

THE SPECIFICS OF COGNITIVE ABILITIES OF FOOTBALL PLAYERS IN RELATION TO THE RANK OF COMPETITION

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Abstract

The knowledge of the high coefficient of the correlation between the success in sports and sports capacities primarily determined by psychosomatic status has been determined the subject of this work. To be precise, the subject of this work represents identification of the dominant cognitive dimensions of football players of two ranks of competitions, which participates in sports success in football, and recognition of quantitative and qualitative indices which differentiate them. According to the chosen statistical and mathematical model and program, aims and settled hypotheses, we decided that 154 examinees should be included in the sample, with 77 for each subsample. By condensation of variables in cognitive space, only one discriminative function is isolated, which canonic correlation amounts of .40. The first discriminative function explains the differences with 100% of intergroup variability in cognitive space of applied discriminative variables. Football players of lower rank of competition have better abilities for the evaluation of the efficacy of serial processor (the test AL – 4). This processor represents the basis for abstract cognitive abilities. The factor corresponds to Thurston's verbal factor V, the factor of verbal ease W and the numeric factor R. This factor especially corresponds to the factor of crystallized intelligence G by Cattell and Horn. Football players of higher rank of competition have better abilities for determining relations among the elements of some structure and lower characteristics of such structures (the test S – 1).

Keywords: *sports activity, measurement of cognitive abilities, perceptive reasoning, observing relations and correlations, symbolic reasoning, factor analysis, discriminative analysis*

INTRODUCTION

Sports competitions have a great influence on sports activities. That influence is a result of a few characteristics of a competition.

Above all, sports fight is sharp, which stems from the fact that every contestant wants to achieve better results than their opponent, i.e. to win. Such tendency of contestants demands high sports perfection which can be achieved thanks to multiyear long-term, difficult and, very often, monotonous trainings in which physical, technical, tactical and psychological characteristics are perfected. Without any preparation, which represents the basis for the complex emotional situations which appear

during a competition, lots of talented athletes would not manage to achieve the necessary level of sports perfection, and with it, a high sports results has been achieving, especially because of the hard preparations for such a tough training regime which is characteristic for the top sports.

The results of a research conducted on athletes of several sports disciplines (Geron, 1973, by Lilić 2007), show the presence of psychological difficulties during the competition. The athletes were asked questions about the difficulties they had during the training and during the competitions. The responds shows that during the trainings, several dif-

difficulties appear, but during the competition they are more intensive. From the examinees, the same author got data which shows which kind of problem appears during the training, and which one during the competition. The greatest number responded that psychological difficulties overcome on competitions (68%), than the technical (14%), and the external factors (10%). During the training, the greatest number of the examinees responded that those are technical problems (32%), than psychological (29%), physical (27%) and other factors (12%).

In the analysis of the essence of the sports activity (Lazarević (1983), starts from the fact that the sport is largely socially determined and that there are motivational factors in the basis of every activity, even the sports one. He tries to explain their relation in sport starting from the well-known and widely accepted psychological theories. From the point of view of the psychoanalytic theory of personality, one of the most typical and most dynamic characteristics of sports – competitive character can be a tool for releasing energy which appeared because of the suppression of instinctual impulses. With the help of the psychoanalytical theory, some relations in a sports activity can be discovered, identified and explained, but it is not enough to explain all the sacrifice and tremendous work invested by the top athletes. If a top athlete achieves self-actualization through their sporting, they achieve satisfaction through the feeling of themselves as a complete personality. Top sporting, in which top sports creativity is observed as satisfaction of a human need of “higher rank”, i.e. a desire of a human being “to become even more and more of what their idiosyncrasy is, to become all that they are capable to become” (Lilić, 2007).

Football is, above all, a sport which, by its essence, makes the outline of all the sports phenomena. Contemporary football is characterized by a high degree of physical, psychical and especially, technical preparations; the richness of tactical combinations, speed and precision of actions. The basic characteristic of this game lies primarily in the coordination of technical and tactical elements whose aim is to have an efficient end of the attack with the maximization of the cooperation of all the players on the field.

The success in all sports activities, and also in football, significantly determines the quality of psychosomatic personality dimensions. Because of that, it is necessary to rec-

ognize the level and the quality of dispersed characteristics in the first sports phase already – the phase of selection, and on the basis of the exact indicators of the scientifically checked ethiology. The identification of those dimensions and legal relations of the training procedure, as well as the psychosomatic status, considerably determine the rational and humane way toward the success in sports.

Because of that, two basic aims should be determined in this research:

- determine the structure of motor and situational-motor dimensions of football players,
- determine the discrimination of the previously defined groups of examinees in one point of time and in certain number of measures of the analyzed psychosomatic dimensions.

Starting with the problem and aims of the research, two groups of theoretical hypotheses can be distinguished. These two groups of hypotheses differ in relation to the analysis of the space of examination. According to this division, hypotheses for defining structure and hypotheses for defining differences were formed.

H1 – the structure of cognitive abilities in football players of both ranks of competition will show the existence of general dimension and three subfactors.

H2 – gaining a significant discrimination of the previously defined groups of examinees is expected, according to the rank of competition, in most treated cognitive abilities.

METHODS

The choice of examinees was conditioned by organizational and financial capabilities which were necessary for conducting the examining procedure. In order for the research to be conducted correctly, and for the results to be stable enough in terms of sample errors, it was necessary to take a satisfactory number of examinees. The size of the sample for this character of research is conditioned by aims and tasks of the research, the size of population and the degree of variability of the applied system of parameters. According to the chosen statistical and mathematical model and program, aims and setting hypotheses, we decided that 154 examinees should be included in the sample, with 77 for each subsample.

It was necessary to secure a sufficient number of qualified and trained recorders, certain instruments and tools and standard-

ized conditions under which the planned research would be realized. The measuring was conducted in football clubs which belong to the zone of Pomoravlje and District Football League of Rasina.

The sample of variables for the evaluation of cognitive abilities

For the evaluation of the efficacy of input processor, i.e. perceptive reasoning, the test: IT – 1 has been chosen.

For the evaluation of the efficacy of parallel processor, i.e. observing relations and correlations, the test: S – 1 has been applied.

For the evaluation of the efficacy of serial processor, i.e. symbolic reasoning, the measuring instrument: AL – 4 has been chosen.

In the work, it was started from the results of the research of the structure of cognitive dimensions conducted in Serbia (Momirović, Gredelj and Hošek, 1980; Wolf, 1987; Momirović, Bosnar and Horga, 1982), which are largely congruent with the results of researches conducted in other countries.

These researches gave unequivocal is proving that the structure of cognitive abilities is of hierarchical type, where the general cognitive factor below which are the three primary factors of cognitive abilities, which relates to: the efficacy of perceptive processor, (i.e. perceptive reasoning), the efficacy of parallel processor, (i.e. the ability of observing relations and correlations) and the efficacy of serial processor, (i.e. symbolic reasoning).

For the evaluation of the efficacy of input processor, i. e. perceptive reasoning, the test IT – 1 has been chosen: the test of pairing is designed for the evaluation of perceptive identification and discrimination. The test consists of 30 assignments, and the time of solving is limited to 4 minutes. The analysis of the test (Džamonja, Z. and col. 1973) shows the difficulty of the assignments and their intercorrelations indicating that it is a typical speed test.

For the evaluation of the efficacy of parallel processor, i.e. observing relations and correlations, the test S – 1 has been applied: the test consists of 30 assignments and their type is choosing one of the 4 offered possibilities of response. The time for solving is 10 minutes.

For the evaluation of the efficacy of serial processor, i. e. symbolic reasoning, the test AL – 1 has been chosen: the test of synonyms – antonyms, by F. L. Wells, and is defined to-

ward the evaluation of identification of denotative meaning of verbal symbols. It consists of 40 assignments and their type is a double choice. The time for solving is 2 minutes, and thus, this test belongs to the category of speed tests. The first main subject of measuring is mostly defined by assignments from the other half of the test and is interpreted as the ability of fast identification of denotative meaning of verbal symbols.

Statistical data processing

To determine the latent structure of cognitive dimensions the factor analysis was applied.

For determination of the differences of certain segments of psychosomatic status in football players of different rank of competition, a canonic discriminative analysis was applied. The discriminative model is interpreted as a special type of factor analysis which contains of components that in the best way divide groups in the space of variables. The general statistic significance of the discrimination of the groups of examinees was calculated by the F-test. The discriminative variables are gained according to discriminatory coefficients which depend on the variance of every variable from the applied system of variables and have original results. The discriminatory strength of the applied variables is determined by the Wilks' lambda, and the level of the significance of discriminative equation is determined by the Bartlett's test.

RESULTS AND DISCUSSION

Structure of intellectual abilities of football players of lower rank of competition

By the insight into the matrix of the tests for the evaluation of intellectual abilities (Table 11.), it can be noticed that there is a biggest relationship between the test IT – 1 designed for the evaluation of perceptive identification of denotative meaning of verbal symbols and equal correlations IT – 1 and AL – 4 with the test S – 1 of special reasoning designed for the evaluation of fast simultaneous reduction of spatial relations. In some cases, it is possible to assume factor sets already according to the matrix of intercorrelations (Table 1).

In this case, we can only conclude that the whole system of intellectual variables is based on the significant common variability, which is enough for the approximation of the two factors of intellectual abilities.

The structure of factors of intellectual abilities is analyzed according to all the informations given by the matrix of significant main components (Table 2). According to Kaiser-Guttman criterion, two latent dimensions which bond the whole space of the three cognitive tests with approximately 89% of common variance are isolated. It can be accepted as very satisfactory value for the research of this type.

The test IT – 1 by which the efficacy of input processor, i.e. perceptive reasoning, which is manifested as the ability of solving a problem by activation of perceptive abilities, has the biggest projection on the first latent dimension, than the test S – 1, by which the efficacy of parallel processor, i.e. observing relations and correlations is evaluated and which is defined as the ability of determining of laws in some problem situation, whether it was known or not.

The second latent dimension is by the greatest participation saturated by the test AL – 4 by which the efficacy of serial processor, i.e. symbolic reasoning is evaluated, and which is defined as the ability of operating by notions transferred (mapped) into symbols.

Structure of factors of cognitive abilities in football players of higher rank of competition

By the insight into the matrix of intercorrelations as the basic indicator of the transformed and condensed data in one logic

Table 1. Intercorrelations cognitives variables of lower rank of competition

	IT1	AL4	S1
IT1	1.00		
AL4	-.13	1.00	
S1	.65	.06	1.00

Table 2. Factoral matrix

	FAC1	FAC2	h ²
IT1	.91	-.09	.84
AL4	-.09	.98	.98
S1	.90	.19	.85
Lambda	1.66	1.02	
%	55.4	34.2	
Cumul. %	55.4	89.6	

Table 3. Patern matrix

	FAC1	FAC2
IT1	.90	-.14
AL4	-.00	.99
S1	.91	.14

Table 4. Matrix of function

	OBL1	OBL2
IT1	.90	-.17
AL4	-.03	.99
S1	.91	.11

Table 5. Corelation of oblimin factors

	OBL1	OBL2
OBL1	1.00	
OBL2	-.03	1.00

system, it can be noticed that the gained correlations do not significantly deviate from the expected connection for such a sports discipline as a football. The greatest connection in the mentioned intercorrelational matrix is gained between the test IT – 1 by which the efficacy of perceptive processor is evaluated and the test AL – 4 by which the efficacy of serial processor is evaluated. Then, there is a relatively high connection between the tests AL – 4 and S – 1, i.e. between the efficacy of serial and the efficacy of parallel processor, which could be expected taking into account that, according to the theory of Das and Kirby, and also some researches of Momirović and associates (by Milojević, 1991), such connection is also logic, taking into account that both processors have the function that, in the processing and analysis of data in the hierarchical model, they are both subordinated to the general processor. The smallest connection is gained between the test for the evaluation of the efficacy of perceptive processor (IT – 1) and the test for evaluation of the parallel processor (S – 1). However, it is impossible to make conclusions on the basis of the matrix of intercorrelations, so the analysis of the system of cognitive variables will be interpreted on the basis of the matrix of main components of the cognitive variables.

The analysis of the system of the three variables for the evaluation of cognitive processing, and according to Kaiser – Guttman criterion, gave only one characteristic root, and thus, one factor. The total variance which is exhausted by that factor amounts 60% which is below the expectation. Since this research gave only one cognitive factor, its rotation into a simpler structure was not possible to conduct, and according to the logic, it was also not necessary, so we can conclude that the gained factor represents one integrative cognitive function which could be interpreted as the general cognitive factor, with the three clearly arranged mechanisms which lie in its basis, with the following saturations: IT – 1 (.93), AL – 4 (.88), S – 1 (.39) (Table 6.). By this, the hypothesis H1 is confirmed, and it says that the three factors lies in the basis of the cognitive abilities of football players: the factor of perceptive reasoning, the factor of observing relations and correlations, and the factor of symbolic reasoning. If, beside the statistic interpretation, an interpretation on the basis of physiological foundation of the central nervous system and its subsystems, would be conducted, as well as an interpretation of the structure of certain determinants how this sports game is in relation to its demands, the following could be concluded: according to the simple serial movements (passes, kicks, etc.) which are conducted very fast and precisely at various distances and in limited space, it is logical that perceptive processor has the dominant role, than the serial and in the end, the parallel processor.

Tabela 8. Discrimination of cognitive variables in football players of higher and lower rank of competition

Fnc.	Eig.val.	Can. Cor.	Wilks' Lambda	Chisquare	DF	Sig
1*	.19	.40	.83	2.81	2	.24

MATRIX OF FUNCTION		CENTROIDS OF GROUPS		
	FUNC	Group	Cen.	
AL4	.68	Higher rank	1	-.39
S1	-.59	Lower rank	2	.43
IT1	.33			

seen that the first discriminative function separates the groups according to the tests AL – 4, S – 1 and IT – 1, i.e. the tests for the evaluation of serial, parallel and perceptive processor.

Discriminative analysis of cognitive abilities of football players

The results of discriminative analysis of cognitive variables show that football players of higher rank of competition differ in relation

Table 6. Intercorrelations cognitive variables of higher rank of competition

	IT1	AL4	S1
IT1	1.00		
AL4	.74	1.00	
S1	.26	.08	1.00

Tabela 7. Factor matrix

	FAC1	h ²
IT1	.93	.87
AL4	.88	.78
S1	.39	.15
Lambda	1.82	
%	60.7	
Cumul.%	60.7	

to football players of lower rank of competition.

By condensation of variables in cognitive space, only one discriminative function is isolated which canonic correlation amounts .40.

By the insight into the Table 8., it can be

According to the size and signs of the projection of centroids onto the first discriminative function, it can be concluded that:

Football players of lower rank of com-

petition have better abilities for the evaluation of the efficacy of serial processor (the test AL – 4). This processor represents the basis for abstract cognitive abilities. The factor corresponds to Thurston's verbal factor V, the factor of verbal ease W and the numeric factor R. This factor especially corresponds to the factor of crystallized intelligence G by Cattell and Horn. Football players of higher rank of competition have better abilities for determining relations among the elements of some structure and lower characteristics of such structures (the test S – 1).

Thus defined factor of intelligence corresponds to the factor of fluid intelligence by Cattell and Horn. Football players of lower rank of competition have better abilities for the evaluation of the efficacy of perceptive processor (the test IT – 1). This processor is in charge to accept, recognize and organize signals, which come from different optical or acoustic sensor canals into the CNS, into meaningful unities, to search thus processed information which is in short-term and long-term memory, to transfer those results to further processing into the central processor, and to immediately activate motor processors in special situations.

CONCLUSION

The results of discriminative analysis of cognitive variables show that the football players of higher rank of competition differ in relation to football players of lower rank of competition. By condensation of variables in cognitive space, only one discriminative function is isolated which canonic correlation amounts .40.

By the insight into the Table 3., it can be seen that the first discriminative function separates the groups according to the tests AL – 4, S – 1 and IT – 1, i.e. the tests for the evaluation of serial, parallel and perceptive processor. The test AL – 4 is the test of synonyms. It belongs to the processor for the successive, serial processing of informations which conducts sequential cognitive processes and the analysis of information which are transformed in some symbolic code. It represents the basis for the abstract cognitive abilities.

The test S – 1 is the test of visual spatialization. It belongs to the processor for the parallel, simultaneous processing of information which is capable of simultaneously conducting the processing of greater number of information which flows and simultaneously search the memory, whether it is a short-term

or long-term one.

The test IT – 1 is the test of a comparing images. It belongs to the processor for decoding, structuring and searching the input information which, in interaction with other processors of cognitive system, creates the basis for the perceptive abilities.

According to the size and signs of the projection of centroids onto the first discriminative function, it can be concluded that:

- Football players of lower rank of competition have better abilities for the evaluation of the efficacy of serial processor (the test AL – 4). This processor represents the basis for abstract cognitive abilities. The factor corresponds to Thurston's verbal factor V, the factor of verbal ease W and the numeric factor R. This factor especially corresponds to the factor of crystallized intelligence G by Cattell and Horn (Tubić, Fajgelj, & Bala, 2007).

- Football players of higher rank of competition have better abilities for determining relations among the elements of some structure and lower characteristics of such structures (the test S – 1).

Thus defined factor of intelligence corresponds to the factor of fluid intelligence by Cattell and Horn (Tubić, Fajgelj, & Bala, 2007). Football players of lower rank of competition have better abilities for the evaluation of the efficacy of perceptive processor (the test IT – 1). This processor is in charge to accept, recognize and organize signals, which come from different optical or acoustic sensor canals into the CNS, into meaningful unities, to search thus processed information which is in short-term and long-term memory, to transfer those results toward further processing into the central processor, and directly to activate the motor processors in special situations.

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СПЕЦИФИЧНОСТИТЕ НА КОНГНИТИВНИТЕ СПОСОБНОСТИ КАЈ ФУДБАЛЕРИТЕ ВО ОДНОС НА РАНГОТ НА НАТПРЕВАРИТЕ

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(Оригинален научен труд)

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Апстракт

Сознанијата за високиот коефициент на корелацијата меѓу спортскиот успех и спортските капацитети кои се детерминирани со психосоматскиот статус, го определува предметот на ова истражување. Попрецизно речено, предметот на

истражувањето претставува идентификација на доминантните когнитивни димензии кај фудбалерите од двата ранга на натпревари кои партиципираат во спортскиот успех во фудбалот и препознавањето на квантитативно-квалитативните показатели кои истите ги диференцираат. Врз основа на избраниот статистичко-математички модел и програма, целта и хипотезите, примерокот на истражувањето изнесуваше 154 фудбалери. Тие беа поделени во два подпримероци. Секој подпримерок беше составен од 77 фудбалери. Со кондензирање на варијаблите од когнитивниот простор, изолирана е само една дискриминативна функција, чија каноничка корелација изнесуваше .40. Фудбалерите од понискиот ранг на натпревари, покажаа подобри способности за проценување ефикасноста на серијалниот процесор (тест AL4), односно за апстрактните когнитивни способности, кои одговараат на Терстоновиот вербален фактор V, факторот на вербалната леснотија W и нумеричкиот фактор R, како и на Кателовиот и Хорновиот фактор G на кристалната интелигенција. Фудбалерите од повисокиот ранг на натпревари, покажаа подобри способности за утврдување на релациите на елементите на одделни структури, како и пониските карактеристики на таквите структури (тест S1).

Клучни зборови: *спориски активности, мерење на когнитивните способности, перцептивно резонирање, воочување релации и корелации, симболично резонирање, факторска анализа, дискриминативна анализа*

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