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## FACTOR STRUCTURE ALL-AROUND OF STUDENTS THE PHYSICAL EDUCATION AND SPORTS

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All-around competition is the only competition in which it does not matter whether the athlete is the first, the second or the last in a discipline. What matters is the total number of points, and a rounder competes against his/her personal capabilities and standards. Athletic all-around competitions are a series of consecutive athletic competitions divided in two days. Success is calculated by the sum score of all disciplines that are pointed due to the international athletic tables. The research included a group of 60 students of the Faculty of Physical Education and Sport in East Sarajevo, male, age 20±0,5 years. The aim of this study was to determine the structure of athletic all-around competition, respectively all-around competition type of students and dominance of individual disciplines. In athletic all-around competition were represented a total of 8 (eight) disciplines. Using factor analysis in a defined area were gained two factors (all-round type) with a total of explained 78% of variance of the set. The first factor (type) has exhausted 60% of the common variance of the set and is defined as all-round *type of runner-jumper*. Another factor has exhausted about 18% of the analyzed set and is defined as *throwing type* of students (latent dimension of power). The obtained results of the research are partially in contrast with similar research on a sample of top athletes.

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## INTRODUCTION

The desire of man to somehow express his skills the old Greeks expressed by the fact that on the XVIII Olympic Games in 708 BC they introduced Pentathlons (combination of running on a of stage-192,27m, long jump, discus throw, javelin and wrestling). Due to their magnificence and the role of physical fitness Aristotle believes that " athletes in pentathlon are the most beautiful people, because they are equally qualified both in speed and in power".

American athletes in 1885 set up a kind of all-round competition (*All Around Championship*), where within five hours the competition in 100 yards running, shot put, high jump, running the 880 yards, walking, throwing weights, long jump and running a mile should be ended. In the program of the modern Olympic Games all-around competitions first appeared at the Olympics in 1904 in St. Louis when on the program for the first and only time there was a combination of three athletic disciplines (long jump, shot put and running in the 100m) and decathlon (100 yards, shot pot, high jump, running the 880 yards, walking, hammer throwing, pole vault, 120 yards crotch, long jump and running 1 mile) (Pavlović, 2013). In this 1912 in the athletic program was the pentathlon, which was also held in 1920 and 1924 with the events: long jump, javelin throwing, 200m, discus throwing, 1500m (Bervall, 1913).

Precisely modeled on the Ancient pentathlon were formed modern athletic all-around competitions, primarily from the need to give certain athletes the opportunity to express themselves in multiple disciplines and thus find an appropriate place in the athletic sports.

Today, the men and women all-around competitions are psychologically and physically demanding and the toughest competition that shows the maximum of human capabilities and abilities in a short period of two days. For rounder (male and female) is usually said to be the fittest and most versatile athletes because they have to be good runners (100m, 400m, 110m hurdles, 1500m), jumpers (long jump, high jump, pole vault) and throwers (shot balls, discus throw, javelin), which was much earlier claimed by Aristotle.

Training process of rounders is very demanding and through the XX century it underwent a major change. This primarily relates to the entire methodology of athletes' training, where in addition to the narrow preferences of each participant are also developed those skills which are of encompassing character. Today the most widely is used the combined system that includes training of individual disciplines one after another, simultaneous training of all disciplines with an emphasis on training disciplines that are most suitable for the rounder. However, it is depending on the mental and physical quality of the athletes, the health status of individuals, the period of sports career, the period of the annual cycle. All competitors are necessary to have a consistently developed morphological – motoric - functional space that is highly integrated into the cognitive-conative potentials and will also ensure the achievement of high results of competitors. What is very important in the training process of rounders is their process of transition from one discipline to the other which is a very complex task. During this process, at the beginning there is a quenching of already formed dynamic

stereotypes that were created by the training and training of the prior discipline. New training of a new discipline involves the formation of new functional-motor structures that will enable the best possible way in achieving the success. Rounders always strive to improve their personal results in those disciplines in which they lag behind either by personal or general criteria. A large number of specific movements that allow the active connection of constituent elements of all-around competition and converting into a single structure is one of the main characteristics of the training process of rounders (Pavlović 2013). Key factors in selection of decathletes: Body shape, age, Physical quality, Training team management, Large load training, An emphasis on strength and technique in the late stage (Wang, & Lu, 2007).

The aim of the decathlon is the detection of versatile track-and-field athletes. The abilities required by the multi-events are based on different biomechanical and physiological attributes, therefore decathletes represent a compromise of the different types of track-and field athletes. That is why decathletes who show excellent performances in all ten events are rare.

Speaking of specialties one often talks about the 'runner types' or 'jumper types', or also about 'the combined runner-jumper type' or 'the combined sprinting-throwing type'. Although such terms are frequently used in regard to training or competition, there is no exact method to identify decathlon ability types; therefore, up-to-date every possible combination of exceptional

performances in events might be called a type. To avoid such arbitrariness it is of most importance to develop a scientifically based definition of types of performances to differentiate them from artificial pseudo-types (Stemmler, & Bäumlner, 2005). In research Bilić, (2015) came to the conclusion that discovering the best decathlete profile in relation to the level of world-class performance enable the assessment of matching the most promising structures for achieving the maximum potential in the decathlon. Featured typical taxonomic structure indicated that the area decathlon characterized by a very wide range of disciplines structure the relationship between the presences of versatile types of highly talented decathlon. Not noticed coincidence of result achievements in relation to the branches of disciplines as well as expressed greater coincidence according manifestations motor dimensions that are synergistically manifested in certain disciplines. No apparent domination of sprint quality is not possible to achieve a significant breakthrough 'score achievements at the level of decathlon recorder. The Identifying relevant classification decathlete based on kinship interrelationship between disciplines get more precise information about the presence and effects of various typical decathlete structure in relation to the level of performance, which facilitates the selection procedure for the individual development strategies and optimize the training process. Results from the most comprehensive study of this aspect of the decathlon (Stemmler, & Baumler, 2005), showed

that in reality present a very broad typological furniture. The study of conditions essential for the full expression and development decathlon potential, Smajlovic (2000) is based on a comparative analysis of kinship structures decathlon disciplines pentathlon, heptathlon and decathlon found that with increasing number of disciplines of heptathlon pentathlon to not generate significant changes in the structure of the relationship between disciplines but only by switching the decathlon in which significant but inadequately expanded space for the manifestation of the general and athletic decathlon versatility. To obtain an objective notions of structure and typology decathlon space, an assessment of the measures and community manifestation of decathlon potential in relation to the level of 'score to achieve the most successful decathlon world. In consideration of efficiency of result achievements the most successful decathlon world 'score of different levels and ages determined the presence of a specific and different predictive contribution discipline decathlon total pointing score. A comparative analysis of the dominant predictor had found that disciplines whose outcome depends more on the technical efficiency performance than the level of training of basic motor abilities are the key determinant of the success of his score in the decathlon (Bilić, Smajlović, & Balić, 2015). The structure of the decathlon as disciplines consists of three large groups of disciplines: racing, jumping, throwing. By analyzing the results over 8000

points from 1966 to 2002 that are decathlete exercised, differentiated several models compete in all events. Both models decathlon to 1980 were model throwers, jumpers and runners, followed by runner-jumper, jumper-thrower and runner-throwers (Cox & Dunn, 2002; Kenny et al.2005) while today a modern model decathlons requires uniformity in all disciplines. Woolf, Ansley, Bidgood, 2007 are based on the results from 1986 to 2005 defined clusters in disciplines gymnasts. The first cluster are running sprint and long jump, the second cluster of the remaining jumping discipline, the third cluster throwing disciplines, while the 1500m race stand-alone cluster. In their study Bilić, 2015 states that the key determinants of success in the decathlon consists of technical efficiency (pole vault), and the efficiency of expressing the energy capacity and aerobic-anaerobic components (1500m). But without the express dominance spinterskih quality can not be achieved result at the level of decathlons recorder. Grey correlation analysis results (Fan, 2014) show that Chinese and foreign athletes each single event influence on total performance as well as correlation sequence as 110m hurdle-100m-long jump-400m-high jump-pole vault-shot-javelin-discus-1500m. While world sequence is 110m hurdle-long jump-100m-400m-pole vault-high jump-javelin-shot-discus-1500m. It is clear from that Chinese athletes still have greater gap by comparing with foreign excellent athletes on high requested special techniques pole vault and javelin such two events which indicates our

country athletes still have shortcomings on technical motions completion with high speed, high rhythm that should be taken seriously by our country all-round coaches. From factor analysis result, it is clear that in Chinese and foreign excellent athletes' performance structure, 100m, 400m, 110m hurdle these three single event have the greatest functions, they can call speed, explosive force factor, discus, javelin and shot these 3 events functions are the secondary, they can call strength factors; High jump functions are the next that call nimble factor; Minimum functions event is 1500m, it can call speed endurance factor. These four factors all are related to speed quality, which reveals that men decathlon feature is core with speed (Fan, 2014). It is an indisputable fact that the decathlon competitor does not have to be remarkable in any part of the competition to be a champion in all ten, but he must be good in the disciplines in which he is weaker and excels in disciplines that are his forte. Given that he must be good in three racing, three jumping, three throwing and one discipline in endurance, there's not much space to refine just one discipline. Therefore decathlon competitor must compromise, and therein lies the very nature of decathlon. This is a compromise in which the trade-offs must be made in the preparations in order to achieve maximum results (Tidow, 2000). The comparative analysis of five world records it was found that discipline whose outcome is more dependent on technical efficiency performance than the level of basic motor abilities, are

crucial determinants in top results in the decathlon. At the present time, can be noted better results in sprint disciplines, long jump, pole vault, so that in the future we can expect progress in the decathlon but also the opportunity of differentiating the new model of decathlon competitors (Mandarić, & Mandarić, 2016). Decathlon is the only competition in which it does not matter if the athlete is not the first, second or last in a discipline. What matters is the total number of points, and a rounder competes against own capabilities and standards.

Namely, it is a known fact that students of all Faculties of Physical Education and Sport in the syllabi of Athletics study have represented some athletic disciplines that they train and develop as part of practical training. Also they have to meet certain standards and techniques of these disciplines in order to take the final exam in Athletics. Precisely on the basis of the previously presented facts about the athletic all-around competition was realized the current study among students of Physical Education and Sports East Sarajevo. The main objective of the research is to determine the structure of athletic all-around competition, i.e. to establish dominance in the all-around individual disciplines.

## METHOD

The investigation included population of 60 male students of the Faculty of Physical Education and Sport in Eastern Sarajevo, ages 20±0,5 years. All the achieved results of the students were

scored according to the tables adopted by the IAAF in 1984.

From athletic all-around competitions were represented the following disciplines:

1. Running 100m (M100)
2. Running 200m (M200)
3. Running 400m (M400)
4. Running 800m (M800)
5. Long Jump
6. High Jump
7. Shot put
8. Javelin throw

To obtain the necessary information defined by the aim of the research was applied Factor analysis (Principal components method - Varimax normalized).

## RESULTS AND DISCUSSION

Decathlon is one of the oldest events in athletics with high requests of human functions, is a comprehensive sports event that combines techniques, physical ability, intellectuals into one, whose competitive levels reflects a country athletics levels to some extent. Modern men decathlon by far has nearly 100 years history, human closely focus on its changes and development since it appeared. From world range, decathlon researches experienced events meticulous designing and combination, athletes' selection and training, grading method development and revision, different periods' cases summarizing and analysis and other stages (Zou, 2002).

In comparison to the profile and level of success of the most successful decathlon all the time, it was observed that the absence of the special quality of

the expression of the maximum potential of decathlons impossible to achieve the highest level of success. Joining the results of other authors in the analysis of typological sets decathlon (Etcheverry, 1995; Lee, 2001; Van Damme, et al., 2002; Stemmler, & Baumler, 2005), it can generally be divided into two distinct areas: the versatile types with 3 of the 4 factors (sprinting, jumping, throwing, and durability) with excellent performances and types of specialists with 1 or 2 factors with average and below-average performances. For versatile types dominate pentathlons jumper sprint and sprint-type jumper in relation to the types of sprinter-thrower and jumper-thrower (Bilić, 2015). Management of complex systems, such as a human, in the training process is not possible without knowledge of the anthropological characteristics for which one can assume a high prediction in the formation of competitive track and field results (Tončev, Tumin, Solaja, et al. 1996). Therefore, due to the purpose of the application of those methods and forms of work which contribute to increasing the efficiency of training work according to individual peculiarities in the training practice, more and more are present studies of different age groups or differences within the different generations of the same population. What is important is that the factors of success in athletics are specified hierarchically, which means that in the series, at the beginning, there are the most important factors or dimensions and in the end less important (Tončev, 2001). In connection with that the researchers who work in athletics are

also required to use scientific methods to allocate hypothetical factors (skills and characteristics) that define the promising athlete and participation of each factor in achieving high results in a particular athletic discipline (Pavlović, Idrizović, Rakovic, et al. 2014). It is this research that represents a model which should be hierarchically specified in terms of athletic all-around competition and to identify certain dominant factors (discipline).

Disciplines of all-around competition require an unprecedented level of development of morphological dimensions, motor and functional abilities (speed, strength, endurance) that are routed through training to optimal values. Simply put, male and female rounders must be complete athletes with very high levels of basic, specific-situational and technical-tactical preparedness in all disciplines individually, and in all-around

competition in general. Each rounder has his own characteristics i.e. group of disciplines in which he achieves better results. Some of them are more of a racing type, others are more of jumpers and the third are more of a throwing type. Normally, their typology depends primarily on the domination of certain motor and functional abilities as well as the morphological status, i.e. type of constitution (Mihajlović, 2010; Pavlović, 2013). Precisely this study was conducted in order to determine to which group the students of physical education and sport belong.

For the obtained results of athletic all-around competition first were calculated the basic statistical central and dispersion parameters and correlation analysis. On the basis of the parameters in accordance with the defined goal of the research were applied appropriate multivariate methods.

Table 1 Descriptive Statistics

	<b>Mean</b>	<b>Min.</b>	<b>Max.</b>	<b>Range</b>	<b>Std.Dev.</b>	<b>Skew.</b>	<b>Kurt.</b>
M100	591,44	218,85	733,20	514,35	150,51	,077	-,512
M200	512,47	141,24	896,31	755,07	216,20	-,016	,255
M400	483,15	122,05	611,50	489,45	133,09	,519	-,613
M800	320,20	96,15	587,90	491,75	136,07	-,583	,637
Long Jump	372,95	109,00	522,30	413,30	140,67	-,050	-1,598
High Jump	301,27	254,50	564,20	309,70	107,98	,390	-2,028
Shot Put	396,19	120,00	530,20	410,20	81,20	-1,419	6,130
Javelin Throw	311,29	144,12	498,20	354,08	92,31	1,544	2,343

Table 2 Correlations

	M100	M200	M400	M800	Long Jump	High Jump	Shot Put	Javelin Throw
M100	1,00							
M200	,94	1,00						
M400	,78	,85	1,00					
M800	,61	,74	,85	1,00				
Long Jump	,64	,41	,45	,26	1,00			
High Jump	,61	,69	,47	,43	,27	1,00		
Shot Put	,44	,34	,28	,16	,49	,25	1,00	
Javelin Throw	,40	,37	,26	,19	,17	,34	,60	1,00

By inspecting the Table 1 it can be concluded that students on average had the highest score and thus achieved the highest score in running 100m (591,44), running 200m (512,47) and running 400m (483,15). The worst result and the minimum number of points they won in the 800m discipline (320,20).

From jumping disciplines, they were dominant in the long jump (372,95) compared to the high jump (301,27) and shot put (396,19) compared to the javelin (311,29) in the throwing disciplines.

Also in the maximum result there is identical ranking by disciplines, the most points were won in the discipline of 200m (896,31) and the lowest number of points in running 800m (96,15). In terms of the range of results the points range from 309,70 (high jump) to 755,07 (M200). In terms of the distribution of the results, jumping and throwing disciplines had higher values of kurtosis (from -

1,598 to-Long Jump 6,130-Shot Put), i.e. higher heterogeneity of results.

Overall, student achieved lower results in technical disciplines than racing disciplines which are based on natural forms of movement and motor manifestation (speed, endurance) and the result does not depend so much on the technical performance. In comparison between the jumping and throwing disciplines students on average made more points in the jumping disciplines (674,22) than in the throwing (707,48) i.e. in the disciplines in which, in the addition to technical performance, the motor abilities (strength, speed, coordination) have a big impact and the ability of synergistic action with the equipment. In the correlation analysis of athletic disciplines (Table 2) were recorded 36 connections of which 17 are in the medium level, medium-high and high correlation. From racing disciplines the largest number of correlation is achieved in M100 discipline, ranging

from (.40 Javelin Throw) to (.64 Long Jump) and the least M800 (.43 High Jump). Between jumping and throwing disciplines were realized only two medium strength correlations (.49 Shot Put-Long Jump) and (.60 Shot Put-Javelin Throw).

In factor analysis of a set athletics of disciplines 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. A set of 8 manifest athletics disciplines-motor skills was explained with 75,54% of cumulative variance. Two factors has been identified, defined as latent dimensions that determine the total variance of the athletic round competition of students.

Table 3 Eigenvalues, Extraction: Principal components

	Eigenval	% total Variance	Cumul. Eigenval	Cumul. %
1	4,41	59,70	4,41	59,70
2	1,43	17,94	5,84	77,44

Table 4 Factor Loadings (Varimax normalized), Extraction: Principal components, (Marked loadings are >0,70)

	Factor 1	Factor 2	Com.2	Factor 1 Score Coeff.	Factor 2 Score Coeff.
M100	,93	,20	,91	,26	-,07
M200	,91	,33	,89	,23	,09
M400	,89	,16	,81	,25	-,03
M800	,80	,01	,77	,28	-,19
Long Jump	,69	,46	,34	,20	,26
High Jump	,66	,24	,53	,15	,01
Shot Put	,23	,89	,83	-,12	,58
Javelin Throw	,22	,80	,62	-,10	,49
Expl.Var	3,97	1,91	,83		
Prp.Totl	,46	,21	,91		

Table 5 Correlations between factors

	Factor 1	Factor 2
Factor 1	1,00	
Factor 2	,47	1,00

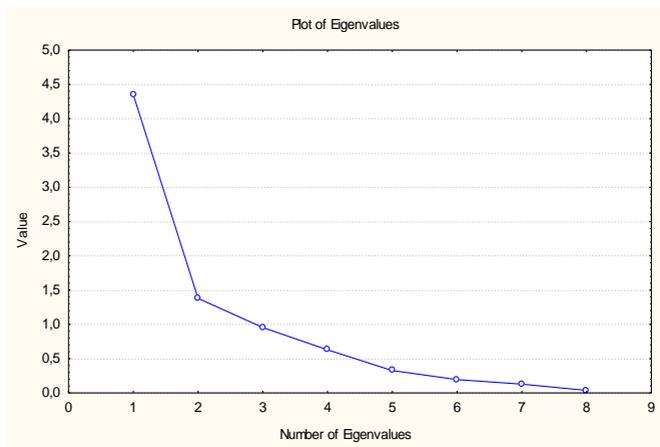


Fig. 1 Factor structure (Eigenvalues)

The first factor in the Varimax rotation is defined by running which gave the largest contribution to the total common variance with about 60%, with a significantly higher homogeneity of all-around competition disciplines. Eigenvalue of 4,41 is very much greater than zero, and reserves the right to extraction (Table 3). This strong saturation of isolated vectors provides the basis for defining and extraction of the first factor, i.e. all-around type of students. From a total of four racing discipline, disciplines sprint M100 and M200 are of extremely strong and leading vector saturation and are contributing to the extraction of the first factor. Their strength of ,93 are significantly more >,70 and the guarantor of a strong and independent impact of extraction. A large contribution to the variance of the first factors have been enabled by the disciplines M400 and

M800, with extremely strong vector saturation (,89-,80).

Also, somewhat smaller but significant impact with smaller vector strengths were achieved in the jumping disciplines Long Jump (,71) and the High Jump (,66) (Table 4). The values of the factor determination or the value of communality of the first factor are of extremely high projection (Com.53-91). It is noted that this set is positioned close to the largest number of manifest variables besides which passes the stack. The values of factor coefficients of racing disciplines are satisfactory in the range of ,26 (M200) to ,28 (M800). These disciplines are under the mechanism control of the energy and central regulation of movements and are partly genetically predisposed where some physiological mechanisms and muscle fiber structure have the impacts.

The disciplines that are mostly responsible for the extraction of the first factor are responsible for anaerobic-aerobic endurance. Thus, the first factor, from a functional standpoint, can be interpreted as a latent dimension of anaerobic-aerobic endurance of students. Given that this is the type of all-around competition, then it matches the type of **runner-jumper** (latent dimensions speeds and explosive strength).

The second factor in the Varimax rotation is defined by throwing disciplines that showed a high homogeneity of the set, with the domination of throwing balls (Shot Put ,89) and a slightly lower intensity vector in the discipline Javelin (Javelin Throw ,80), with a lower projection which is also a smaller carrier of variability (Table 3). Also in this factor, the long jump exhibited lower volume saturation of the second factor. This can be explained by the fact that in the shot put and javelin throw, at the stage of maximum stress, the explosive power has a significant impact (Pavlović, 2016). The second factor exhausted 17,94% of common variance of the system with eigenval value (eig. 1.43) that is greater than zero and reserves the right to self-extraction. The values of the factor determination or the value of communality are of high projection (Com. 64-83). It can be seen that this set is also positioned close to the largest number of manifest variables besides which passes the stack (Table 4). Such is the position in the coordinate system and the behavior of this factors as secondary, which in relation to the first defines the measure of common variability of extracted factors (latent dimensions). Also the value of the factor coefficients is of high value. With regard

that in the second factor there were isolated variables that are used to evaluate the throwing disciplines, it can be defined as a type of **thrower** (latent dimension of power).

Based on the factor analysis of all-around competition disciplines it can be concluded that at the current sample of students dominant are two main types, the first type of runner-jumper and other of a throwing type. If we look at the top all-around competition it is stated that some of those who compete are more of a *racing type* and dominate the racing disciplines, they are average in jumping, while relatively weaker in the throwing disciplines. The others are of a *jumping type*, dominant in jumping, average in running and weaker in throwing disciplines. The third group of competitors is of a *throwing type*, dominant in the throwing disciplines, and a bit weaker in racing and jumping disciplines (Mihajlović, 2010; Pavlović, 2013). The obtained results of the study support the above, since they reflect a combination of a racing (primary) and partially jumping (secondary) type of students (dominant in the first factor) and the thrower as the second type (in the second factor). The correlation coefficient is (Fac.1-Fac.2=,47), which corresponds to the average connections. In the first factor there is a logical connection between running and jumping, especially at running with long jump, where is recorded the saturation of jumping discipline in the extraction of the first factor (all-around competition type of students). Both at running and long jump the speed and explosive strength are dominant in result success of beginners, where rectilinear movement is present. However, the participation of discipline high jump is less because in its structure

the dominance of technical performance is higher, especially for beginners, as is the case in this study. Both of these disciplines are based on the large share of motor skills (speed, strength).

By analyzing the relation of the first and second factor coefficients as of medium strength (.47), (Table 5), the following question arises – where does the relation between running and throwing come from; logical would be the relation between running and jumping, as confirmed through the extraction of the first factor. The answer can be obtained by reviewing the following parameters. The first parameter is the defined sample of respondents (students), the second parameter is the very nature of disciplines and the third parameter is the training time and improvement of the same. This means that better results were achieved in the disciplines in which is expressed greater participation of motor and functional abilities, without the complexity of performing techniques. It is known that running is natural form of movement for whose performance it is not needed to have a lot of technical experience, and it does not take a lot of time for their training (Pavlović, 2010). It is similar with the long jump, where beginners rely on the running start speed and explosive strength at the rebound as the primary factors. The disciplines javelin and shot put, in most cases, are under the influence of the morphological status (body height and body weight), and already acquired motor skills at the beginners (strength, speed), where the technique does not come to the fore due to insufficient time of "training" process, so consequently the ball is usually thrown using the side and back

technique and javelin using the Swedish variant. These results are in contradicts the finding of top-Rounder. In consideration of efficiency of result achievements the most successful decathlon world 'score of different levels and ages determined the presence of a specific and different predictive contribution discipline decathlon total pointing score. A comparative analysis of the dominant predictor had found that disciplines whose outcome depends more on the technical efficiency performance than the level of training of basic motor abilities are the key determinant of the success of his score in the decathlon (Bilić, Smajlović, & Balić, 2015; Mandarić, & Mandarić, 2015).

Such extraction of factors, i.e. all-around competition types of students is expected, because the insufficient time of training process of students could not provide better results, especially in technical disciplines (javelin, high jump, shot put). However, this is a good indicator for the further development process of individual disciplines which ultimately aims at better mastery of the performing technique of particular athletic disciplines. Athletic disciplines, through a permanent process of training and development, have a direct impact on the development of basic motor abilities manifesting reversible process between motor ability-discipline-athlete (Pavlović, 2010). In another aspect, we have a situation where the results in the athletic disciplines depend on the participation and influence of motor abilities, which is officially confirmed in this study.

## CONCLUSION

Current research was carried out to determine the factor structure of the student all-around competition in order to determine all-around competition type of students, i.e. to establish the dominance in the athletic disciplines of individual all-around competition. The research included 60 male students of the Faculty of Physical Education and Sport in Eastern Sarajevo, male, ages 20±0,5 years. There was involved a total of eight all-around competition discipline. Based on the research results, by using factor analysis in a defined area, two factors were extracted and defined (all-around competition types) with a total of explained 77,44% variance of the set. The first factor (type) exhausted 60% of the common variance of the set and is defined as all-around competition type

runner-jumper (latent dimensions speeds and explosive strength). The second factor exhausted about 18% of the analyzed set and is defined as throwing type (latent dimension of power). The research was partially inconsistent with the similar studies, but on a sample of top athletes, in terms of discipline domination. In the majority of realized researches the major contribution to the successful results of all-around competition is given by the technical disciplines. From the point of our research this is a good indication of which direction training in certain disciplines should go, in order to improve performing techniques. The emphasis should be more on the technical disciplines in terms of a longer duration in the teaching process of training and the improvement of technical disciplines.



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