

## CANONIC RELATIONS OF CONATIVE CHARACTERISTICS AND SUCCESS IN WATER POLO

*Dragan Toskić<sup>1</sup>, Tomislav Okičić<sup>2</sup> and Veroljub Stanković<sup>1</sup>*

The aim of our research was to determine the connection between the conative characteristics and success in water polo. The sample of participants for this research can be defined as the population of water polo swimmers (N=60) aged 16 to 18 years, who were only included in the study under the condition that they had taken part in the water polo training process for a period of at least four years. In order to evaluate their conative regulatory mechanisms, we relied on six primary variables: the activity regulator (EPSILON), the organic function regulator (HI), the defense reaction regulator (ALFA), the attack reaction regulator (SIGMA), the system for the coordination of regulatory functions (DELTA), the system for the integration of regulatory functions (ETA), all of which were selected so that the structure of the analysis could be carried out on the basis of the cybernetic. For the evaluation of the criterion variables, we used two variables. The first variable represents the relationship between the number of times a participant played for his team and the number of achieved victories during these matches, and the second variable represents the evaluation of technical ability on the basis of the participants' performance on certain tests related to water polo. The relations between conative characteristics and success in water polo were determined using a canonical correlation analysis. A correlation analysis was carried out and it indicated a very high correlation between conative characteristics and success in water polo. During the training and competitive process of water polo players, the training components were well balanced, which could mean that they were optimally focused on the development of the relevant motor skills, which correlate with conative characteristics and make up the basis for the training process of water polo players. *Acta Medica Medianae 2012;51(2):15-18.*

**Key words:** water polo players, conative characteristics, success in water polo, correlation

University of Priština, Faculty of Sport and Physical Education, Serbia<sup>1</sup>

University of Niš, Faculty of Sport and Physical Education, Serbia<sup>2</sup>

Contact: Toskić Dragan  
Faculty of Sport and Physical Education  
Dositeja Obradovića bb, 38218 Leposavić, Srbija  
E-mail: dragan.toskic@pr.ac.rs

### Introduction

Owing to the success of the water polo national team of Serbia and the Partizan water polo club, which is one of the most successful clubs both in Europe and the world, not only in water polo, but in sport in general, the game of water polo is at its peak of popularity in Serbia. Serbia is one of the rare countries in which we find an organized system of competition for prepubescent participants (ages between 10 and 12). Unfortunately, during the last several years, we have witnessed a devastating situation where Serbian water polo has been reduced only to the results of the Partizan water polo club.

There are many reasons for this state of things, some of which, like the economic crisis, lie outside the field of sport and are not dependent on the individuals employed in the

field. We still have to be objective and have to say that this is only a part of the problem. One of the bigger problems is the lack of professional staff which as a result has led to an improvisation of the training process which is based only on one's own experiences or the experiences of others. This kind of work, without the use of modern scientific-methodological principles in educational-training work will inevitably lead to a decrease in quality, and thus to the gradual lack of results, since it is difficult to believe that we can forever continue to achieve top results on the basis of the work of one single club in the country.

The use of modern scientific-methodological principles in training, that is, the planning of contents of training, includes perfect knowledge of the human body, its ability to adjust to the influences of training and the laws of change which occur under its influence. In order to understand and be able to explain these laws which regulate the training process, it is necessary to carry out a thorough analysis of this same process. While planning and programming training we should bear in mind all the factors which could give a significant contribution to the improvement of the results (1, 3, 5, 12, 13).

In order to achieve success in water polo, one needs to be in possession of a very complex

set of abilities. Water polo is physiologically a very demanding sport since it consists of an alteration between very intense activities of a duration shorter than 15s, which are succeeded by periods of activity of lower intensity which last for less than 20s. As in the recent research, the parameters which are meant to show physiological adaptation to specific type of training were monitored (10, 14).

What we are referring to here in particular are motor skills such as strength, speed, agility, coordination, etc., but also other anthropological dimensions such as the morphological, functional, cognitive, sociological and conative dimension (11). It is this last anthropological dimension in particular, conative characteristics and success in water polo which is the subject matter of this paper.

It was determined that the increased intensity of conative characteristics decreases the level of adaptation, and that they cause disturbances in personality integration. This hinders the balance between the process of excitation and control. In addition, there is the relative influence of the disposition on most individual characteristics or groups of these characteristics, which in particular means that they are primarily genetically conditioned (4-6). Water polo belongs to a group of polystructural complex sports. It is a very dynamic and very attractive sport where it is necessary during the course of a game to continuously create new programs of attack, defense and counter-attack activities, which requires the possession of certain optimal combinations of anthropological dimensions, among which we normally also find conative characteristics. Considering the fact that we are familiar with the influence of conative characteristics which limit or stimulate human activity, it is clear that having knowledge of this status plays an important role in the planning and organization of work, as well as in the prognosis of success in sport.

The basic aim of this research was to determine the relationship between conative characteristics and success in water polo.

### Subjects and methods

The population from which we extracted the sample for this research could be defined as the population of water polo players aged 16 to 18 years. They were included in the study under the condition that they had taken part in training for at least four years. The very sample of participants was conditioned by the goals of the research, the size of the population and the degree of the variability of the system of parameters. On the basis of the selected statistical-mathematical model and the aim of this research it was decided that the sample should include 60 participants as the number is optimal for this type of research.

To evaluate the conative regulatory mechanisms, we used six primary variables which were selected so that the structure of the analysis could be carried out on the basis of the cybernetic model of conative functions which

originated from the research of Momirović et al. (1982). The model is based on a hierarchical organization of the following mechanisms for the regulation and control of the modality of behavior: activity regulator (EPSILON), organic function regulator (HI), defense reaction regulator (ALFA), attack reaction regulator (SIGMA), the system for the coordination of regulatory functions (DELTA) and the system for the integration of regulatory functions (ETA) (6,9).

To evaluate the success achieved in water polo, in this paper we used two variables. The first variable represents the relationship between the number of times a player has played for the team and the number of achieved victories on these occasions. In the range between the best and worst results we formed a scale of 10 values, so that the participants could get a grade of 1 to 10. The second variable represents the technical abilities on the basis of performing certain exercises which contain elements of the water polo technique. These exercises are organized in such a way that the participant demonstrates swimming technique, the technique of handling a ball and the technique of moving without a ball. The effectiveness of performing these exercises was estimated by three coaches who awarded grades ranging from 1 to 5.

While calculating the relationship between the system of variables of basic motor variables and conative characteristics, we used a canonical correlation analysis. The canonical correlation analysis, which is usually defined as the maximization of the correlation between the stochastic independent linear composites derived from two groups of variables, can be defined as the maximization of the scalar products between two groups of orthogonalized centered and normalized vectors, and thus as the solution to an essentially geometric problem (8). The testing of the statistical significance of the hypothesis of the global connection between two different anthropological systems of variables was carried out with the help of:  $I$  - the statistically significant characteristics roots,  $R_c$  - the coefficient of the canonical correlation between the statistically significant pairs of canonical factors,  $R_c^2$  - the square of the canonical correlation,  $\chi^2$  - Bartlett's Chi-square test, and  $p$  - the testing of the statistical significance at the 0.05 to 0.00 level. (2,7,8).

### Results and discussion

By analyzing the cross-correlation matrix between the system of conative variables and the system of criterion variables (Table 1) we noted a statistically significant correlation between the pairs of variables at the  $p=0.05$  level. Between both of the criterion variables KV1 and KV2 and the predictor variables of the conative regulatory system, statistically significant correlations were determined.

In the procedure for determining statistically significant relations, that is, the determination of the maximal connection between the multivariate system of conative variables and the system of criterion variables, a canonical correlation analysis

was used, with parameters of the canonical correlation ( $R_c$ ), the determinant coefficient ( $R_c^2$ ), the Chi-square test ( $\chi^2$ ) and its statistical significance ( $p$ ). By reviewing Table 2 we can note that only one canonical correlation is statistically significant at the 0.01 level. The canonical correlation obtained in this manner is sufficient for the explanation of the relationship between two systems of predictor and criterion variables. As the canonical correlation represents the greatest conveyer of information and has a value of 0.61 which represents 78% of the explained variance, this means that the conative regulatory mechanisms have a significant relationship with the achieved success in water polo (KV1 and KV2).

The first canonical and only factor in the space of conative dimensions (Table 2) is the best definition of the activity regulator (EPSILON), the defense reaction regulator (ALFA) and the system for the coordination of regulatory functions (DELTA). What follows are the organic function regulator (HI), the system for the integration of regulatory functions (ETA) and the attack reaction regulator (SIGMA).

The corresponding canonical dimension isolated in the space of the criterion variables is equally defined both by success during water polo games and the performance of exercises which contain water polo techniques (KV1 and KV2).

The specific nature of water polo as a sport lies in the fact that the technical elements are performed in water, without any support and with constant pressure from the opposing players. Under these conditions, when we add the limited time of attack, which leads to quick decision making and quick reactions for the purpose of achieving the ultimate goal, which is the scoring of points, we come to a very unusual conclusion which would be more appropriate for a combat sport.

Namely, although water polo and all team sports are precisely defined by the rules of the game, it is an especially physically demanding sport and a sport which borders the rough play. So, we can freely say that all of the technical elements in water polo as well as the complete system of the game take place during direct confrontation with the opponent, which explains a large part that the activity regulator plays, along with the defense reaction regulator and the system for the coordination of regulatory functions play in the forming of this canonical dimension.

## Conclusion

Effectiveness in the performance of any human activity is not independent of the features which regulate the modality of human behavior, water polo included. Namely, it is known that some features of conative space limit the effectiveness of various activities directly, and in others indirectly (for example, due to the contaminating effect of some other anthropological feature, ability or characteristic). It is not infrequent that in certain activities the same conative features represent a restrictor, and in others a stimulator of effectiveness, especially in situations in which they play a part in the success of certain activities.

Table 1. Cross-correlations of conative and criterion variables

Variables	KV1	KV2	
EPSILON	0.63	0.58	
HI	0.44	0.46	
ALFA	0.52	0.51	
SIGMA	0.34	0.32	
DELTA	0.47	0.49	
ETA	0.42	0.40	
$R_c$	$R_c^2$	$\chi^2$	$p$
0.78	0.61	56.52	0.00

$R_c$  - canonical correlation  
 $R_c^2$  - the square of the canonical correlation  
 $\chi^2$  - Bartlett's Chi-square test  
 $p$  - statistical significance

Table 2. Canonical structure of conative and criterion variables

Variables	Fc - 1
	Conative variables
EPSILON	0.80
HI	0.58
ALFA	0.67
SIGMA	0.43
DELTA	0.61
ETA	0.54
	Criterion variables
KV1	0.99
KV2	0.98

Thus, the rule that there are no two subjects who could share an identical structure, including any features, even conative one, irrespective of their ultimate number, also applies. For this reason, being familiar with the complexities of a certain activity, including the space of conative characteristics, is an important assumption in the operationalization of the aim of every activity, including water polo.

Namely, even though water polo, just like all the other team sports, is precisely defined by the rules of the game, it is an especially physically demanding sport which verges on rough play. Thus, we can easily say that all of the technical elements in water polo, including the complete system of the game, take place during direct conflict with the opponent, which explains the great role that the activity regulator, the defense reaction regulator and the system for the coordination of the regulatory functions play in forming of this canonical dimension.

In the general conclusion of this research, it is important to point out that the results have shown that both during the training and competitive process of water polo players, the contents of the training were well balanced. This might mean that on the one hand, they were to an optimal extent directed at the development of relevant quasi-motor skills, which correlate with conative characteristics and make up the basis for the training process of water polo players, and on the other hand, that the training-program contents of water polo players to a great extent influenced an improvement in the results of most relevant quasi-motor skills.

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## KANONIČKE RELACIJE KONATIVNIH KARAKTERISTIKA I USPEHA U VATERPOLU

*Dragan Toskić, Tomislav Okičić i Veroljub Stanković*

Cilj istraživanja bio je da se utvrdi veza između konativnih karakteristika i uspeha u vaterpolu. Populacija za ovo istraživanje može se definisati kao populacija vaterpolista (N=60) starih od 16 do 18 godina, uz uslov da se u trenažnom procesu nalaze najmanje četiri godine. Za procenu konativnih regulativnih mehanizama primenjeno je šest primarnih varijabli: regulator aktiviteta (EPSILON), regulator organskih funkcija (HI), regulator reakcija odbrane (ALFA), regulator reakcija napada (SIGMA), sistem za koordinaciju regulativnih funkcija (DELTA), sistem za integraciju regulativnih funkcija (ETA), koje su odabrane tako da se struktura analize vrši na osnovu kibernetičkog modela Momirovića i saradnika (1982). Za procenu kriterijumskih varijabli upotrebljene su dve varijable. Prva varijabla predstavlja odnos između broja nastupa za tim i broja ostvarenih pobeda u tim nastupima, a druga varijabla predstavlja procenu tehničke osposobljenosti na osnovu izvođenja određenih testova vezanih za vaterpolo. Relacije između konativnih karakteristika i uspeha u vaterpolu utvrđena je pomoću kanoničke korelacione analize. Sprovedena korelaciona analiza ukazala je na vrlo visoku povezanost između konativnih karakteristika i uspeha u vaterpolu. U trenažnom i takmičarskom procesu vaterpolista trenažni sadržaji su bili dobro uravnoteženi, što može značiti da su u optimalnoj meri bili usmereni na razvoj relevantnih motoričkih sposobnosti, koji koreliraju sa konativnim karakteristikama i čine osnovu u trenažnom procesu vaterpolista. *Acta Medica Medianae* 2012;51(2):15-18.

**Ključne reči:** vaterpolisti, konativne karakteristike, uspeh u vaterpolu, relacije