interpreted as a latent dimension of *balance*.

The third latent dimension define two latent motor variables with projections of more than>.70. as follows: running a 20m high start (M20V .80) and running 20m flying start (20ml .84) as the main proponent of variability of this factor. Statistically significant screening variables explain 5.79% of the common variance of the system with the retained net value greater than zero (eigen.=1.85). Extracted significant variables whose projections are of vector >.70 describe the sprint speed tests. Communalities of extracted variables are of significant projections. An interesting fact is the behavior of variables of explosive strength, standing long jump, triple jump and medicine ball throw which by their positioning in the coordinate system contributed to a better extraction of factors. Their values range from (MBMD .53) (MTRS .55) to (MSDM .58). From this it can be concluded that their
projections define the third factor as a latent dimension of sprint speed and explosive power.

Analysis of projections in the fourth isolated growth factor reveals important values of variables of segment speed hand tapping (MTAP .71) and taping the foot (MTAN .69). Both manifest variables are from in the velocity space and are influenced by mechanisms of central control of movement with significant values of communality and variance of 5.45%, with eigenvalue 1.75. Another variable that has allowed a better extraction is variable from space coordination agility in the air (MOZ -.64) and coordination of bat (MKOP -.51). These two variables define the coordination of the whole body. Based on these indicators, the fourth factor defines latent dimension of segment speed and body coordination.

The fifth factor carries information not contained in the preceding. It exhausted 4.84% of total variance of the motor space of the system with the relevant value of the characteristic roots. Manifest measures set by the independent extraction of this factor are from the space of repetitive power that are push ups (MSKLE .66), raising body (MDTK .56) as the main carriers of the total variability. Also, the flexibility of the pelvis variables (MSPA .54) and the reach of the sitting (MSRAS .48) by their slightly smaller projections contributed to the extraction of this factor. Beside them is a variable explosive strength of high jump from standing (MSAR. 48). That their projections are significant show values of communality. This factor could be defined as the dimension of repetitive power and flexibility of the pelvis.

In space defined by the sixth factor it was explained a smaller part of the common variance of the system which included the participation of three manifest variables of static strength and a variable of repetitive force. Although their projections <.70 retained the right to extract given the eigen value that is greater than zero (1.43). The main carrier of the variability to the sixth factor is the variable deep squat with a load (MDČO .55), then hold in the knuckle (MVIS .50) and hold of load in the flexion of hands (MFLE .49). These three variables are very close together in the coordinate system of the motor space. Also, communalities of extracted variables are of satisfactory values. The variable that contributed to its position in the extraction of this factor is pull-ups (MZGV.44). With four extracted variables it was explained a total of 4.48% common variance of the system. Based on the vector saturations sixth factor can be defined as the dimension of static strength of arms and shoulders.

As the penultimate seventh factor that independently took part in defining the structure of the motor space of defined population of respondents is the factor that is defined with only one variable of static strength, and, as such, explained 4.07% of total common variance of motor space. The variable hold of load in hold half squat (MPOČ .76) retained a higher value of .70 and significantly different from zero (Eigen.1.30), which has acquired to it the right to self-extraction. Such facts speak in favor of it that it is a heterogeneous sample where we do not have a good relationship between the variables in the same space or some variables were too easy or too difficult for respondents. The seventh factor is defined as the latent dimension of static leg strength. It's variance gave the contribution of less than 13% in explaining the common variance of the overall system.

As the last eight extracted motor space factor is a factor which is defined by two variables of coordination. Their share in the common variance of the system amounts to 3.95% with a still satisfactory eigen. value (1.26). Although still a small enough variance for independent extraction of the motor space. The main carrier of the variability is variable dribbling between the stands with legs (MVLSN.74) and guiding the ball between stands with hands (MVLS .64). The values of the factor determination and communality values
are of high projection (h=.52 - .64). It is obvious that this set is positioned close to the largest number of manifest variable switch passes next to his stack. This position in the coordinate system is also behavior of this factor as a secondary what in relation to the previous seven sets also determines the greatest measure of common variability of extracted factors (latent dimensions). Since in the eighth factor are isolated variables which assessed coordination of arms and legs. This extracted factor can be interpreted as a latent dimension of coordination of limbs.

Table 3. Correlation factors

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<tr>
<th></th>
<th>1</th>
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<th>4</th>
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By the inspection of the correlation matrix of isolated motor factors (Table 3) correlation of the first factor were observed (Factor 1) with the third, fifth and sixth, that is endurance to sprint speed and explosive power where is a negative correlation (Factor 3=-.54) but significant, A positive correlation with the repetitive power (Factor 5=.37) and static strength (Factor 6=.34) with mean values. The third factor (Factor 3) has established a negative correlation with the fifth factor, that is sprint speed and explosive and repetitive strength and flexibility (Factor 5=-.46). Factor 4 and Factor 8 and also made a small negative correlation (-.24) and with Factor 7 Factor 8 positive correlation (.28). Almost zero correlation was achieved between the other factor balance with all the other. Here you can spot the links within the variable mechanism of energy regulation which are mostly positive and the central control variables which are generally negative. Since it is about a lack of homogenity of the motor space. When it comes to basic manifest variables in the common set, then this correlations are justified.

This study is similar to previous studies that have treated the issue of regulation of motor areas of the student population (Gajic et al. 1981; Doder, 1998; Dragaš, 1998). The results obtained enabled the interpretation of the motor space from the perspective of phenomenological models which is very common in research in physical education. It is possible, however, small differences between this sample and sample of previous research are the consequences of certain endogeno-exogenous factors that have significant influence in the formation of motor habits in students. Also the existence of motor factors depends from development and condition of the population, that is age of respondents. It is known that motor skills exercise achieve trend of growth in individual life ages of respondents, when their development can be much more influenced and achieve better results (Kukolj, 2001; Pavlovic, 2010). Also directed physical activity is very important in the formation of the motor model that would characterize a population. In our research we have a situation that a number of students (½) are involved in physical activities out of school, training in sports clubs, and their motor structure is the result of physical activity and motor skills that are most represented in the implementation of physical activity.

CONCLUSION
After processing the data and the results obtained using factor analysis in a defined motor behavior was isolated a smaller number of latent dimensions based on the applied of the actual manifest variables in the group of patients. In the area of motor skills, factor analysis revealed the existence of eight different factors defined as the latent dimensions of aerobic-anaerobic endurance, balance, sprint speed and explosive power, segment speed and coordination of the body, repetitive power and flexibility of the pelvis, static strength of arms and shoulders, static leg strength, coordination of limbs. Here is the phenomenon of integration of variables within a single mechanism of central regulation of energy or movement. Which indicates a certain independence of the variables defined subspace within motor space. n the motor space is clearly defined eight different latent dimensions. That have stood out as unique to this population of respondents, which formed a common model motor space, which is best defined study population, age 15-16 years of age.

REFERENCES


EFFECT OF MOTORIC SPACE ON EXPLOSIVE STRENGTH OF LOWER EXTREMITIES IN BOYS

ABSTRAKT

In a sample of 70 seventh-grade male students from Belgrade attending primary school Marija Bursać a research was carried out to assess the effect of motoric space on the hypothetical motoric factor for the assessment of explosive strength of lower extremities. By the Linear regression analysis there was revealed a statistically significant effect of the predictor system (motoric factors) on the criterion. Based on the value of the standardized coefficients Beta the largest and statistically significant effect on the criterion variable was made by the variables which evaluate the hypothetical motoric factor of agility, subordinate to the functional mechanism for structuring of movement and hypothetical motoric factors of the static muscle strength of arms and shoulders and static muscle strength of the hand flexor, subordinate to the functional mechanism for the regulation of excitation. Statistically significant effect was not achieved regarding the functional mechanism for synergetic regulation and regulation of muscle tone.

Keywords: motoric, boys, linear regression analysis

1. INTRODUCTION

Movement expressions of the human are diverse, there is practically unlimited number of possible movements of different kinematic and dynamic structures that are simultaneously determined by some complex internal factors. The movement is perceived visually and expressed with some physical quantities - length, time, altitude, etc.. However it is important to note that the manifest forms of motion can be expressed primarily due to some hidden (latent) abilities of an individual that are impossible to be measured directly, but the existence of their presence can be felt (Bala, Stojanovic, Stojanovic, 2007). One of the main goals of kinesiology itself is among other determining the functional mechanisms responsible for latent motoric dimensions of man.

In the essence of every programmed and accurately determined physical activity there is a large number of physiological and metabolic processes. A body involved in a physical activity in such a manner respond with changes in almost all physiological systems, primarily musculoskeletal, cardiovascular, respiratory, endocrine and immune system (Mišigoj-Durakovic, 2006).

Given that the explosive strength belongs to the factor of the functional mechanism for the regulation of excitation intensity, and it was scientifically proven to be genetically quite predestined with 80% (the impact with the kinesiology treatment is still present) and to
have a specific feature of a general type, which in the field of physical education and sport has a huge role, and in practice that means that an individual who has a strong service in volleyball would have good jumping ability, and somewhat rapid change of direction. The explosive strength with its existence fulfills each equation of the specification in any movement activity which is agonology (competitive) directed.

Research conducted by (Stojanovic, Nikolic and Nesic, 2006) supports the effect of morphological characteristics on the explosive strength on a sample of 40 male volleyball players aged 13. They took nine anthropometric measures as a system of predictor variables and 3 motoric tests to assess explosive strength. By regression analysis the existence of the effect of the system of predictors on the criterion was confirmed, which allows to securely predict the results in manifestation of the explosive strength (the mechanism for the regulation of excitation intensity).

On a representative stratified sample consisted of 49 sport dancers divided into subsamples of 25 girls and 24 boys Lukic, Bijelic, Zagorc and Zuhrić-Sebic (2011) investigated the importance of the effect of strength on the technique of performance in sport dancing. By regression analysis it was determined the existence of a statistically significant effect of strength on performance of Latin American dances, and a statistical significance of the effect of the strength on the performance of standard dances was not determined In a sample of 42 students of Faculty of Kinesiology of the University of Split, Rogulj, Foretić, Srhoj, Cavala and Papic (2007) analyzed the effect of basic motoric abilities on the speed of the ball in handball. The system of predictors consisted of 8 variables for assessing agility, speed, frequency of motion, endurance and explosive and repetitive strength, while the speed of the ball as the criterion variable was assessed with a radar gun. The results of the regression analyzes indicate that the motoric efficiency to a great extent determines the efficiency of the speed of the ball. Individually analyzed the speed of the ball is statistically determined only with the explosive strength. This is understandable because this motoric ability from the kinesiological and anatomical point of view (in terms of the kinetic chain and sequence of movements) defines the result of the speed of the ball.

The strength of children decreases as they grow and get heavier. This especially happens in puberty in the period of rapid growth and development. Most often the strength of children in childhood and puberty decreases because during maturation the muscles of an adult produce more power per unit weight. So, in childhood there are two simultaneous processes going on with different effects - growth (increase in body size) and maturation. Due to growth the strength decreases, while at the same time it increases due to maturation. The superposition of the two processes determines the increase or decrease of the demonstrated strength, and their interaction in the development of a child is very important (Zatsiorsky, Kraemer, 2009).

The aim of the research is to determine which of the hypothetical motoric factors most affect the expression of the motoric factor of explosive strength of the lower extremities of children aged 13 and 14 from Belgrade.

2. METHOD

For the purpose of the research will be used empirical and statistical methods. The research will be of transversal character (it implies only one measurement on a sample of schoolchildren from Belgrade). A non-experimental research design will be applied, that is ex post facto design.
The research was conducted on a sample of 70 male subjects who attended the seventh grade of primary school Marija Bursac in Belgrade, aged 13 and 14. To assess the motoric space as the predictor system there were applied seven motoric variables that covered following hypothetical motoric models. The motoric model of functional mechanism for synergistic regulation and regulation of muscle tone which is superior to the hypothetical motoric factor of the general equilibrium was assessed with the motoric test Flamingo balance test (MFLAMI); the hypothetical motoric factor of the speed of alternative hand movements with the motoric test Hand tapping test (MTAPRU) and the factor of mobility in the hip joint with the motoric factor Forward bend in sitting test (MPRETS). The motoric model of the functional mechanism for the regulation of excitation duration which is superior to the hypothetical motoric factor of the static strength of the hand flexor muscles with the motoric test Hand grip (MSTSAK); the hypothetical motoric factor of the repetitive body muscles strength and the flexor in the hip joint with the motoric test Body lifting in 30 seconds (MPODTR) and the motoric factor of the static strength of the muscles of the arms and shoulder with the motoric test Endurance in pull-ups (MIZDZG). The motoric model of the functional mechanism for structuring of movement which is superior to the hypothetical motoric factor for assessment of agility was assessed with the motoric test Pin running 10x5 meters (MT10X5).

The functional mechanism for the regulation of excitation intensity superior to the hypothetical motoric factor of the explosive strength of the leg extensor muscle as a criterion variable in this paper is assessed with the motoric test Standing long jump (MSKODA).

The modified "Eurofit" battery of tests prescribed by the Committee for the Development of Sport of the Council of Europe was applied (Council of Europe, 1993).

Statistical data processing with the Kinesiology statistics will be carried out in several stages:

1) For all variables were determined the descriptive statistics, of the measures of central tendency: the arithmetic mean (AM), median (M), the modal value (MOD), of the measures of variability: the standard deviation (S), the minimum value of the results (MIN), maximum value of the results (MAX), and of the measures of the forms of distribution: the measure of symmetry of distribution-skewness (SKEW) and the measure of homogeneity of distribution-kurtosis (KURT).

2) Then the normality of distribution for all variables using the Kolmogorov-Smirnov test was tested.

3) With the linear regression analysis there was determined the effect of the set of hypothetical motoric factors (which presented the system of independent variables in this paper) on the assessment of the motoric factor which is based on the mechanism for the regulation of excitation intensity for the
assessment of explosive strength of the lower extremities in male children (as the criterion variable in the paper).

3. RESULTS

Table 1. DESCRIPTIVE STATISTICS OF MOTORIC VARIABLES

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>AM</th>
<th>M</th>
<th>MOD</th>
<th>S</th>
<th>MIN</th>
<th>MAX</th>
<th>SKEW</th>
<th>KURT</th>
</tr>
</thead>
<tbody>
<tr>
<td>MFLAMI</td>
<td>16.44</td>
<td>16.00</td>
<td>20</td>
<td>6,340</td>
<td>6</td>
<td>30</td>
<td>0.280</td>
<td>-809</td>
</tr>
<tr>
<td>MTAPRU</td>
<td>12,300</td>
<td>12,200</td>
<td>13.0</td>
<td>1,1890</td>
<td>10.0</td>
<td>15.0</td>
<td>0,200</td>
<td>-414</td>
</tr>
<tr>
<td>MPRETS</td>
<td>17,30</td>
<td>15.00</td>
<td>12</td>
<td>7,498</td>
<td>8</td>
<td>40</td>
<td>1,018</td>
<td>0,346</td>
</tr>
<tr>
<td>MSKODA</td>
<td>172,04</td>
<td>171,50</td>
<td>161</td>
<td>25,241</td>
<td>114</td>
<td>221</td>
<td>-231</td>
<td>-557</td>
</tr>
<tr>
<td>MTSASK</td>
<td>32.83</td>
<td>30.00</td>
<td>26</td>
<td>9,299</td>
<td>19</td>
<td>64</td>
<td>0.992</td>
<td>0.754</td>
</tr>
<tr>
<td>MPODTR</td>
<td>24.29</td>
<td>24.50</td>
<td>25</td>
<td>3,620</td>
<td>17</td>
<td>33</td>
<td>0.192</td>
<td>-503</td>
</tr>
<tr>
<td>MIZDZG</td>
<td>17,159</td>
<td>13,650</td>
<td>1.0</td>
<td>11,7240</td>
<td>1.0</td>
<td>60.0</td>
<td>1,286</td>
<td>1,807</td>
</tr>
<tr>
<td>MT10X5</td>
<td>20,797</td>
<td>20,250</td>
<td>19.0</td>
<td>2,1164</td>
<td>16.8</td>
<td>25.7</td>
<td>0.702</td>
<td>-112</td>
</tr>
</tbody>
</table>

Legend: AM-arithmetic mean; M-central value; MOD-the most frequent value; S-standard deviation; MIN-minimum value of results; MAX-maximum value of results; SKEW-measure of symmetry of distribution; KURT-measure of homogeneity of distribution.

Table 1. shows the measures of central tendency, the measures of variability and the measures of distribution shapes of the tested motoric variables. Based on the measures of asymmetry of distribution (Skewness) and their coefficients it can be seen that all skewness values have a positive sign and that it is below 1.00, except for the variables: Forward bend in sitting (MPRETS) 1.018 and the variable Endurance in pull-ups (MIZDZG) which have slightly higher value of 1.286. This suggests a grouping of the results in the zone of lower values and a slight positive asymmetry of these variables, which may indicate the severity of the motoric test in this sample of subjects, since the arithmetic mean, the median and the mode are in the zone of lower values. Mild negative skewness value is observed in the criterion variable Standing long jump (MSKODA) -0.231 which indicates a slight grouping of the results in the zone of higher values. Based on the measures of homogeneity (Kurtosis) it can also be seen from Table 1 that the variables which have a negative sign and a mild platycurtic distribution, and that indicates the increased dispersion of the results, that is, slightly reduced homogeneity. This is expressed in the following variables: Flamingo balance test (MFLAMI), Hand tapping (MTAPRU), Standing long jump (MSKODA), Body lifting (MPODTR) and Pin running 10x5 (MT10X5). In the variables Forward bend in sitting (MPRETS), Hand grip (MSTSAK) and Endurance in pull-ups (MIZDZG) there can be seen a positive curtic distribution i.e. (leptocurtic distribution) in which is expressed the grouping of the measurement results around the arithmetic mean, that is increased homogeneity of the measurement results in the three mentioned variables.
Table 2. KOLMOGOROV – SMIRNOV TEST OF NORMALITY OF DISTRIBUTION

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>KS</th>
<th>MEA</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>MFLAMI</td>
<td>0.891</td>
<td>0.106</td>
<td>0.406</td>
</tr>
<tr>
<td>MTAPRU</td>
<td>0.444</td>
<td>0.053</td>
<td>0.989</td>
</tr>
<tr>
<td>MPRETS</td>
<td>1.486</td>
<td>0.178</td>
<td>0.024</td>
</tr>
<tr>
<td>MSKODA</td>
<td>0.531</td>
<td>0.063</td>
<td>0.941</td>
</tr>
<tr>
<td>MSTSAK</td>
<td>1.217</td>
<td>0.145</td>
<td>0.103</td>
</tr>
<tr>
<td>MPODTR</td>
<td>0.780</td>
<td>0.093</td>
<td>0.577</td>
</tr>
<tr>
<td>MIZDZG</td>
<td>1.314</td>
<td>0.157</td>
<td>0.063</td>
</tr>
<tr>
<td>MT10X5</td>
<td>1.135</td>
<td>0.136</td>
<td>0.152</td>
</tr>
</tbody>
</table>

Legend: KS-value of Kolmogorov-Smirnov test; MEA-absolute extreme deviation; P-statistic significance for KS-test.

From Table 2, based on (MEA) absolute extreme deviation, the values of the Kolmogorov-Smirnov coefficient (KS) and the significance of two-way testing for KS coefficient (p) it can be seen that all KS values are above the value of the absolute extreme deviation, and the statistical significance of the two-way testing above the values 0.01. Based on the above it can be concluded that the distributions in all variables do not differ statistically significantly from the normal distribution. With the review of the statistical significance of the variable: Forward bend in sitting (MPRETS) and the variable Endurance in pull-ups (MIZDZG) it can be seen that in these variables deviation occurs most. This can be seen by ordinary inspection of the coefficients for assessment of the shape of distribution. For the purposes of this research it is sufficient that the distribution of the tested variables do not statistically significantly differs from the theoretical distribution.

Table 3. STATISTICS OF LINEAR REGRESSION ANALYSIS OF CRITERION VARIABLE

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>r</th>
<th>rpart.</th>
<th>Beta</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>MFLAMI</td>
<td>-0.366</td>
<td>-0.197</td>
<td>-0.149</td>
<td>-1.585</td>
<td>0.118</td>
</tr>
<tr>
<td>MTAPRU</td>
<td>-0.357</td>
<td>-0.183</td>
<td>-0.133</td>
<td>-1.466</td>
<td>0.148</td>
</tr>
<tr>
<td>MPRETS</td>
<td>0.268</td>
<td>0.177</td>
<td>0.123</td>
<td>1.418</td>
<td>0.161</td>
</tr>
<tr>
<td>MSTSAK</td>
<td>0.178</td>
<td>0.247</td>
<td>0.182</td>
<td>2.008</td>
<td>0.049</td>
</tr>
<tr>
<td>MPODTR</td>
<td>0.440</td>
<td>0.027</td>
<td>0.024</td>
<td>0.213</td>
<td>0.832</td>
</tr>
<tr>
<td>MIZDZG</td>
<td>0.451</td>
<td>0.248</td>
<td>0.199</td>
<td>2.011</td>
<td>0.049</td>
</tr>
<tr>
<td>MT10X5</td>
<td>-0.665</td>
<td>-0.465</td>
<td>-0.459</td>
<td>-4.140</td>
<td>0.000</td>
</tr>
</tbody>
</table>

R=0,757 R²=0,573 F=11,865 P=0,00

Legend: r- Pearson coefficient of correlation; rpart.-coefficient of partial correlation; Beta-standardized regression coefficients; t-distribution; p-level of significance of effect of predictors on criterion; R-coefficient of multiple correlation; R²-coefficient of determination; F-testing of relations of multiple correlation; P-level of significance of F relations.

We will start the interpretation of the shown results of the linear regression analysis with the values of the coefficient of the multiple correlation, as an indicator of the predictive
value of the system of predictor variables as a whole. From Table 3 we can see a very high value of the coefficient of the multiple correlation ($R = 0.757$), indicating that the applied system of predictors is statistically significantly associated with the criterion variable. The testing of significance of the multiple correlation of $F$ relation and the level of its significance can be seen that the value of $F$ relation is ($F = 11.868$) high, and its significance is less than $p = 0.01$, $p = 0.000$ respectively. The system of predictor variables explains 57.3% of the variability of the criterion ($R^2 = 0.573$) while for the rest of the variability of the criterion variable, which is not included in this research, responsible other characteristics and abilities of the anthropological space of the subjects. The values of the standardized coefficients (Beta), indicate the predictive value of the motoric variables. From Table 3 it can be observed, based on the beta coefficient, that the greatest effect on the criterion variable Standing long jump (MSKODA) has the variable Pin running 10x5 (MT10X5) whose coefficient has a mathematical negative, but logical positive sign, considering it is about the inverse metric -0.459 at the level of significance $p = 0.000$. Variable Endurance in pull-ups (MIZDZG) with Beta coefficient of 0.199, and the variable Hand grip (MSTSAK) 0.182 are also statistically significant at the level $p = 0.049$. It is these variables that show the highest correlation with regular inspection of the Pearson correlation coefficient ($r$) and partial correlation ($r_{part.}$) with the criterion variable, after partialisation of the effect of other variables in the system of predictors.

4. DISCUSSION

Probably the majority of kinesiology experts will agree that one of the most important abilities in most motion activities is explosive strength, the ability to produce maximum force values in a time-limited period. Most of the key movement structures in a large number depends primarily on this ability (fast first step in running, sprinting over short distances, change of direction and pace of movement, performance of high jump and many other movement structures). Understanding and knowledge of the kinanthropology analysis of motion allows us to analyze the performance of movement in humans in terms of muscle contractions. To be able to predict, prevent and eliminate certain lack in respect of the movement structure it is necessary to determine which of the factors most affect and define that structure.

As can be summarized from so far mentioned, the greatest effect on the factor for assessment of the explosive strength of the leg extensor muscle (which, with quite high coefficient, makes specific movement structures) was achieved by the factor for the assessment of the agility with the largest effect, followed by the factor of the static strength of muscles of arms and shoulders and the factor of the static strength of the hand flexors muscles.

Position of the agility in the general motoric space was considered differently. Gredelj et al. (1975) classify agility among the capabilities that are subordinate to the mechanism for structuring of movement, within which are also coordinating abilities and the speed of alternative movements.

Bompa (1999) treats the agility as a combined motoric ability of the fundamental abilities of speed and coordination and explains the high incidence of the agility in the development of the ability of streng along with the abilities of the maximum strength and maximum speed. Given that the sample of subjects is specific for defining such problems, the major effect of the agility can be explained by the fact that children in addition to the regular practice of physical education also practice additional kinesiology activities included in the training process of complex sports in which the agility dominates (football, basketball). Of course, physical education at this age is practiced in a part of such vacant teaching contents in which the agility is developed. Since the factors of the static muscle
strength of arms and shoulders and hand flexors muscles also influenced the explosive force of the leg extensor muscles in children, it is to assume that one part of the sample is probably involved in a training process in the field of martial arts in which the static strength of these two factors has a big impact. The children may have been subjected to earlier estimates of motoric abilities in sports organizations, and so this also must be taken into account. Internal and external validity of the research was not controlled, nor the sample was randomized (randomly selected) and it cannot certainly be said that there are no children who are involved in different types of training process in the sample. In any case, the usefulness of this research for practice reflects primarily on the help for teachers in schools, who are a link in the chain for the selection in sports. Based on the value of the results obtained there could be planned the majority of the sample for the section of complex and partly polystructural sports within the school if there are conditions for that or direct the children to sports clubs.

5. CONCLUSION

The research was conducted in order to determine which of the hypothetical motoric factors mostly affects the expression of the motoric factor of the explosive strength of the lower extremities of the seventh grade children aged 13 and 14. Linear regression analysis showed the highest effect of the hypothetical motoric factor of the agility that is subordinate to the functional mechanism for structuring of movement and the hypothetical motoric factors of the static strength of muscles of arms and shoulders and the static strength of the hand flexor muscles subordinate to the functional mechanism for the regulation of excitation duration. Statistically significant effect was not achieved in terms of the functional mechanism for synergetic regulation and regulation of muscle tone.

It can be concluded that, with increasing of the factors of the explosive strength of the lower extremities, physical education in schools which can be less affected (given that there is a curriculum that is already prescribed) or a training process within the school sections (whose influence can be greater) should be directed and conceived at training the agility, training to increase the static strength of arms and shoulders and the static strength of hand flexor.

6. BIBLIOGRAPHY

EFFECTS OF TRAINING WORK MODEL ON THE DEVELOPMENT OF SPEED STRENGTH OF SPORTS PLAYERS

ABSTRACT

Twelve tests were used in order to assess the motor abilities of 42 young sports players, 14 and 15 years old. The aim of the research was to establish the effects of the training work model on the development of speed strength of sports players. The results of the canonical analysis showed that the used tools such as physical exercise, methods and exerting training efforts in the experimental period had a positive influence on the increase of the level of body adaptation of the examinees. Under the influence of the training work for speed strength development, significant increase of the motor abilities of the examinees took place, in the final as compared to the initial state.

Key words: sports players, speed strength, initial and final measurement, discriminatory analysis

1. INTRODUCTION

The process of adaptation of the whole body and its specific functions to the applied devices for physical exercising is essential for the increase of the fitness level of sports players. The fitness level (according to Farfelj 1983, Matvejev et al. 2000, Željaskov 2003) is a result of a long-term adaptation in the course of which useful motor and functional changes or reaction take place which makes it possible to adjust efficiently to the specific muscular activity. The level and degree to which the body adapts to the applied devices depends on the character and scope of the training load.

According to some researchers (Naumovski 1984, Kukolj and Sar 2000, Holman and Hetinger 2000, Komes 2003, Pržulj 2007), the training load can be seen as the complex kind or strain exerted upon the body of sports players and its physiological influence depends on the following factors: coordinative structure of an exercise, the duration of exercising, the number of repetitions or series of exercise and the duration of a break between exercises or series.
Speed strength represents the ability of athletes to exert biggest possible efforts while moving at great speeds. It is characterized by the maximum intensity of the muscular effort at sports which demand cyclical work of the maximal intensity, at overcoming considerable strain (throwing, weight lifting) and during playing when maximally fast engagement of muscles is demanded i.e. the ability to move at the maximal speed and while the opponent is trying to prevent such performance. The improvement of speed and strength abilities of athletes has got an important place, both during the preparatory training period as well as during the training for competition.

Some scientists (Markov and Ozolin 1992, Bompa 2001), investigated experimentally the efficiency that training work shows in relation to the development of speed strength, mainly among the adult athletes. It is found out that the optimal level of speed strength is a very important component which makes it possible for athletes to achieve high results in competitive sports. Therefore, it can be assumed that the improvement of speed strength of young athletes can also lead to higher sports results.

On the basis of this hypothesis and previous researchs, the main problem of this research is to investigate whether a model of training work applied on the development of speed strength can influence the development of motor abilities among young athletes. In relation to this, it is needed to get an answer to the following question: whether a training that is focused on the development speed strength (as an experimental factor) will contribute to the knowledge that the established level of motoric abilities statistically considerably differs in the final correlation in comparison to the initial state of athletes. The main aim was to establish the effects of the model of training on the development of speed strength at the end of the experimental period among athletes.

2. METHOD

Population from which the sample is taken comprises of 42 examinees, young athletes 14 and 15 years old who are enrolled in the training process in sports clubs.

Motoric abilities were estimated with by use of the following tests: (1) Repetitive strength: lifting the torso up on the Swedish bench - MLTSB, mixed push-ups – MPUU and squats - MSQT. (2) Segmented speed (leg tapping – MTAL, arm tapping – MTAA, and leg tapping against the wall – MTAW; (3) Explosive strength (standing long jump – MLJS, standing triple-jump – MTRS and standing penta-jump – MPTS); (4) Flexibility (touch-toe on a bench – MTTB, split – MSPL and baton twist – MTWB). The applied set of variables is taken from the research by Kurelić, Momirović, Stojanović, Šturm i Viskić-Štalec 1975.

2.1 Experimental procedures for speed strength development

The experiment lasted for a month and it comprised of three hours of exercising per a week. The class consisted of the introductory, preparatory, main and final part of a class in sports clubs. Before the beginning of the class initial measuring was done. At the beginning of the realization process of the training work, all the exercises for speed strength development were learned so that the full concentration of the athletes could be focused on doing exercises as fast and strong as possible. The exercises were dynamic and they were practiced at times when the body of an athlete was rested and relaxed enough so that the central nervous system could successfully coordinate fast movements. For that purpose muscle relaxation was continually done during break intervals. Interval-serial method was
used for the speed strength development which comprised of jumping exercises and sprint running in alactate regime of work in order to improve the functional abilities of creatine – phosphate mechanism of ATP restitution.

3. RESEARCH RESULTS

Discriminatory results were used in order to find out whether there is a statistically significant difference between the results of the initial and final measuring of the motor abilities by use of a training model for speed strength development and in order to establish the variables which show the greatest contribution to the established difference or discrimination. The differences between the initial and final state are that were established by use of the experimental programme for speed strength development among sport players are presented in Tables, 1, 2, 3 and 4.

Table 1. The significance of the isolated discriminatory function

<table>
<thead>
<tr>
<th>Disc Func.</th>
<th>Eugenvalue</th>
<th>Canonical R</th>
<th>Wilks' Lambda</th>
<th>Chi-Sqr.</th>
<th>df</th>
<th>P-Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.379</td>
<td>.528</td>
<td>.621</td>
<td>48.648</td>
<td>2</td>
<td>.004*</td>
</tr>
</tbody>
</table>

Table 1 shows square coefficients of discriminations (Eugenvalue), coefficients of canonical correlation (Canonical R), results of Bertlet's test (Wilks' Lambda), results of Chi-Square test (Chi-Sqr), degree of freedom (df) and a sign for probability of error (P-Level) which in case the hypothesis is rejected renders to all the items the value of canonical correlation that equals zero.

One statistically significant discriminatory function of the medium intensity was obtained (CR=52.8%) and it shows what is the correlation of the data which served as the basis for the discriminatory analysis of the obtained results. The results of the discriminatory strength of Wilks –Lambda test motor variables (.621) indicates that the differences between the initial and final measuring in the field of examinee's motor abilities are significant (P=.004), which confirms the value of Chi-Sqr. Test which has got high value (Chi-Sqr = 48.648).

On the basis of the isolated discriminatory function results it can be concluded that there are statistically significant differences of motoric abilities between the initial and final measuring of the examinees.

Table 2. Factoral structure of the isolated discriminatory function

<table>
<thead>
<tr>
<th>Variables</th>
<th>Root 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPUU</td>
<td>.547</td>
</tr>
<tr>
<td>MSQT</td>
<td>.542</td>
</tr>
<tr>
<td>MLTSB</td>
<td>.485</td>
</tr>
<tr>
<td>MTAW</td>
<td>.448</td>
</tr>
<tr>
<td>MTAL</td>
<td>.432</td>
</tr>
<tr>
<td>MTAA</td>
<td>.424</td>
</tr>
<tr>
<td>MTRS</td>
<td>.410</td>
</tr>
</tbody>
</table>
Table 2 shows discriminatory function structure of the participation of motor abilities variables in the establishment of the important discriminatory functions. The group centroids the represent the arithmetic centre of the results of the initial and final measuring. In order to check the efficiency of the training model for speed strength development, 12 motor ability tests that are thought to be good predictors for the examined field were applied. The obtained results indicates that the tests of *repetitive strength* (mixed push-ups MPUU .547, squats MSQT .542 and lifting torso lifting on the Swedish bench - MLTSB 485) have got the greatest contribution to the establishment of the discriminatory function, the the tests of *segmented speed* (leg tapping against the wall – MTAW, leg tapping – MTAL .448, arm tapping – MTAA .432 and .424), and finally there are somewhat smaller tests of *flexibility* (touch-toe on a bench – MTTB.398, baton twist – MTWB .365 and split MSPL .288).

**Table 3. Group centroids**

<table>
<thead>
<tr>
<th>Measurements</th>
<th>Root 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial</td>
<td>.573</td>
</tr>
<tr>
<td>Final</td>
<td>-.573</td>
</tr>
</tbody>
</table>

Results in Table 3 represents the discriminatory function of centroids that was obtained on the basis of motor tests and it has got the following values .573 i -.573. The significance of the presented centroids is tested on the basis of their discriminatory function and it indicates that their distance (discrimination) is significant.

**Table 4. Classification matrix**

<table>
<thead>
<tr>
<th>Measurements</th>
<th>Percent correct</th>
<th>Initial p=.50000</th>
<th>Final P =.50000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial</td>
<td>77.34%</td>
<td>32</td>
<td>29</td>
</tr>
<tr>
<td>Final</td>
<td>74.05%</td>
<td>12</td>
<td>15</td>
</tr>
<tr>
<td>Total</td>
<td>75.69%</td>
<td>44</td>
<td>4</td>
</tr>
</tbody>
</table>

The group classification as presented in Table 4, as well as presentages indicate that such classification (discrimination) of the measurement results is explained by preciseness of 75.69% (the average value of all the group percentages) from the coefficient of canonical relation which is CR=52.85.

Obtained results of discriminatory analysis of motor ability tests between the initial and final measuring shows that significant changes of motor abilities of examinees took place under the influence of training work for speed strength development.
4. DISCUSSION

The results obtained in this research showed that, in the final as compared to the initial measuring (Table 1), under the influence of the training process for speed strength development, the examinees achieved better abilities of fast muscular contraction and improved their muscular elasticity, which is indicated by the results of factorals structure of the isolated discriminatory function.

Repetitive strength, segmented speed and explosive strength and, to a somewhat smaller degree flexibility, showed the biggest contribution to the discriminatory function. The training mechanisms that took place in the alacatel anaerobic regime with short-lasting intensity, also had a significant contribution, which enabled the optimal improvement of the functional abilities for the compensation of creatine-phosphate.

Some other researches had a similar approach to speed strength (Anohin 1970, Bompa 1994, Bowerman et al. 1998, Klark 2001). They noticed the increase, in the final as compared with the initial measuring, in the level of the coordinational relations of muscle innervation in the regime of fast. That is of big importance (according to these authors) for the improvement of the special speed strength endurance, and, at the same time, for the improvement of special physical fitness of sports players.

5. CONCLUSION

The research of the training model for speed strength development showed significantly positive influence of the programme on the obtained changes of the motor abilities of the young sports players. On the basis of the results of discriminatory analysis it was concluded that the training process lead to the positive changes of the motor abilities of the examinees. Because of such positive results, the research is recommended for the improvement of the repetitive and explosive strength, segmented strength and motor flexibility in everyday training practice.

6. REFERENCES

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EFFECTS OF TRAINING WORK MODEL ON THE DEVELOPMENT OF SPORTS PLAYERS' FUNCTIONAL ABILITIES

Summary
This research has been carried out in order to establish the effects of the training model for the development of functional abilities of sports players. Six tests for the functional abilities assessment were applied on the sample of 30 young sports players. By the use of the multivariant analysis the statistical significance was established (P — level 0.014) in the final, in comparison to the initial measurement.

Key words: sports players, functional abilities, variance analysis.

1. INTRODUCTION

A big number of researchers (Verhošanskiv 1981, Matvejev 1987, Najšteter 1997, Pržulj 2007) points out to the fact that by use of certain models of training work, a significant influence can be exerted upon the change of the anthropological characteristics, under the condition that methodical shape of exercises is maximally adapted to the individual abilities of sports players.

Such a process of exercising, according to some researchers (De Vries 1976, Malacko i Radosav 1985, Matvejev i Uлага 2000), needs to be based on the scientific facts along with the use of methods that comply with the level of sports players’ fitness.

The main problem of this article is to investigated whether, by used of programmed tools for functional abilities development, certain statistically significant differences between the functional abilities in the final measurement in comparison to the initial one. The aim of this research is to establish the effects of the training work model on the development of functional abilities among sports players.

2. METHODS

In order to follow the effects of a training model on the development of functional abilities among sports players, as the experimental programme in the research, the method of pedagogical experiment was used. Statistical method was used for the analysis the obtained data. Descriptive method and method of logical concluding was used for the description and explanation of the obtained results.

The research was carried out on the sample of 30 examinees, of a male sex, 11, 12 and 13 years old and all of them are enrolled into the training work of different sports clubs.
of East Sarajevo. The sample of measuring instruments comprised of the test of functional abilities: vital capacity of lungs (FVPUL), Margery test for the assessment of anaerobic capacity (FMARG), Harvard step-test for the assessment of a pulse frequency after training (F02LM), systolic pressure (FTASI) and diastolic pressure (FTADI).

2.1 Experimental procedures for the development of functional abilities

Experimental programmes for functional abilities development exercises was carried out in East Sarajevo. It lasted for a month and it comprised for classes of exercising per a week. The structure of each class of training work comprised of introductory, main and final part of the class. Initial measurement (at the beginning of the treatment) and final measurement (at the end of the treatment) of the same measuring instruments for the assessment of functional abilities were carried out.

The use of physical exercising tools was directed towards the improvement of glycolytic abilities (the exposure to effort lasted from 20-30 seconds to 1.5-2 minutes) and anaerobic abilities (it was mostly repeated effort that lasted about 7-8 minutes).

In order to improve anaerobic alactate mechanism, the regime of work comprised exercises that enabled the development of sprint speed endurance, i.e. the development of ability to repeat short distances in the form of interval work. The effort was of almost maximal intensity (about 95%) and of short span (4-10 seconds), which corresponded to the distances from 20 to 80 meters. Breaks between series lasted from 20 seconds to 2 minutes. The training was usually carried out in 3-5 series with 4-6 repeatings of elements in each series along with the use of relaxing intervals of 3-5 minutes in each series in order to make up for creatin phosphate.

In order to develop glycolytic anaerobic mechanism exercises that lasted 20-40 seconds and longer were used, at distances of 200-600 meters. The exercises were carried out with the highest intensity from the beginning until the end (for example, running back and forth, exercises of running techniques of 2 or 3 sports players), while the pulse rate was above 180 beats/min, which indicates that the training was carried out in anaerobic phase. The number of repeating was about 4 times, the number of series 2-4, and relaxing time between the series was 10-15 minutes for exercises of small intensity.

For the development of aerobic and non-aerobic abilities that are important for special endurance of sports players, the method of repeating effort was mainly used. The exercises were mostly technical and tactical (of a situational character) and they lasted from 5-8 minutes, and were repeated 4-6 times with the break of a small intensity of 3-5 minutes between repeating. The pulse rate ranged from 150-180 beats/min.

For the development of aerobic abilities, the repeating exercises that took about 7-8 minutes and longer were carried out, the single exercises took up to 30 minutes were used. The intensity of exercising was high, the pulse rate went up to 180 beats/min and more, and therefore it would cause the lack of oxygen.

1 Such a training model is suggested by many researchers (Anohin 1970, De Vries 1976, Hofman, 1980, Heimar i saradnici 1997, Malacko 2002, Željaskov 2003) since it causes the high use of creatin-phosphate in muscle cells. Namely, it fully activates the creatin-phosphate mechanism that creates the energy that is needed for resynthesis of ATP on muscle cells (alacte regime).

2 According to Željaskov 2003, such work that is done in intervals fully engages glycolytic mechanism of resynthesis (updates) ATP and it produces a big amounts of lactates in muscles, that are being eliminated from muscles and blood during breaks.

3 The trainings that combine aerobic and anaerobic exercises (according Matvejevu 2000) makes up 95% of the overall training work in the training period.

4 After the previous work (according to Markovu and Ozolinu 1992) new training effort needs to exerted when
The data that were obtained through the initial and final measurement among sports players were at first analysed by use of the main statistical descriptive parameters (Mean, MIN, MAX, RANGE, SD), and then by use of Kolmogorov-Smirnov test the regularity of a distribution of each variable was tested. The transformation of functional abilities in the course of the experiment was established through the analysis of variance on the multivariant and univariant level.

### 3. RESULTS OF INVESTIGATION

Testing the regularity of distribution of the results of functional tests by use of Kolmogorov-Smirnov test shows that further data analysis is possible.  

**Table 1.** Multivariant variance analysis between initial and final measuring of functional abilities of sports players

<table>
<thead>
<tr>
<th>WILK'S LAMBDA TEST</th>
<th>0.612</th>
</tr>
</thead>
<tbody>
<tr>
<td>RAO-va F-aproximation</td>
<td>0.736</td>
</tr>
<tr>
<td>Q</td>
<td>0.014*</td>
</tr>
</tbody>
</table>

The obtained results of the significance of level differences of all the arithmetic middles of the tests of functional abilities between the initial (IN) and final (FI) measuring at the multivariant level (Table 1) shows that there is a statistically significant difference, since WILK'S LAMBDA is 0.612, which prilikom Raove F-aproximation of 0.736 gives the significance of the result of Q=0.014.

*These results points out to the fact that statistically significant differences were obtained in the final in comparison to the initial measuring, in the course of the experimental period.*

<table>
<thead>
<tr>
<th>TESTS</th>
<th>Measuring</th>
<th>N</th>
<th>Mean</th>
<th>F-relationship</th>
<th>P-level</th>
</tr>
</thead>
<tbody>
<tr>
<td>FVKPL</td>
<td>IN</td>
<td>30</td>
<td>3782.00</td>
<td>6.64</td>
<td>0.013*</td>
</tr>
<tr>
<td></td>
<td>FI</td>
<td>30</td>
<td>4129.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FMARG</td>
<td>IN</td>
<td>30</td>
<td>3.72</td>
<td>8.20</td>
<td>0.032*</td>
</tr>
<tr>
<td></td>
<td>FI</td>
<td>30</td>
<td>3.18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F02LM</td>
<td>IN</td>
<td>30</td>
<td>148.00</td>
<td>5.90</td>
<td>0.024*</td>
</tr>
<tr>
<td></td>
<td>FI</td>
<td>30</td>
<td>132.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FTASI</td>
<td>IN</td>
<td>30</td>
<td>112.13</td>
<td>6.20</td>
<td>0.070</td>
</tr>
<tr>
<td></td>
<td>FI</td>
<td>30</td>
<td>110.56</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FTADI</td>
<td>IN</td>
<td>30</td>
<td>72.16</td>
<td>12.46</td>
<td>0.096</td>
</tr>
</tbody>
</table>

The results of the research as shown on Table 2, were established on the basis of the univariant analysis of the variance, by comparing the results of the arithmetic middle tests of

---

the pulse rate gets down to 120-140 beats per a minute, i.e. 45-90 sec, depending on how long the intensity lasts.

5 Basic statistical parameters of Kolmogorov-Smirnovs, for limited space will not be displayed.
the functional abilities in the final and initial measuring. The results of coefficient F-relation and its significance P-Level at the level P<0.05 shows that at the end of the experimental period statistically significant increase of functional abilities took place in relation of vitaly capacity of lungs (FVKPL 0.013), Margery test (FMARG 0.032) and puls rate after exerting training effort (F02LM 0.024).

Statistically significant increase of the level of functional abilities tests is probably the result of the influence of the efficient methods, tool, models of work, as well as the genetic characteristics of sports players.

4. CONCLUSION

Six tests that investigate the functional abilities were applied on the sample consisting of 30 young sports players, 11-13 years old, from the sports clubs of East Sarajevo. The aim of the research was to establish the effects of training work model on the development of functional abilities of the examinees. The use of multivariate analysis showed statistically significant increase, in the final measurement in comparison to the initial measurement, of the vital capacity, of the Magery test to the assessment of the anaerobic capacity (FMARG) and of the maximal oxygen use after the training effort (F02LM). Other functional tests did not show statistically significant difference in the final measurement.

5. REFERENCES

Differences in the situation efficiency between teams Adriatic and Euro Basketball League in the season 2012

SUMMARY

The study was conducted to determine differences between the ABA team and Euro League in season 2011/2012, in eight standard situational efficiency indicators in basketball. Multivariate analysis of variance and Student’s t-test results are obtained which show the difference between the teams ABA and Euro League. Teams from the Euro league positively define the best overall jump variables (attack and defense), the percentage of balls pocketed by one point and steals, while teams from the ABA league best defines a variable percentage of positive two-point shot.

Keywords: Basketball game, the standard situational efficiency indicators, ABA League, Euro League.

1. INTRODUCTION

In order to monitor events in the FIBA basketball game 13 standardize the situational efficiency indicators that are monitored at every official match. The proposed situational efficiency indicators: the number of balls pocketed from the game in the basket for two points, the number of attempts to sink the ball in the basket of the game by two points, the number of balls inserted into the basket of the game by three points, the number of attempts to sink the ball in the basket of the game for three points, the number of balls inserted into the basket behind the free throw line (one, two and three), the number of attempts to sink the ball into the basket behind the free throw line (one, two and three), the jump to defend, rebound, assists, personal fouls, turnovers, received the ball and blocking shots.

In this paper, we analyzed eight of the 13 indicators of effectiveness in the game (average points per game, shooting percentage for 1, 2 and 3 points, total rebounds (attack and defense), steals and team foul.

1.1 Analysis of the Game

Basketball game is characterized by a high intensity so that lists 105 highly intense
activity that lasts an average of 1.7s, and repeated every 21s (McInnes et al., 1995). Taking into account the average values of different intensities of movement, we can say that basketball player during a game spend 15.5% in standing, walking, slow jogging 14.4% 11.6%, 10.4% high-speed running, sprinting, and 5.3% in the specific activities (movement of the defensive, running back jumping) 42.8% (Abdelkrim et al., 2007). Another important parameter is the average duration of attacks in basketball is 7-18 with the pozicionii attack (75% of total attacks), while the transition takes 4-6 s attack (25% of total attacks) (Gomes and Tavares, 2003). During game play, on average, a total of 180-200 attacks. When analyzing the specific requirements of individual gaming positions can be concluded that there are significant differences including the backs and wings spend significantly more time in the percentage of high-intensity activities of the centers (17.1% and 16.6% compared to 14.7%) (Abdelkrim et al., 2007).

2. METHOD

All data were processed in the software package Statistica for Windows, and the modules are used to calculate descriptive parameters, the total difference between the teams in two different leagues (discriminant analysis) and the difference between the teams in the ABA and Euro league in each variable separately, (t - test for independent groups of subjects).

Applying Discriminant analysis we tried to determine whether there is a statistically significant difference at the global level between the teams and leagues Adritic Euro leagues based on 8 standard situational efficiency indicators in basketball. Further statistical analysis that included implementation of t-test showed that the variables individually manage to vary significantly Adritic League and Euro League.

2.1. The sample

Data were collected on Adritic league matches in the regular season 2011/2012 and the Euro league, all matches of the team that entered the top 16 teams. The collected data were entered into the data matrix so as to allow grouping of teams based on the tables at the end of the regular work season in Adriatic league 14 teams in the Euro league 16 teams, which allowed further statistical comparison of the teams in the league.

2.2. Sample of variables

The sample comprises 8 manifest variables of standard situational efficiency indicators in basketball. These are:

- average number of points per game
- percentage of balls inserted into the basket in the space bounded by lines of 6.75 meters.
- percentage Sink the ball in the basket outside the area that borders the line 6.75 meters.
- percentage of balls inserted into the basket behind the free throw line.
- total jump (attack and defense)
- Assistance
- Steals
team's fault (foul)

The collected data are official statistics carried in every game. Registration data was carried out by specially trained statisticians for the job of computer programs for keeping statistics on the basketball matches.

### 3. RESULTS AND DISCUSSION

T-test (Table 1) shows that show a statistically significant difference between the two teams from different leagues in the variables percentage shot for two points, the total jump (defense and attack), steals a lesser extent, the percentage by one point. Adriatic league teams from having a better shooting percentage in the variables for the two points and steals, while teams from Euro leagues achieving better results and percentages of variables and the percentage of the total jump shot for one point.

**Table 1.** T-test, statistically significant differences between the teams

<table>
<thead>
<tr>
<th></th>
<th>Meanel</th>
<th>Meanad</th>
<th>t-value</th>
<th>df</th>
<th>p</th>
<th>F-ratio variances</th>
<th>p variances</th>
</tr>
</thead>
<tbody>
<tr>
<td>POEN_PRS</td>
<td>75.21</td>
<td>76.47</td>
<td>-.67</td>
<td>28</td>
<td>.507</td>
<td>1.277</td>
<td>.643</td>
</tr>
<tr>
<td>POEN_2</td>
<td>50.56</td>
<td>54.47</td>
<td>-3.90</td>
<td>28</td>
<td>.000</td>
<td>1.291</td>
<td>.629</td>
</tr>
<tr>
<td>POEN_3</td>
<td>34.48</td>
<td>33.16</td>
<td>1.03</td>
<td>28</td>
<td>.311</td>
<td>1.042</td>
<td>.929</td>
</tr>
<tr>
<td>POEN_1</td>
<td>75.10</td>
<td>72.85</td>
<td>1.80</td>
<td>28</td>
<td>.081</td>
<td>1.504</td>
<td>.465</td>
</tr>
<tr>
<td>SKOK_TOT</td>
<td>34.14</td>
<td>30.47</td>
<td>5.99</td>
<td>28</td>
<td>.000</td>
<td>1.209</td>
<td>.737</td>
</tr>
<tr>
<td>STOLEN</td>
<td>6.14</td>
<td>7.41</td>
<td>-.325</td>
<td>28</td>
<td>.002</td>
<td>1.150</td>
<td>.808</td>
</tr>
<tr>
<td>TO</td>
<td>12.90</td>
<td>13.31</td>
<td>-.97</td>
<td>28</td>
<td>.335</td>
<td>1.098</td>
<td>.873</td>
</tr>
</tbody>
</table>

Based on the results in Table 2 we see that the one obtained by discriminant function and the correlation value is high, indicating that the situational efficiency indicators 8 different teams from the two-level and quality of the competition.

**Table 2.** Values of discriminant functions and test of significance of discriminant functions by Wilks' Lambda test and Chi² test

<table>
<thead>
<tr>
<th></th>
<th>Eigenvalue</th>
<th>Canonic R</th>
<th>Wilks' Lambda</th>
<th>Chi-Sqr.</th>
<th>df</th>
<th>p-level</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>4.719</td>
<td>.908</td>
<td>.174</td>
<td>41.85</td>
<td>8</td>
<td>.000</td>
</tr>
</tbody>
</table>

The obtained values of different teams at the level of significance, 000 with a relatively high correlation, 908th The results in Table 2 shows the statistical significance of
discriminant functions Wilks and Burtlet Chi² test at .000.

In Table 3 are given values of discriminant function coefficients. The variables that contribute most to the team rezlici Adriatic League and the Euro are: average total jump (defense and attack), the percentage shot for two points, steals and shooting percentage by one point.

Table 3. Correlations between individual variables and discriminant functions

<table>
<thead>
<tr>
<th>Var</th>
<th>Root 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>POEN_PRS</td>
<td>0.058</td>
</tr>
<tr>
<td>POEN_2</td>
<td>0.339</td>
</tr>
<tr>
<td>POEN_3</td>
<td>-0.090</td>
</tr>
<tr>
<td>POEN_1</td>
<td>-0.157</td>
</tr>
<tr>
<td>SKOK_TOT</td>
<td>-0.521</td>
</tr>
<tr>
<td>ASIST</td>
<td>-0.016</td>
</tr>
<tr>
<td>STOLEN</td>
<td>0.283</td>
</tr>
<tr>
<td>TO</td>
<td>0.085</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Centroids</th>
<th>Root 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>el</td>
<td>-1.96</td>
</tr>
<tr>
<td>ad</td>
<td>2.24</td>
</tr>
</tbody>
</table>

According to these results the greatest positive contribution to the success (distinguishing the two teams in the league) in a basketball game shooting percentage for the two points, which is an indicator of the success of the attacking team. It can be assumed that the Adriatic League team had more shots from the favorable opportunity, and better shot selection and more shots from the zone of a high percentage shot (perimeter). Better success rates in this variable can be attributed to the different style and philosophy of the game. Teams competing in the Euro league placed more emphasis on defensive play, the players tend to come into position for a smooth shot, so the percentage shot for two points a little lower.

The variable total jump (attack and defense) in the Euro League teams at a higher level of approximately 4 rebounds more per game, which can be attributed to a number of attempts to reach that point. faster game evroligaških team.

Euro League teams from making an average of 1.5 errors fewer per game, so based on that information we can conclude that the ball more "care", ie. individual tactics on a higher level of players who play in the Euroleague teams.

The variable percentage shot for one point, free throw, the more success they have teams that compete in the Euro League and to three percent, which was expected given the level of leagues in which teams compete.

The results obtained by discriminant analysis confirmed that the standard situational efficiency indicators statistically different teams competing in two different levels of competition.

4. CONCLUSION
The aim of this study was to determine whether the ABA teams from different leagues and euro in eight standard situational efficiency indicators in basketball. Differences between the eight teams in the area of standard situational efficiency indicators in basketball were analyzed discriminant analysis and t-test.

Presented significantly different teams from the ABA, the Euro League, and it is possible to conclude that the three standard situational efficiency indicators clearly distinguished successful from unsuccessful teams and confirms the high predictive value of three standard indicators of situational efficiency in basketball for the final result is defined as a victory. The data is somewhat surprising is that the players who play in the ABA league teams have been successful for four percent of the variables percentage shot for two points.

5. REFERENCES
THE ROLE OF A TEACHER IN THE PREVENTION OF PUPILS’ AGGRESSIVE BEHAVIOUR

Abstract

Aggressive behaviour of elementary school pupils is constantly increasing. Be it verbal or non-verbal aggression, its consequences can be unpleasant for both, those who are exposed to it and and those who exert it upon others. Being exposed to aggressive behaviour causes anxiety, depression, lack of self-confidence and it can last until the adult age. On the other hand, pupil who act aggressively are not socially adapted in a proper way and therefore they are very often rejected by their peers. The lack of social communication and clashing with teachers’ authority removes and isolates pupils from others which can cause bad results at school and consequently to even more destructive behaviour. In order to prevent aggressive behaviour at school, it is necessary to get to know about the sources and reasons that cause such behaviour. Psychological and social connotation of aggressive behaviour should be detected and, also, try and understand what role aggressiveness plays in pupils’ growing up and getting independent. It should also bear in mind the fact that each kind of aggressiveness is not apriori negative. In relation to that, nowadays it is spoken of assertive behaviour i.e. about positive, healthy and controlled aggressiveness in which self-confidence dominates together with investing efforts and energy into the achievement of life-important aims. The role of teachers, school pedagogues, psychologists and parents is to get, through joint efforts, as much information as possible about each pupil’s personality and to get to know them in the best possible way, understand their problems and on the basis of that to apply the most adequate methods for the prevention of the unwanted forms of aggressiveness.

Key words: aggressiveness, assertiveness, behavioures, pupil, teacher, prevention.

INTRODUCTION

The term aggression originates from the latin word agressio (aggredi) which refers to attacking, assaulting, harassing, the use of force and threatening with the same. It is most defined as the form of behaviour whose aim is to harm somebody. Aggressiveness is a very complex term that is comprised of many different criteria and meanings and therefore it is very difficult to define it. This article will not deal with human aggressiveness that is
condemned by everybody and which manifests itself in wars, war destruction, aggressiveness in family, at sports fields and similar. The central idea of this article is to speak about aggressiveness as the phenomenon that has got different features at school as an educational institution. The majority of authors describe aggressive behaviour in their works as the bad side of a human’s personality, its tendency and readiness to act aggressively to other people. However, when a child rebels against the authority, he is aggressive but he also expresses its need for independence, which is a necessary and very important feature in the process of growing up (Storr, 2007: 15). Therefore, at school, it should be differentiated between aggressive and assertive behaviour of a child. Assertive behaviour represents the positive, healthy and controlled aggressiveness in which confidence dominates together with investing efforts and energy into realization of the aim. In order to be able to differentiate between assertive (wanted) from aggressive (unwanted) behaviour of pupils, one needs to possess rich pedagogical and psychological education related to practical experience.

1. THEORETICAL STANCES ABOUT HUMAN AGGRESSIVE BEHAVIOUR

Despite the fact that aggressive behaviour is common among human beings, it is still being discussed whether aggressiveness is innate to human beings and, as sexual drive, it strives to be expressed spontaneously or it is only the spontaneous answer (natural reaction) to unfavourable outer circumstances, therefore, it is not an instinct. In order to be able to understand aggressiveness more properly we will first give a few theoretical viewpoints that can help us to understand aggressive behaviour among pupils. There are six types of theories that are related to the possible causes of aggressive behaviour:

1. **Instinct theories** explain aggressive behaviour as a result of the existence of more or less permanent and stable biologically determined moving force, i.e. instinct. The most important theories of this type are psychoanalytic theory, neoanalytic theory and etiology. The basic tenet of these theories is the belief that people have got an inborn instinct to be aggressive and it is being developed until it is finally expressed. The inborn instinct of aggressiveness can be expressed through the direct attack on another human being or it can be expressed through catharsis that is released or channeled through socially acceptable modes such as sport. However, a biologically innate instinct of aggressiveness has not been defined and also the term chatarsis has not been further supported. Therefore this theory cannot be accepted and we, also, cannot claim that physical exercises provide socially acceptable tools for natural aggression instincts channeling.

2. **Frustration agression theory.** The most common explanation of aggression sees frustration as its main cause. This theory is based on the hypothesis that human aggression is directly related to frustration that is caused by inability to achieve an aim or because of a failure to succeede. This theory was established in 1939. By psychologists from Yale (Dollard et al.) Somewhat later it turned out that frustration results in other types of behaviour in addition to aggression. However, frustration-agression hypothesis contributed to the deeper insight into aggressive behaviour among pupils since at traditional schools they are constantly being exposed to frustrating situations.

3. **Social learning theory** whose founder is A. Bandura (1973. and 1986.), is a very important theory which can contribute to better understanding of human aggression. This theory explains aggressive behaviour as being learned through observing others while behaving aggressively and who, therefore, serve as a modal of aggressive behaviour. The one
who learns comes up with a conclusion as to whether aggressive behaviour of a model was a successful or unsuccessful aid in achieving the aim and whether it was punished or awarded. If aggressive behaviour is seen as a successful aid, the learning is generally taking place. Even if a model’s aggressive behaviour was not approved, or if it is not punished, learning can still take place. Even if a pupil is not seen as acting aggressively as a model, it does not mean that „the lesson” has not been learned.

4. Revised frustration-agression theory. This theory combines elements of the original hypothesis of frustration-agression theory. As seen from that perspective, and also on the basis of the claim that frustration doesn’t inevitably lead to aggression, it was found out that aggression provokes heightening of excitement and fury. (Berkovic, 1993; Baron and Richardson, 1994). However, heightened excitement and fury result in aggression only when socially learned signals signal that aggression is convenient in a certain situation. If socially learned signals indicate that aggression is not convenient, in that case it will not appear. The process of aggression as based on Berkovic’s model is presented on picture 1.

Firstly, an individual gets frustrated in some way (bad playing, loss of a game, etc.). Secondly, the level of excitement heightens, usually in the form of pain or fury as a result of frustration. Thirdly, such state will not automatically result in frustration. It will happen only if the individual has learned to be aggressive in a certain situation. Revised aggression-frustration theory offers in its essence an interactive model which combines the best achievement of the initial models of frustration-agression theory and social theory of aggression.

Picture 1. The process of aggression (Berkovic’s model)

5. Cognitive theories. These theories are oriented towards cognitive processes that take place in an individual from the moment he/she was exposed to a certain stimulus all the way to the eventual reaction, in other words – aggressive behaviour. The most important authors related to this group of theories are Kennet Dodge and Raphel Human who suggested the model a separation of aggressive behaviour.

6. Biological theories. These theories explain aggressive behaviour as a result of the functioning of biological and physiological structures in a human body. According to the authors who support these theories, aggressive behaviour can be caused by genes, hormones or the centers in brain that are responsible for such behaviour. Moyer theory is the most famous one (up. Žužul, 1989: 42-43 and Čokorilo, 2010: 173-175).

Philosophers and scientists have never fully agreed as to whether aggression is innate, instinctive or such behaviour is learned (Baron and Richardson, 1994; Berkovic, 1993; Gin, 1998). The contradictory opinions of Hobbes and Rousseau on this issue were strengthened and rejected in the course of the time. According to Hobbes, human beings are in their natural animal state and, therefore, society can prevent their natural instincts by imposing on them the rule of law and order. Contrary to Hobbs, according to Rousseau’s theory of the noble savage, human beings are in their natural state of being noble but the restrictive society forces them to be aggressive. Hobbes’ pessimism was further developed by Freud who believed that human beings were born with the instinct for living (eros) and the instinct for dying (tanatos). The instinct of dying acts in every human being with the
tendency to bring it down to the level of its original state of still nature. Freud believed that agressive energy needs to vent out so as not to create an illness. According to Freud, society plays the main role in the control of these instincts and it helps people to sublume them – i.e. to convert their energy into acceptable and useful behaviour (Aronsonu et al., 2005: 417-418).

As observed from the point of view of pedagogy theories of agressive behaviour can be divided into two groups: 1. Theories that do not accept the role of education on agressive behaviour and its prevention; this group comprises instinct and biological theories. 2. Theories that explain agressive behaviour as the result of the influence of the environment and learning; this group comprises theories of frustration and social learning (up. Savović, 2003: 11).

2. THE FORMS OF AGRESSIVE BEHAVIOUR AT SCHOOL

There are different defintions of agressive behaviour, however, they are essentially only variations of of the theory that was suggested by Dollard and his coworkers according to whom agression is behaviour whose aim is to hurt a person towards whom it is directed. The special form of behaviour of peers that takes the form of maltreating and molesting of pupils, and in English such behaviour is covered with terms bullying and mobbing. Along with the mentioned ones there is a whole array of other terms similar to the notion of agression. Therefore, it is very difficult to give a precise answer to what agression is. In connection to this, the notion of asocial behaviour represents a very broad category to which agression belongs, too. Among pupils, asocial behaviour comprises the whole array of different kinds of behaviour (disobedience, undisciplined behaviour, lying, bad company, skipping classes, stubborness, consuming drugs and alcohol, etc.). Playing violent video games. A child that plays violent games „destroys“ probably hundreds of enemies in a day, but that is not seen as real agression or violence since no harm has been inflicted upon a human being but upon a fictional character. On the other hand, such games contribute to the appearance and growth of agression, and it also increases a childs indifference towards violence. Prejudices themselves are not seen as violence, but discrimination as a result of prejudices is seen as such. Punishment as an educational measure is not seen as violence and it does not have to lead to it, even if non-pedagogical punishment can be seen as violence. What makes punishment different from violence is that it is used in order to help to a child, which makes a justifiable and legitimate educational measure.

In general, there are two criteria on the bases of which different kinds of agressive behaviour at school can be differentiated among. Firstly, according to the way agression is being exerted: a) verbal agression (swearing, yelling, threatening) and b) physical agression (hitting, trippin somebody up). Secondly, according to the causes of agression: a) impulsive agression (expressing emotions of rage and anger) and b) instrumental agression (agression used as an instrument for achieveing a goal (Žužul. 1989: 53).

Apart from the mentioned forms of agressive behaviour, in literature we come across other forms of agressive behaviour ovih oblika agresivnog ponašanja at schools, such as: a) agressive expansion – when a child, without expressing agression openly, pushing himself and his personality in the foreground and by doing so is disturbing the rights of others; b) agressive vengance – stands for a pupils vengeance because he was deprived of parental love and (because of death, divorce, long absence), or because of not being accepted by his peers; c) agression as a pupils reaction to big dameands – it represents the inability of a pupil to answer to big demands set by his parents, teachers, or a wider social environment,
which provokes in him the feeling of guilt and defeat. (Gašić-Pavišić, 1996: 727).

At school, the biggest amount of attention is devoted to aggression of a pupil to too big and non-adequate educational demands. Those could be represented by too demanding subject curricula, inability to understand certain terminology, bad communication with teachers, etc. Very often these factors provoke in pupils the feeling of inability and failure, and on the other hand parents and teachers exert pressure upon them and that is very often followed by punishment. In that way a pupil develops repulsion towards the source of failure (school and school environment), and very often that feeling turns into aggression. It can be expressed through quarrelling, but also through physical conflicts among peers, as well as through destroying school assets, etc. Such kind of tension is especially noticeable in physical education classes, and it is expressed through the lack of cooperation when it comes to being a part of certain class activities. Repulsion towards school is sometimes expressed through formation of social groups of pupils who have got similar problems. Various researches point out to the conclusion that aggressive behaviour is a reaction to the situation which is perceived by an individual as being provocative. It depends on the following for factors if the provocative situation will lead to aggression.

1. Emotionally motivational factors. When a provoking situation causes the increase of emotional excitement in the body and consequently it leads to the motivation for aggressive behaviour.

2. Cognitive-informational factors. They appear in three phases that are set in between the acting of social stimulation and reaction. The first factor is related to the recognition of the provoking situation, while it is thought that the aggressive reaction will not appear as a result of the situation, but it will depend on the way in which it is going to be perceived by an individual – as provoking or non-provoking. The second group of factors are related to the recognition of the emotional excitement and finding the possible answers to it. Finally, there is the third group of cognitive factors which is related to the estimation of the consequences and aggressive behaviour.

3. Social factors. Since aggressive behaviour is aggressive social behaviour it is logical that certain social factors will have an influence on the possible appearance of aggressive behaviour. Among different social factors that can have an influence of the appearance of aggression, three factors are of particular importance. The first factor is related to the sources of frustration. Individual characteristics of a person that is the source of provocation will have no influence on whether the situation will be seen as provoking. The second factor that has got an influence on the recognition of an emotion is the behaviour of other persons who are being present in a certain situation. The third social factor relates to the third cognitive factor and those are the characteristics of the aim of aggression.

4. Situational factors. Aggressive behaviour is always the reaction to a certain situation and therefore it is possible to single out three groups of situational factors. It is being emphasized that the intensity of the aggressive motivation is directly dependent on the intensity of emotional excitement. The second group of factors comprises the outer motives that did not come about as a result of emotional changes. The third and the most important group of factors is represented with aggressive symbols that stand for the stimuli from the surroundings and as such they purports the appearance of aggression. Such symbols of aggression can be films with aggressive contents, toys, observed violence, weapons and similar. (up. Žužul, 1989: 64-79).
3. CAUSES AND CONSEQUENCES OF PUPILS’ AGGRESSIVE BEHAVIOUR

When speaking generally about the causes and consequences of pupils’ aggressive behaviour at school, it is important to bear in mind the fact that the causes of such behaviour are multiple and that they differ in different development phases. The identification of causes is important because it helps with spotting “risky children” and it makes it possible to act preventively before problematic behaviour appears. If we do not act preventively, aggression is more difficult to be dealt with once it appears.

3.1. A pupil’s personality as the cause of aggressive behaviour

One of the important factors that can cause aggressive behaviour is a pupil’s personality. The individuals that show the biggest number of aggressive reactions in one situation tend to be more aggressive in other situations, too. This confirms the hypothesis of aggression being a stable feature of a personality and it gets formed rather early in one’s life. (Žužul, 1989: 93-99).

The author Thomas A. Speaks about three kinds of temperament that can be recognized in the earliest childhood.

_unique temperament_ is related to babies that have a predictable rhythm eating and sleeping. These are children with a positive disposition and they are capable of adapting easily.

Children with temperament that is characterized by a somewhat slower “phase of warming up“, have also got a predictable rhythm of eating and sleeping. In new situations they act cautiously but they adapt to the situation as soon as they have investigated the circumstances in their own pace.

_difficult temperament_ in the earliest childhood comprises lability, restlessness and short attention span. Researches have shown that children with such temperament often show certain kinds of deviant behaviour in their youth. It depends on parents and their educational influence whether aggressive behaviour will appear or not. It is not difficult to conclude that “difficult temperament” in itself does not obligatorily lead to aggressive behaviour.

Aggressive children very often find an excuse for their behaviour by claiming that they have been provoked, and less often by claiming that the victims are physically weaker and that they do show resistance. They are prone to attribute adversary intentions to others and to claim that victims are responsible for being maltreated. They find an excuse for their behaviour by claiming that their peers behaved in an adversary manner, and they tend to interpret “the social signs” of their peers as the signs of antagonism. However, the researches shows that a small number of children behave provocatively and therefore we can assume a several causes of aggressive behaviour among children even though they have not been provoked. A certain number of children behaves aggressively in other to show others that they are powerful and strong. In this way they satisfy their need to dominant among their peers. Aggressive behaviour can also appear when a victim is similar to children that a bully sees as victims, if children tolerates the demands of a bully and when they do not show facial and verbal signs that act repressively of a bully’s behaviour. (Krnjajić, 2002: 25).
4. THE POSSIBILITY OF AGGRESSIVE BEHAVIOUR PREVENTION AT SCHOOL

School as an educational institution puts in the foreground two sides in a partnership – pupils and teachers. Despite the fact that a teacher is traditionally seen as a lecturer and one who conveys knowledge, that is not his only role. Very often we tend to forget another very important educational role of a teacher whereby he acts educationally by setting his own example.

A teacher is a mediator between a school, school programme and a pupil. He has got a big role in school’s functioning and therefore it can be concluded that he has got an important role when it comes to the appearance and prevention of aggressive behaviour. The researches that dealt with discipline problems point out to the fact that teachers of slightly older children see speaking in the class and disturbing other children as the biggest discipline problems, while teachers of the youngest children see speaking in the class, aggressive behaviour and noise as the biggest discipline problems. (Krnjačić, 2002: 19).

When it comes to aggressive behaviour of pupils at school, the teacher has got the biggest role in it its prevention. It is not unknown that quite often teachers use threats as well as physical punishment as strategies for the prevention of aggressive behaviour. Teachers very often use violent strategies that end the conflict, whereas pupils, according to the teachers’ claims, also use kind of behaviour that are not adequate and do not contribute to the resolution of the conflict, but they often only deepen the initial conflict and lead to the new ones. In the same way, in order to prevent aggressive behaviour, teachers very often yell at pupils, threaten them with low grades and the removal from the class. Such „educational“ measures for the prevention of aggressive behaviour are least efficient and successful. In this way teachers become models of aggressive behaviour. It would be desirable for teachers to build up a kind of pedagogical behaviour that suppresses and rejects repressive measures and to build with pupils a relationship of cooperation and partnership.

We will single out some of the most efficient ways that teachers can use in order to prevent aggressive behaviour among pupils.

A teacher should get to know about a child’s personality and the situation in his family, his the level of his emotional development, situations that he finds himself in at a school so he could discover the causes of a child’s aggressive behaviour (it has been already said that discovering of causes of aggressive behaviour is the first step towards its).

A teacher should behave towards pupils with attention, kindness and respect.

A teacher should present pupils with kinds of social behaviour that are an alternative to aggressive behaviour.

A teacher should reward desirable behaviour and show open disapproval towards aggressive behaviour.

Teachers should be provided with educational contents that enables non-aggressive resolution of conflicting situations.

Parents, pedagogues and psychologists should be included in the process of solving the problems of aggressive behaviour.

A teacher should exchange their experience with their colleagues, follow the adequate literature and attend seminars of professional advancement.
It is important for a teacher to create the atmosphere in which everyone feels safe, accepted and appreciated. If there are problems related to pupils’ behaviour, concrete repressive measures should be used in the classroom. We will list several concrete steps that create a positive atmosphere in the classroom.

A teacher should act efficiently as soon as the case of aggression appears.

A teacher should come up with a set of simple, concrete and applicable rules in the classroom and gymnastics hall (together with pupils).

A teacher should listen to pupils and try to understand them.

A teacher should try and help pupils to express their emotions.

A teacher should present to his pupils the skills that will help them to solve conflicts, to accept others (to develop the sense of empathy) and he should also promote teamwork.

A teacher should help pupils to develop self-confidence and self-respect.

One should never be aggressive towards a bully, since in this way, aggressive behaviour gets suppressed only temporarily, but it does not solve a problem, since in this way an example of positive behaviour is not being set.

A teacher should give an example of proper behaviour in all the situations.

A teacher should give an opportunity to bullies to „shine“, to be very good at certain activities and since it will make them feel that somebody has got belief in them. The key for constructive approach to aggressive behaviour among children is restitution. Restitution is the process in which the mistake is being corrected. Instead of a punishment it gives a child the opportunity to correct the mistake by his own efforts and in this way to keep and improve his self-respect, and all of that by not depriving him of the responsibility for his own decisions at the same time. Above all, it should be put to a pupil’s knowledge that everyone makes mistakes and then an accent should be put on what should be done in order to correct a mistake that was made. The pupil should suggest solutions by himself and by acting in that way he corrects the mistake. It happens very often that pupils reject a teacher’s help or talking to him (be about a victim of aggression or the bully himself). Teachers do not succeede to help pupils since they do not know how to act efficiently. Their failure is usually in what they say to a child when he has got problems with behaviour.

CONCLUSION

Our analysis showed that aggressive behaviour at school is a very complex problem to which proper attention should be devoted. Since aggressive behaviour is inevitably followed by the risk of the appearance of conflict, pupils' demotivation, neglecting primary school obligations, etc., it should be seen as a serious problem. Therefore, it is very important to differentiate between assertive (reliable) behaviour from aggressive behaviour, both at school and everyday life. On the basis of has been learned about aggression so far, it is possible to give a main features of a strategy for control and regulation of this undesirable kind of pupils' behaviour.

As it has been already said, there are many sources of aggression at school, family and society. Discovering and controlling frustrating situations should be some of the main tasks of each teacher. It is difficult to control such situations if we do not follow a pupil and if we do not warn them after they show the first signs of aggressive behaviour. It is more
efficient to act preventively, i.e. to try and teach pupils the skills of controlling their emotions and reacting to frustration. On the basis of that it is possible to to use the strategy of social learning (modelling and stimulating) so we could, in this way, enable pupils to solve conflicts related to school and social life with the use of non-aggressive techniques. Finally, we remind teachers of some important moments that can the of essential importance in their effort to act educationally and preventively when it comes to pupils' aggressive behaviour:

1. to work permanently on their pedagogical and psychological education,
2. to try and recognize the first symptoms of aggressive behaviour among pupils,
3. to learn to differentiate between aggressive and assertive behaviour of pupils,
4. to discover and control frustrating situations in which pupils find,
5. model non-aggressive behaviour,
6. moderate and timely punishment,
7. learn how to control your own emotions and emotions of your pupils,
8. help your pupils to express their rage and to get conscious of it,
9. provoke and „teach“ empathy,
10. use pedagogical tactics in order to sublime (up. Čokorilo, 2010:180).

LITERATURA

AEROBIC CYCLING AS AN ADDITIONAL CONTENT IN THE CONDITIONAL PREPARATION OF PROFESSIONAL SWIMMERS

INTRODUCTION

Development of sport and increasing people's awareness of healthy living and the need for physical exercise in the world, have lead to developing fitness centers, wellness centers, aerobic centers. They were developed by different applications. In that way the need for the program, where cyclists and other athletes can do their training, and keep fit during the winter season, or even work on developing other skills over a period of training, has been borne and developed as aerobic cycling. Nowadays, the tendency of trainers (and not just those in swimming world) is to provide athletes an additional new content in the training that it can be used to develop certain skills. A new content is to break the monotony of training to become more interesting. Since aerobic cycling ensures full and complete sports training his rightful place is in the conditional preparation of swimmers.

DEVELOPMENT OF AEROBIC CYCLING

Spinning means to spin, turn and determine the activity that is designed in California 1986. by Johnny Goldberg (Johnny G), the American cyclist preparing for the
race in America. Spinning is a cycling program indoors. In 1996, spinning the world is expanding and getting very popular in Italy, Germany and other countries. Evolution of the spinning has developed another way of training defined as aerobic spinbike (SBA). The creator of this program is **Nazzareno Margon**. The new program, spinbike aerobics, involves different disciplines (cycling, aerobics, martial arts, strength training, etc..). Thus, aerobic cycling can be divided into spinning and spinbike aerobics. Today there are different schools for instructors and a lot of spinning and aerobics spinbike, and Nazzareno Margon designed 32 different programs.

**THE DIVISION OF AEROBIC CYCLING**

1. **Spinning**

   Spinning is a unique group activity on a specially designed stationary bikes in enclosed spaces such as aerobic halls and etc., with no load on the joints. Spinning program brings elements of sports training for people of all ages and fitness levels. It is an effective, high-energy program that includes music, working with the instructor, complete visualization of the mind & body workout. Spinning training takes about 40 minutes or more depending on the type of training, to training and quality level of the group. Spinning training can be: speed training, endurance, distance, fat-burning, hill training, interval training. Spinning program can influence the development of the cardiorespiratory system, decrease body fat, increase endurance, speed and lower body strength. The beauty of spinning is that what trainees, depending on their capabilities, determine their own workload. The spinning training needs a heart monitor so that more training is individualized, so that each trainee can be seen in the area where work is thus easier to monitor training and exercise training objectives.

2. **Spinbike aerobics (SBA)**

   SBA is not just a sedentary static cycling, but a real fitness program that brings together different disciplines, such as cycling, aerobics, martial arts, strength training and exercises with loads of free exercise and body sculpting. The main characteristic of this discipline is the training and fun at the same time. The duration of training varies from 45-60 min., depending on the type of training, level of training and well trained group. SBA training goals are: improving or maintaining high level of cardiovascular system, improving stamina, speed, flexibility, coordination and body shaping. SBA offers the advantage of using not only the lower body, but the upper part also. The work done by the body during typical hours includes all muscle groups. The muscles that allow pedaling: leaves, the muscles of the front and back of the thighs, gluteus muscles, muscles that allow exercisers to maintain an upright position in the phase of choreography: the abdominal muscles and lower back. And through a variety of choreography and use of tools such as weights, rubber bands, etc., strengthening muscles: shoulders, chest, back and arms. In the hour of SBA is useful to have a heart monitor for better monitoring of training.

**THE ADVENTAGES OF PROGRAM**

**The advantage of aerobic cyclinga**
Do not burdens your joints
The possibility of injury is minimized
Participant dosing load of his choice
Motivating music
Group work
Improving aerobic capacity
Reduction of heart rate at rest
Rapid consumption of subcutaneous adipose tissue

The advantage of spining

The participant do not need to learn the demanding choreographies that require a certain level of concentration and coordination, and can fully concentrate to do the task better.

The advantage spinbike aerobics program

The advantage of SBA programs is gradually mastering the choreography or exercises for the upper body with and without requisites, resulting in a greater involvement of the whole body muscle.

METOD

AEROBIC CYCLING AS AN ADDITIONAL CONTENT IN THE CONDITIONAL PREPARATION OF PROFESSIONAL SWIMMERS

Aerobic cycling is carried out by all the principles of sports training and therefore it can be used in all stages of preparing swimmers for the development of certain functional and motor abilities. Of course this is not the primary program for the development of certain skills, but an additional program, because we must take into account the specificity of the swimming sport.

Favor of spinning

Spinning can be used for development of aerobic and anaerobic capacity, to reduce the PMT (in spinning and SBA (40-45min) hourly can be spent, and 500-600 calories depending on the type of training and duration of training), strengthening the muscles of the leg (round pedaling), rehabilitation of the injured knee warming up before the main workout on land.

Types of training in spinning

Speed

When training speed participate fast muscle fibers at max.effort to quickly run out of energy stocks (max 2 min) but, on the other hand, the energy supplies quickly and fill up a muscles ready for the new effort.

Speed training has brief duration and very high intensity, it is in all three parts of the fifth zone and it is necessary to emphasize that this is the only training that can not be traced because the heart rate monitor heart muscle reacts much more slowly. It is therefore important to track no. rpm, which moves more than 180 r/min.
It is a pure anaerobic training and his interval of values in the range of 5-60 seconds.
Rest between intervals is 3x higher than the operating time.

**Endurance**
- Durability is the ability of muscles to sustain the effort over a long period of time.
- It is one of the most important training in spinning hour increases as the size and number of mitochondria in muscle cells and increases the number of capillaries and improves aerobic enzymes for metabolism of fats and carbohydrates.
- Trainees prefer to work in this mode because there is no production of lactic acid and thus do not sense pain in the muscle, and training intensity is a little stronger.
- Conducted in the third and early fourth zone so it is time to clean aerobic training.
- Endurance training can be done in two ways:
  1. constant over 5 min easy-paced, 3 zones and over 120 o/ m
  2. interval of 1-5 min with a break of 5-60 s - that is, a stronger intensity, the transition from third to fourth zone, and with over 150 r / m.

**Race**
- The instructor leads participants through the cycling race.
- The clock is max. 45 min with very strong intensity, and its structure depends on the instructor's imagination.
- The goal of this type of training is to break the monotony after months of repetition of similar exercises.
- One of the advantages of this type of spinning clock is that there is a max. energy consumption.

**Distance-fat burning workout**
- This training is low intensity and high volume, duration between 30 minutes and several hours of work konsantnog depending on the possibilities of trainees.
- This is basic training for all other hours and can also serve as heat.
- Preparing the body for the exercise of higher intensity and therefore began to use from the first hour of exercise and the last but in a smaller volume.
- Pay attention to the intensity, which should not exceed the limits of zone 2, so we recommend the use of heart rate monitor.
- It is good to be in such training gradually increases the volume as this will increase stamina, confidence and mental strength trainees.
- This type of training because of its length can be very monotonous and suggests inserting the various sprints and jumps shorter duration if the whole hour of that type.
- The number of revolutions per minute varies between 100 and 120
- Average power consumption is expressed in kcal per kg body weight per hour for this training is 7-8.

**Hill**
- Hill training can be implemented in several ways:
  1. interval, where the duration of work is between 1-5 min, and recovery is between interval of 1-3 min
  2. constant work over 5 min.
- Both the training can be done sitting or standing on all the aforementioned ways.
- All exercises are performed by hill in the third and fourth heart rate zone,
depending on length.

Load is very high and the very lowrevs, a move in the range of 60 to 80 per minute.

Depending on the area of this training can spend from 13-17 Kcal per kg of body weight per hour of work.

**Interval Training**

The name describes the whole exercise. So, it exercises a very small volume but high intensity work.

Training can be divided into three groups:

1. running time of 1-3 min, 100% of is rest interval
2. duration of 3-5 min, where is rest 75% interval
3. length intervals over 5 min, where the rest is 50% of interval.

All three types of training are made in zone 4 and therefore are very strenuous and difficult because they are completely anaerobic, which means the production of lactic acid and thus a feeling of pain in the muscles.

There are many benefits of such kind of training but for us is most important to increase the blood volume, increase storage of glycogen in the muscle cell, increasing the levels of enzymes for the oxidation of carbohydrates and the last, most important, is move the anaerobic zone, increase in lactate threshold and thus the use of fats in increasing heart rate.

**Favor of the SBA**

Spinbike aerobics can be used for: the same as in spinning (spinning as the basis SBA) for the development of aerobic and anaerobic capacity, to reduce the PMT, the strengthening of leg muscles (circular pedaling), rehabilitation of the injured knee warming up before the main training on land. However, most are used in the preparation period and to the anatomical adaptation phase, we work to improve aerobic capacity and prepare the muscles for weight training.

**Types of training for the SBA**

The SBA hour can be used the same kind of training and as the spinning zone depending on the purpose and objectives of training, with the SBA, the main work hours, throwing the whole body exercise with and without aids. Periodization or cycling aerobic type training (spinning or SBA), extensity (number and duration of training sessions) and the intensity depends on the very periodization, swimming, swimmer's abilities and goals and objectives of the curriculum.

**Ergometry test**

Before the start of training on aerobic cycling in it would be desirable to make a maximal ergometry test on a bicycle ergometer for better planning of training and define their own zone, and using a heart monitor (heart rate monitor) to the best training we can monitor the implementation of the training itself.

**REZULTATI**

**Periodisation of swimming training**
Plan and program of training is planned according to the calendar contest, in relation to specific maintenance.

Depending on whether it is Olympic Games, World Championships, continent, country or republic in which the athlete to participate, based on the calendar of events planned and I am training. Apart from these competitions may be held at certain meetings, etc.

Most often the curriculum process for one year, and he is then fit the two-year or four-year cycle. If the state championship is held every year, then it is monociklusu, if related to summer or winter event, and then it's two-cycle system.

Swimming season is divided into 4 phases:
- First adjustment phase (2 - 4 weeks)
- Second phase of endurance and preparation phase (8 - 12 weeks)
- Third competition phase (4 - 6 weeks)
- 4th relaxation phase or transitional phase (1 - 3 weeks)

As for winter swimming period starts from September to April, a summer series from late April to mid-August. Within the cycle, particularly prominent in the preparation period, the load can be increased both in volume and intensity.

The preparatory period or phase of endurance

The preparation period can be divided into two phases. In the first part, we can raise the general physical condition, and the second part is related to a specific or special preparation.

When looking at the one-year curriculum cycle of period, it may be noted that the preparatory period lasts the longest.

Athletes, swimmers in this case, you should prepare your body for even greater future burden, which follow thereafter. Insufficient use of or total disregard of that period can lead to many unintended consequences, not only in terms of poor performance, but also adverse effects on the healthy body of an athlete.

Without the rational use of that period can not be imaginable excellence. The importance of the preparatory period and how much he needed in terms of professional sportsmen, but also demonstrates the fact that the division of the annual cycle of training most of the time takes this very period. Almost all sports fields, regardless of whether the year was training in one or two cycles, the preparatory period lasting at least 6 to 8 months, though there are other divisions. As for the length of the preparatory period in swimming organizations, it will be different depending on the conditions under which these organizations operate.

The preparation phase is extremely important for whole year of training. During the preparatory period, swimmers develop general physical, technical, tactical and psychological preparation for the competition phase. In adequate training during this phase will have a visible impact in the competitive phase. Throughout this phase, especially during the initial part of the body for proper adaptation to the specific training is a key high-volume
training.

At this stage, emphasis should be on the following:

a) improve the technique of styles, starts and turns. It is recommended to be performed at this stage because the competitors are not concentrating on results

b) to increase muscle strength, muscle endurance and flexibility of the joints, mostly in the water and partly on land

c) improve the anaerobic threshold and maximal oxygen consumption VO2max, where swimmers for this purpose have much of their style of swim training

d) set goals for the season, which serve as a motivation and provide direction to the season

e) improve the speed, which is usually transmitted at a later stage, and no obligation. Training speed is not too strenuous, and therefore should not be afraid of overtraining, or premature peak form.

Table 1. Week of endurance training on a dry

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<td>Active</td>
<td>Active rest</td>
<td>Hill training</td>
<td>Distance –</td>
<td>Interval</td>
<td>Distance –</td>
<td>Race</td>
<td>Distance – fat burning training</td>
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<tr>
<td>Stretching</td>
<td>I week</td>
<td></td>
<td>30-40' Low</td>
<td>I week</td>
<td>30-40' Low</td>
<td>I week</td>
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<tr>
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<td>50 min</td>
</tr>
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<td></td>
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<td>training</td>
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<td>I week</td>
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<td>30</td>
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<td>60 min</td>
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<tr>
<td></td>
<td></td>
<td>IV week</td>
<td>IV week</td>
<td>II week</td>
<td></td>
<td>35</td>
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</tr>
<tr>
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<td></td>
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<td>35</td>
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<td>30</td>
<td>60 min</td>
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Table 2. Week of endurance training in water

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<td>Hill</td>
<td>Distance –</td>
<td>Interval</td>
<td>Distance –</td>
<td>Race</td>
<td>Distance – fat burning training</td>
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<td>I week</td>
<td>30-40' Low</td>
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<td>I week</td>
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<td>intensity</td>
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<td>50 min</td>
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<td>II week</td>
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<td>II week</td>
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<td>IV week</td>
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<td></td>
<td>65 min</td>
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</table>
### CONCLUSION

Aerobic cycling arose from the needs of cyclists to maintain form during the winter months, and that the training becomes more interesting. For the present we see that part of the aerobic cycling involves a complete physical training for the development of functional and motor abilities, with a maximal ergometry test and a heart monitor and allows easy planning, programming and monitoring of the training itself. Central to the swimmers aerobic cycling activity on your joints. Aerobic cycling can be most useful in the preparation period, although it can be used in other stages taking into account the specificity of swim training. He neither case can not replace training in water but can serve as additional training to develop certain skills. Definitely can be used to break up the monotony of training, especially long aerobic workouts. Swimmers and seniors who need something new to add further motivations can do a very good training and willingness to training will be higher. There are only two problems in the use of aerobic cycling, as well as additional content in the conditional preparation of swimmers, the first is that some coaches hard to digest a new method to fear or ignorance, and the second is that there is no spin bike everywhere. All in all aerobic cycling in belonging to a deserved place in the conditional preparation of swimmers.
LITERATURA


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² Faculty of Physical Education and Sports, University of East Sarajevo

Scientific work review
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ANALYSIS OF 100 m FREESTYLE SWIMMING
AT THE OLYMPIC GAMES IN 1992 – 2008. YEAR

Summary
In every athlete's career, Olympic Games are the most important competition. Almost every race in the world's biggest competition is analyzed in detail, and the results are used to improve achievements in sports, and in swimming as well. 100m freestyle swimming was one of the most exciting disciplines which attracted a lot of attention, not only with competitors but with spectators too. During the research and application of relevant statistical analysis (measures of central tendency, regression analysis and other procedures) the correlation with certain parameters of competition results and progress over time was determined.

**Keywords:** competition swimming, Olympics, regression analysis

**INTRODUCTION**

The Olympic Games are the greatest sports spectacle, especially those in Beijing, where they had been held in 2008. In addition to the largest number of participants from most countries so far, Serbia also took part (after 96 years of performing under that name).

We can find a lot of answers to the question: Why is it so?
- One of those answers is: precisely defined goal i.e. sports performance.
- Besides, modern sport has become a business and it represents the opportunity to promote every state and all athletes.
- Swimming is the mass sport in the Olympics besides athletics (sometimes over 1,000 competitors).
- All of them (as all other athletes) have a common goal:
- They give their best to achieve the best results and placements in their own sporting career.

Besides World Championship, the Olympic Games are of the highest quality and represent the maximum of a competition for a single Olympics (four-year), so winning an Olympic medal is dream of every top athlete, but for many only participation in the Olympic Games represents great success. Unfortunately, in practice, not every athlete succeeds, because excellent results are difficult to achieve and depend on many factors, such as:

- individual and functional capabilities,
- the overall conditions for the optimal preparation throughout the season (buildings and appliances) and continuous training;
- educated and skilled professional staff;
- controlled and optimal nutrition,
- and allowed funds for recovery medical and psychological treatments in continuity,
- way of athlete's life,
- financing the swimming athletes and the results achieved,
- desire to succeed and the will in demanding training process and,
- engagement of members and other relevant institutions during the competition period.

Only a small number of elite top swimmers manages to qualify for the semifinals and finals because the competition is numerous and getting more and more difficult and also because results are continually improving. It is evident that apart from great swimming schools, three have distinguished themselves: American, Australian and European school. Each school carries some specific qualities but in the end they all have the same aim of achieving better results in competitions. Qualifying for the Olympics is a great success and represents special honor for athletes. Trust, which athletes earn by passing the qualification and election contests, gives them special value (especially if it is about a multiple Olympic
athlete). Olympians have a special status in sports and society. Their successful results and medals remain evident, and they often become idols for young athletes.

In most countries swimming is main sport that is very important for:
- proper development of children,
- maintaining the health of the population,
- recreation of citizens,
- forming a balanced and complete personality.

METHODS

Problem of the topic

Problem of this topic stands for an identification and analysis of the parameters that are present in each race, as well as the comparison of the variables at the last five Olympic competitions.

The aim of the topic

The main objective of this paper is an analysis of the competitive parameters in 100 m freestyle swimming during the above mentioned period.

Competitive swimmer analysis

In the last 15 years, the competitive analysis became regular analytical procedure at every major event. The purpose of competition analysis is to show the coach and the swimmer clear and detailed content of each race in the competition. It shows parts of swimming and parameters at which some swimmers are better than others. The purpose of this analysis is:
- comparing progressively competitive swimmer models after the researches,
- identifying (through analysis of parameters at every stage of swimming) and improving deficiencies in the competition performance (by applying technique, its elements, and tactics during the competition),
- comparison between the parameters of the swimmers in the race, swimming competitions and athletes, who compete in different competitions at different times,
- providing a coach with an information that helps him choose the best strategy for swimmer to win, for example, eliminating the disadvantages in the competition through training. During exercise the optimal ratio of the length and frequency of stroke in certain parts of the race can be determined.

Variable samples

Sample selection of measuring instruments (Dr. Rein Hyland default) that are used for regular analysis of European and world competitions is consisted of:

1. The total swimming speed, m / s UBP
2. Clean swimming speed, m / s BCPL
3. Start reaction time, sec VRKC
4. Start time, sec VRST
5. Clean swimming time, sec VČPL
6.  50 m passing time VP50
7.  Stroke frequency, no / min FMIN
8.  Stroke length, m DUZZ
9.  Efficiency index INEF
10. Time of turning VROK
11. Finish time VFIN
12. Final result, sec KREZ

In addition to this set of variables, we have more variables that are exclusive representatives of the longitudinal dimension of the volume and weight:

Body height, cm AVIS
Body weight, kg ATEZ
Age, year UZRS

METHOD OF RESEARCH

The sample of respondents

The sample of respondents included 80 top swimmers that participated in the 100 m freestyle discipline, participants of swimming competitions in the last five Olympics between 1992-2008, and at least 16 participants of each Olympics.

Sample of variables

Sample of variables will consist of parameters of tested swimming disciplines, 13 competitive, 2 morphological and swimmers' age.

Programme and measurement procedure

Measurements and recording the results of the studied parameters of competitive analysis were made using the methodology established by Dr. Rein Hyland from Tallin University of Estonia. He has established and refined a system for video recording and registering these competing parameters for each participant in each race. This methodology was modified and adapted for Australian conditions by Bruce Masonand and Jim Fowil at the Australian Institute of Sport in Canberra. This methodology claims that in every race results of above mentioned parameters are automatically and electronically recorded for each participant. Maximum reliability of this information is simply imposed as necessary for race analysis at all European, World and Olympic competitions. Collecting and recording data are done with the help of eight video cameras around the pool length at: 7.5 m, 10 m, 15 m, 20 m, 25 m, 35 m, 40 m and 42.5 m from the starting point. The accuracy of the results in each parameter is recorded when the swimmer's head comes in a certain position, and the entire system is turned on before the race. Data for each swimmer, for all required parameters are recorded in each section of 50 m, and at the end of the recorded values for each parameter separately in relation to the number of sections (50 m).

Statistical data processing

For the needs of this research and for all displayed variables, basic descriptive data are used: range, minimum and maximum score, mean, standard deviation and coefficient of variation.
For determining prediction criterion variables based on applied system of predictor variables linear regression analysis will be applied, and it is described by the following parameters: regression factor (B), coefficient of standard regression errors (SIGMA), the ratio of the partial effects of predictor variables on the criterion variable (BETA), testing the significance of evaluated parameters of regression (t) and the level of signification (sig.).

For determining the difference in the arithmetic means of all parameters analyzed separately, (realized at various Olympic Games in period between 1992-2008 yr.) and determining their level of significance, analysis of variance with one factor (ANOVA) will be applied.

RESULTS OF THE RESEARCH

Table 1. Descriptive analysis of finalist in 100m freestyle swimming at the Olympic Games in the period 1992-2008

<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>N</th>
<th>Range</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>CV %</th>
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<td>47,05</td>
<td>50,65</td>
<td>49,21</td>
<td>,86</td>
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<td>2,12</td>
<td>2,02</td>
<td>,03</td>
<td>1,77</td>
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<td>BČPL</td>
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<td>,12</td>
<td>1,88</td>
<td>2,00</td>
<td>1,92</td>
<td>,02</td>
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<td>VRCK</td>
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<td>,26</td>
<td>,62</td>
<td>,88</td>
<td>,76</td>
<td>,05</td>
<td>7,28</td>
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<td>34,55</td>
<td>33,64</td>
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Table 2. Regressive analysis of swimmers in final competition at Olympic Games in 100 m freestyle discipline

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<thead>
<tr>
<th>Variables</th>
<th>Not standardized B</th>
<th>Coefficients Std. Error</th>
<th>Standardized Coefficients Beta</th>
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<th>Sig.</th>
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Table 3. Analysis of variance of swimmers in final competition in 100 m free-style discipline at OI in the period of 1992-2008

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<th>Mean Difference (I-J)</th>
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<td>2004-2008</td>
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DISCUSSION

Disciplines of freestyle technique are the most mass and the most attractive among the other ones at the swimming competitions. The most successful swimmer in this discipline at 90s was the Russian swimmer Aleksander Popov, later on “The Flying Dutchman” Pieter van den Hoogenband took the champion throne. In recent years, French swimmers are the best in sprint.

Table 1. represents the relationship between the basic descriptive statistical parameters of the variables (studied at the total sample of male finalists enrolled in OI in 100m freestyle discipline), standard deviation (SD) and coefficient of variation (CV%). High level of homogeneity of these parameters can be determined from that relationship. (Figure 1) The biggest discrepancy in the total analyzed period can be seen in the following variables: reaction time at the start (VRCK), start time (VRST), the frequency of strokes per minute (FMIN), stroke length (DUZZ) the time of the turn performing (VOKR) finish time (VFIN), lap time at 50m (VP50), swimming efficiency (INEF) and age (UZRS). Among the morphological variables applied, the largest dispersion is seen at: anthropometric height (AVIS) and anthropometric weight (ATEZ).

The different tactical plans are noted in the planning of the race which is reflected in the diversity of parameters VRST, VP50, VOKR and VFIN.

Figure 1. Descriptive analysis of finalist in 100 m freestyle swimming
By the analysis of regression on the total sample of respondents in 100 m freestyle, the parameters that most influence the final result of the race are separated: (Figure 2), and these ones are: the overall swimming speed (UBP), time of swimming (VCPL), swing time (VROK) and time of final swimming. (VFIN) Parameters that significantly less influence the result are: start time (VRST), lap time at 50 m (VP50) and the length of stroke (DUZZ). Variables that affect alternatively the result are: swimming speed (BCPL), stroke frequency (FMIN) and swimming efficiency (INEF).

After examining the regressive analysis of 100 m freestyle discipline, we conclude that for achieving better results is important significantly higher swimming speeds and shorter time needed to finish and turn. that less significantly affect swimmers results in 100 m freestyle are: Start improving speed up to 15 m and the first 50 passages and maintain of a constant length of stroke.

**Figure 2.** Regression analysis of finalist in 100m freestyle swimming
Analysis of variance 100 m freestyle discipline at OI in the period of 1992 – 2008 (Figure 3) we have determined that some parameters are changed throughout period analysed: final result – KREZ (mostly in period 1992 - 2008), total swimming speed – UBP (mostly in the periods 2004 - 2004 and 2004 - 2008), start time – VRST (mostly in the periods 1992-1996), a lap time on the 50m – VP50 (mostly in the periods 2004-2008), swimming efficiency - INEF (mostly in periods 1996 - 2000 and 2000 - 2004) time of turn performing - VOKR (mostly in periods 2000 - 2004) and finish time – VFIN (during the first three OI). This analysis leads to the conclusion that the 100m freestyle discipline advanced the most throughout the analyzed period in speed parameters – UBP, VRST and VP50, in a better performance of the technical elements (VOKR) and in better resistance of the fatigue in finish of the race (VFIN). Parameters which were less changed throughout the time are: the length of the stroke (DUZZ) and anthropometrical gight (ATEZ). These parameters show that the freestyle technique has been mostly changed in increasing of the stroke length and with that, the efficiency of swimming has been improved. Since the speed is associated with the power and with the amount of muscle tissue, constitution of the freestyle swimmer has been changed throughout the time.

Parameters of swimming speed (BCPL), stroke frequency (FMIN), anthropometric height (AVIS) and age (UZRS) have not been significantly changed during the analyzed period.

Figure 3. Analysis of variance 100 m freestyle discipline at the OI in the period 1992-2008

CONCLUSION

The Olympic Games represent the best achievement in the career of one athlete. Because of the complex competition in the 100 m freestyle discipline, result depends on a number of details that determine who will advance to the finals and who will win the medal. Competitive analysis certainly helps us to view and analyze the swimming parameters in the race. Such an analysis is an ideal opportunity for the correction of errors and suggestion on
how to repair the defects. It also contributes to the quality improvement of competitive strategy.

Competitive strategy, or as it is also called, tactical preparation for a performance, has been developing and improving in the process of training. During that process, both the coaches and the swimmers have the opportunity to choose the more effective preparation for participation in competition. In 100m freestyle swimming discipline, result was significantly influenced by the overall speed and the time of swimming, as well it was influenced with the good quality of turn during swimming and crossing the finish line. The result in this discipline has been improved throughout the time and the progress in technical and technological parameters is obvious. Sport has become increasingly scientific and because of that, stationary technology and results will be improved in future.

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INCIDENCE OF SPINAL DEFORMITIES IN CHILDREN OF II AND III GRADE

Abstract

Problem physical activities children younger school-age children, with the basic tasks research is construction kinesitherapy adequate prevention and avoid postural disorders spinal column, optimal ontogenetic level morphological(anthropological) development. The main objective research is contents teaching physical education as well as and content that can be put in regular program teaching physical education with the basic task prevention potential and eliminate disorders spinal column, with auxiliary a harmonious biological development. The entities from which he was carried out sample size for this research is defined as population students male primary schools II and III grade. The first and basic condition was that they are included in teaching physical education in the course of this research sample is taken 778 respondents. According to the manner elections respondents sample was targeted selected. Were taken II and III grade elementary schools in Bijeljina, Teslic, Foca and Pale.

Key words: prevention, children, postural disruption spinal column

1. INTRODUCTION

Proper body posture involves the proper relationships among all segments of the body, and this is the condition of their functioning.

The most important role in forming and maintaining proper posture with muscles, as an active part of the apparatus to move.

The weakness of certain muscle groups, and their excessive unilateral load can cause the occurrence of various disorders of the spine, thorax, upper and lower segments, especially on foot. Because of the plasticity and sensitivity of child proper body posture status is of particular importance in school development in the early years of schooling.

Postural status of school children in our investigated by many authors whose results are somewhat different, although largely similar, however.

Radisavljević Street Arunović (3) the project in the sensitive period of development of motor abilities of children of younger school age children including track and determine the physical status and the status of the foot. The present results indicate that a relatively large number of students of both sexes, with a disturbed physical status and the status of the
foot. Disorders are generally winged scapula-21%, lordotic posture 44% of boys and 57% girls and 79% of flat foot. He also registered a large number of children with certain asymmetries shoulder blades and Lorentz triangles.

B.K. Velitčenko (1993) points out that more than 70% of school children have specific problems that result from lack of motion activities such as disturbances in the posture. In children with disorders in posture typically impaired locomotoric apparatus weakens the muscles are inflexible ligaments reduced the ability of the lower extremity and is especially important to the spinal column.

According to Petrovic-Radic (1996) for scoliosis with a curve of 70% of cases. Of these the thoracic scoliosis about 19%, 25% of lumbar and cervical scoliosis of about 1% of cases. According to the author of scoliosis with two curves waste 30% of cases of which the thoracic plus lumbar approximately 25%.

R. Kršmanović and associates (1988) were performed by the method of assessment N.Volanskog posture of the fifth and seventh grade in Sarajevo. Results showed that seventh grade students have a significantly worse posture than five grade where it is estimated that students seventh grade are often located in the area of shoulder and the neck.

Dealing with this problem Solarić (1971), Milekić (1971), Poljaković (1977) point out that the mere occurrence of physical deformity, regardless of their size significantly affect the mental state of a person especially if they are in adolescence. People do not adopt such a situation because of their impaired image consious causing a disorder certain personality traits and psychological conditions that are reflected in introversion and sometimes aggressiveness, neuroticism, anxiety.

The subject of this study are spinal postural disorders in children of younger school age and procedures to prevent postural deformities of the spinal column-preventive exercise.

The aim of the research is to determine the physical education curriculum and content that can be put in the regular program of physical education, with the main task of prevention and potential elimination of manifest disorder of the spinal column.

Based on a target the following tasks are determined: a) to determine the current state of spinal posture status b) analyze the current way of organizing the physical education of children in schools, program content, means and methods by which the exercise of activities to meet the needs of children and the present state and the organization of professional work c) after this defined the future direction of development of physical education in part related to the prevention of spinal postural disturbances school age.

Consistent with the objectives and tasks of the research hypothesis was that there was no statistically significant difference between the experimental and control children groups in postural status of the spinal column. It was presumed that in the final stage of the procedure eksperimentalnog to be significant differences between the experimental and control groups in postural status in favor of the experimental subsample of children of junior school age, as well as the introduction of a special program of physical exercise significantly influences the establishment of good posture status of the spinal column, better and more harmonious development.

2. METHODS

2.1. Sample respondents
The sample is derived from a population of younger school age children, male and female.

Children attending primary schools in the Pale, Foca, Bijeljina and Teslic. The number of respondents was 778 of which 396 boys and 382 girls.

2.2. Sample variables

To determine the status of the spinal column was used: determination of the degree of spinal deformity in children of school age with surplus, ruler and defrmograf, preklon test. To determine the status of the spinal column, it was necessary that the subject which takes the status of the spinal column turned back to the examiner, but a bit spaced parallel set foot in his usual position. All subjects were in her underwear in the rooms where the temperature ranged from 20-23 degrees.

2.3. Description research

Assessment and measurement of the respondents made in the school premises. Children at the same time they were barefoot and in underpants. The inspection was performed in each patient from a distance of about 2 m, with individual segments were analyzed according to the established order of authority.

The collected data were reviewed, arranged in measurement lists specifically for each patient, and then sorted by gender and subjected to mathematical and statistical analysis. The results are discussed and finally conclusions.

2.4. Methods processing

The results were analyzed according to frequency of occurrence in certain categories of postural status in particular by gender. The situation in some segments of the body is expressed numerically and procents. Relevance difference between boys and girls (p) was analyzed by t-test. For test the null hypothesis we used two thresholds of significance:

- When the p <0.05 to 0.00-rejects the null hypothesis and is considered to be statistically significant deference.
- When p> 0.05 accepts the null hypothesis and concluded that there was no statistically significant differences.

2.5. Experimental procedure, the draft and the course of research

The research contained in exdperimental procedures and control subsamples. The experiment lasted for one year. With the experimental group was three times a week for 45 minutes per group. They worked for trained teachers of physical education. Subjects in the experimental subsamples were trained by the program for the prevention of postural disorders that were made after the initial measurement. Content activity in experimental subsamples consisted of a prevention program of postural disturbances of the spinal column and regular activities directed at the activities of physical education.

The concept of physical exercise is made so that it is implemented through a form of applied activity in physical education of school age. With any physical exercise begins with the preparation of the body, primarily focused on the physiological and emotional. Cardiovascular function of load introduction that is yet to follow was the initial
physiological lost. Emotionally introduction to this type of special program had great significance. Each exercise is performed from easier to more difficult. In order to obtain the best effect, special attention is addressed to the following:

- Proper demonstration exercise, because it is a strictly defined movements. Therefore, after each explanation and demonstration, the children are just trying to do it. The explanations were brief and concerned the manner of performance and goal specific exercises with respect to age.

The content of the program were not static they are adapting to changing situations given, supplemented, depending on the motivation of the time because some of the exercises the children have become monotonous and decreased attention to the proper execution of movement.

3. RESULTS AND DISCUSSION

Results are presented in tabular form with tekst interpretation of the experimental and control sample.

The significance of differences postural status of experimental and control groups of boys and girls at the initial and final measurements of kyphotic posture and lordotic type II class

Table 1.

<table>
<thead>
<tr>
<th>kifotično loše držanje(K)</th>
<th>lordotično</th>
<th>loše držanje(L)</th>
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<td>p&gt;0,05</td>
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</table>

In the experimental group of boys after the final measure was statistically significant (p<0.001) was no difference compared to the control group, when it comes to bad kyphotic posture.
The significantly less postural disturbance irregular kifotic poses the type of experimental grupa. Postural disorders lordotic type on the final measurement showed a tendency to decrease in the experimental group of boys, but not statistically significant in boys of the control group. \(P > 0.05\).

For girls the situation is similar and in which there exists a statistically reduce irregular kifotic poses posture in the experimental than in the control group \((p < 0.01)\), but also just a tendency of decrease of lordotic curve types in this group without statistical significance. \(P > 0.05\).

The table where the data t-test significance proportions we can observe the relevant equivalence groups in the initial measurement \((p > 0.05)\) in boys and girls. The significant differences were determined between experimental and control groups measure at this age.

But at the final measurement was found highly significant differences between experimental and control groups at this age kifotic posture \((p < 0.001)\), namely the experimental group significantly in boys.

This can not be said for postural disturbances lordotic types that are not establishing any changes.

The significance of differences postural status of experimental and control groups of boys and girls at the initial and final measurements of kyphotic posture and lordotic type III class

**Table 2.**

<table>
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<tr>
<th>kifotično loše držanje (K)</th>
<th>lordotično loše držanje (L)</th>
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<td>(p&gt;0,05)</td>
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</tr>
</tbody>
</table>

For girls of this age showed no statistically significant differences in the final measure in any case, but there is a tendency to reduce the decline of postural disorders in the experimental group compared to controls both types of irregular kifotic poses disorders and disorders lordotic type.
As a brief summary of the analysis of quantitative differences in the measurement of postural status indicators can be concluded that the statistical methods established a positive correlation relationship between the effects of experimental factors and postural status of the spinal column, which was under the influence of the above factors in relation to the control group showed a tendency improvement.

On this way is confirmed that a special exercise program significantly affects the establishment of good posture status of children of school age at which the applied experimental procedure.

4. CONCLUSION

Preventing the emergence of postural disorders is very important element in maintaining the health of children, because disturbances in its evolution can progress to deformity, the consequences are far more difficult than it might assume. There impact is very significant for the overall physical and mental development.

The results indicate the following facts:

- The study monitored effects specifically programmed to work with the postural status of school children and third grades.

- Special-work program that applied in the study had significant effects on the prevention of postural disorders.

- The applied-prevention program of postural disorders is well fit in the activities implemented in schools institution, and it can be said that the scheme with certain modifications may put in the regular program of activities aimed at the area of physical education.

- Research indicates the need for longitudinal study of postural status of population. So a long-term research that would in the long interval followed, the state provided no change in posture status, given the manifest objective of postural behavior disorders in relation to the applied program.
5. REFERENCE

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BASIC CONCEPTS OF PHYSICAL EDUCATION

ABSTRACT

In order to develop the theory and practice of physical education, and successful professional approach in this area of human activity, it is not enough to define technical terms and expressions only. It is necessary, above all, to determine appropriate terms in an accurate way. Every form of human activity has its own language. The basic difference between the term and concept corresponds to the difference between language and thought. In fact, the term represents linguistic expression of the concept.

As well as in any science, so in physical culture, it is essential to determine precisely what each term means, in order to avoid mutual misunderstandings and misinterpretations.

With every new knowledge and deeper access to the essence of objects and phenomena, the concepts expand, upgrade and change. Therefore, we can conclude that defining the basic concepts of physical culture is temporary and only for a certain period of time.

Concepts do not last forever. The process of establishment, in fact, is nothing but a continuously defining subject of cognition.

According to their method of production, people regulate not only their social relations, they produce believes, ideas and concepts, too, which are temporary or historical.

Keywords: physical culture, education, exercise, exercising.

1. INTRODUCTION

Analysis of terms, their study, the skill of their usage, always requires the study of their movement, their connections and their mutual interactions. As knowledge develops, according to the changes in the practice, there is always a need and opportunity of reviewing previously given definitions. What is required is dialectisism of knowledge, which means the creation of the term, which corresponds the objective processuality of knowledge, in the first place of processes and phenomena of objective reality. Each term is then located in a certain relation, that is, in a certain connection to others. Defining a term, means to determine the content of that term. Without a definition, as a relatively constant provision of term, it is impossible to get the knowledge.
Scientific understanding of the world is part of the human capacity to change the nature and himself, so that the scientific truth can be reached through historical research using certain methods. In this case, facts should be subjected to re-test in order not to make speculation and mysticism of science.

Basic terms of physical education represent a reflection of the historical movement of relations of production in which we should look for their deeper meaning. The meaning of terms is important to rely on them in thinking, as the specifying of a term increases the possibility of a practical action, to a large degree. Otherwise, any conclusion escapes the truth. Terms are not eternal and unchangeable, but change with the development of events in society and our knowledge about them.

Several basic terms about physical education are:

1. Physical culture
2. Physical education
3. Physical exercise
4. Physical exercising

These terms are fundamental, because they represent essential features of the entire scientific field of physical culture.

2. PHYSICAL CULTURE

The term „physical culture“, and other terms represent a reflection of historical trends in production and society. The beginning of systematic work on the culture of the human body, begins at higher levels of development, when the human body and moving does not just imply a bunch of muscles and simple locomotion. Quite the contrary, the human body begins in a certain way to nurture, to prepare for specific skills and to practice for more effective work or to another purpose. It is evident that physical culture did not exist before the culture, that is, cultivation of body and movement could not precede the cultivation of other forms of human existence. In its broadest sense, culture usually implies the totality of scientific behaviour, with all products of that behaviour.

There are several definitions of physical culture:

1. Conscious, planned, free, purposful, creative social activity for cognition and management of material and spiritual benefits of human physical activities, as well as structural: physical education, sport and sports recreation.

2. Physical education represents part of the material and spiritual values of society, directed by special and various motoric activities, towards the optimal bio-psicho-social status of man.

The dilemma of the term „physical education“ creates serious difficulties to the theory and practice. On the one hand, the term implies idealistic division of man into spiritual and physical being, while on the other hand, implies physical education and sport. The solution for this confusion of meanings should be sought in one broad term that would include everything that is common to physical education, sport, recreation etc., characterizing basic purposes of society in this field. Culture, as it turns out once again, includes all human activities in the field of material and spiritual work, as well as the creations and changes
made in nature, society and human thinking, as a result of these activities. It could be said that culture represents the creation of new values that are objectified through labor.

The term „physical culture“ refers to the area of creating changes that reflect the man’s physical being directly. These are the activities whose main goal is purposeful changing of man’s physical characteristics and abilities. However, explanation of the words themselves is not enough to understand the concept. What the words themselves do not indicate is that the physical education means the process of creating new values. Moreover, the term „physical culture“ applies to the knowledge of the process and these values, that is, here lies the essence of science of physical education. In other words, when we say „physical culture“, it is usually referred to the science of physical culture.

Physical culture does not only include the integrity of material and cultural values, but also implies certain conscious activities and its results. That conscious activity is manifested in the form of various physical movements, in order to achieve certain results. These results are quite different from the results of productive labor. Namely, while in the process of labor the aim of physical activity is certain material product, here, the main goals are of totally different nature. Since the existence of human material and biological nature (physical being) is given (individual) independent of human activity, we can freely say that the physical culture corresponds to the conscious nurturing of human physical being. Above all, it refers to the human body, than from a theoretical point enters the domain of science, while in an educational service it occurs as the subject of physical education.

3. PHYSICAL EDUCATION

Physical education is the most organized, most systematic and professionally managed educational process in which, in correlation with other educational areas, with systematic and different movement activities, strives to achieve the main goals of our social system (development of motoric skills and acquisition of motor habits). It seeks for the values wanted to be achieved, in a broader overall personality development of students.

In general, the term education means both gaining knowledge and total cultural formation, focusing on the formation of personality and its world view.

Physical education is planned organizational activity that man, according to objective social needs, uses for his liberation through physical activities.

There are some other, similar or different, interpretations of the term physical education:

1. Physical education, part of the overall education process in which using physical exercises, planned and systematically, influences on physical constitution of the trainee. Using this kind of upbringing, helps in overall development of personality. The main goal of physical education is to improve the working and defensive capability of the individual and society. The task of the individual consists of providing healthy holiday, concerning the health, hygiene and education task, too.

2. Physical education is pedagogical process of forming and developing versatile personality, using appropriate motor activities.
3. Physical education is planned and systematic activity whose aim is, through physical exercise in the direction of versatility and through training in the direction of creativity in certain branches of sport, to develop human personality in terms of achieving educational goals.

4. Physical education is pedagogical process of forming and developing complete personality using appropriate motion activities. That is deliberate, systematic and permanent impact on human being, through particularly organized motion activity, for the sake of defining certain educational tasks.

The goals, means and physiognomy of educational and physical activity, as well as any other activities, have changed throughout history. Namely, there is no physical education which would be independent of specific historical circumstances. In every socio-economic formation, the historic goal of education has been developed and according to it the goal of physical education, too. Parallel with physical education, other components of education are being changed and developed: metal, moral, aesthetic, etc.

It all stands in a dialectical relation of close mutual connection and mutual influence.

In order to find out what was the physical education of earlier periods, it is necessarily to look at what the people were, that is, what were their needs, their productive forces, their way of production, and ultimately, their social relations which derived from that conditions of existence. The creation of physical education is related to the tools for work. When the man realized that the sharpened stone worked effectively from the rounded one, that he can reach the fruit with a long stick and so, he got the desire to convey that knowledge to man and to the horde. Objective factors of creation of physical education are the material conditions of life, in this case hunting.

Today we can certainly say that hunting could not be the first sole factor that caused the occurrence of physical education. That are material conditions that existed before hunting.

Analysing the development of physical education throughout history, we can conclude that class physical education was based on the lack of production, and this class characteristic was destroyed by the development of modern force of production. The idea that economic eras do not differ from what is made, but in that what kind of tool is used in the process of making, we can conclude that: the bow and arrow are the features in the primitive society; halberd – physical education of the Middle Ages; gunpowder rifle – physical education of Capitalism. For physical education in Socialism, the basic characteristic is the creation of a special (new) science (physical education, kinesiology), whose task is to study the laws of human motion, giving it humane value.

4. PHYSICAL EXERCISE

Physical exercise is, as the primary means of physical education of student, particularly selected and designed methodological movement activity or system of movements collected in relatively unified structural parts in which is primarily, a) biological purpose, achieving an optimal level of motoric abilities and b) pedagogical purpose, the acquisition of motoric awareness throughout acquisition of motoric habits. It is specifically selected motoric activity whose main aim is to expand the level of physical development of man, the formation and improvement of his motoric abilities, habits and traits. The content of these specially composed activities, through which the level of physical development of
man is expanded and other motoric properties are formed, comes from the working environment and serves for solving special pedagogical and medical tasks.

Physical exercise implies all those movements that man consciously uses for his development and improvement in terms of socially conditioned educational purpose. However, all motions, movements and activities cannot be called physical exercise in terms of physical education even though they indubitably affect our body, like: every day walking, sitting, writing, working in the field, factory, etc. Even thought these every day activities represent some kind of physical exercises, they cannot be called like that, because their influence on the body is always random, so that they may affect positively or negatively.

Here are some more definitions of physical education:

1. Physical exercise is motoric activity intended for the transformation of man.
2. The term „physical exercise“ means motion, movement and muscle activity, applied for a certain influence on human organism.
3. Physical exercise is a means of physical education that includes all the movements that one uses for his development and improvement in terms of socially conditioned educational purpose.
4. Particular movement that man does in order to maintain, increase and improve his physical and functional abilities and physical development in general.

In their free time, our ancestors taught others and also practiced shooting a spear, bow and arrow in order to hit the prey and provide food for themselves. He does this because through history he understood the significance of repetition of movements.

By further evolution of human society, physical exercises were given other meanings. The man was still working with the help of physical exercises, physical movement, but also, due to a higher level of consciousness, he began to run, jump, throw even though when these physical movements did not have utilitarian character. As physical exercise develops not only a muscle, affecting the will, the character, the psychic life in general, it has been used for the development of intelligence, the elimination of deformity etc. Thus, in the oldest times appears Culturalism, training in order to gain attractive body and become pleasant only to the eye. But today, science reveals that physical exercise changes both man and nature itself. Each activity practiced only for the purpose of form, movement for movement, becomes the goal for itself and it loses its values and connections with society. Such movements do not create man, but creative labor movements whose effect on human organism, in fact, is positive and progressive.

If we liberate physical exercise from the case, and insert a conscious component, the need that person intentionally uses physical exercise for his development and improvement – then, walking down the street, working in the field or in a workshop, can be a physical exercise. Therefore, physical exercise can be defined as motions and movements of the muscular system, that are made for a certain effect on the body, whereby the creative activity of man would be at higher level.

5. PHYSICAL EXERCISING

Physical exercise, as the process or activity of implementation of physical exercise, is a process of adjustment which, using various motoric activities, or through the sistematic
repetition of physical exercises (as a complex neurophysiological and biodynamic process), causes positive changes of man’s capacity from some primary (initial) state to the desired (final) state. Also, physical exercise includes movement and motions, whose main aim is improving human capabilities. It is as well, a process of conscious, organized and planned movement of material and biological nature of a man, whereby using physical exercises, man achieves specific goals.

Physical exercise is the process of developing of skills, habits and abilities, that is, several times repeated performance of physical exercise.

If it is a process of regular exercising, where the purpose is achieving excellent sports results, then this form of exercise is called training; if the physical exercise is used in order to strengthen and improve our health or due to fun and entertainment, then it is called a recreation. This type of exercise is recommended as an excellent and successful method in facing the disease of modern time – hypokinesia; if by using physical exercises we eliminate certain deformities of the body, then it is called kinesiotherapy.

When we add that our body without exercising loses its function, while it is created to carry out a number of actions in order to survive and develop, then it is needless to speak of the importance of exercising.

Physical exercise represents the basic method of physical education, systematic activity directed on improvement of general and special activities of human being. It could be said that physical exercise, as a process of organized and planned movement of material and biological nature of man, results from the work.

First physical exercise was related to the practical, environmental activity, to secure the material conditions of life.

For every good sports or any other result, it is necessary to exercise and to improve certain skills, but the most important question is why exercising, since the emancipation of the arms and legs became significant only due to emancipation of the head.

While performing our daily activities, we can perform physical exercises such as going to work by foot or running, doing exercises at work etc. These physical movements become physical exercise if a person consciously programs that activity, connecting it with its social practice. Here is physical exercise truly identified with the creative working activity.

6. CONCLUSION

The human movement derives from the eternal human need and the necessity to adapt nature to their needs. Therefore, we can say that the world does not determine the physical movement of a man, but that the human movement is always a product of social development. The productive forces, no matter which period of history is meant, always reproduce such a physical being that makes his working and environmental activity worthwhile. Human abilities, both of physical and spiritual nature, will always obey the power of production. Satisfying human needs, production will always create new capabilities and needs. The human motion is always the same as the physical, i.e., material and biological nature of man, and physical nature of man is nothing but a social being. The essence of the movement of human body is in close connection between the arms and legs with the process of working. Physical existence and physical abilities are nothing more than
the totality of man’s productive activity. Physical activity is particularly important in childhood for the development of functional ability of the heart, lungs, muscles, skeleton. If they are not sufficiently developed during the growth, the opportunity for optimal development of these organic systems is probably lost. Moderate movement, as well, affects mental health very positively, resulting in relaxation of mental stress throughout lifetime. Physical movement, both in childhood and adulthood, strongly influences the control of the body weight.

7. BIBLIOGRAPHY

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