Egzon S. at al. CANONICAL CORRELATION ANALYSIS BETWEEN SPECIFIC-MOTOR AND...

Sport SPA Vol. 14, Issue 2: 5-9

CANONICAL CORRELATION ANALYSIS BETWEEN SPECIFIC-MOTOR AND PSYCHOLOGICAL ABILITIES WITH WRESTLERS

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Abstract

The quality of wrestling sports results largely depends on the quality of the technique's performance (or techniques) and the psychological characteristics of athletes. For this reason, improving the psychological dimensions and increasing the efficiency of the technique is the basic task in the training process of the wrestlers. The survey was conducted on the sample of the top wrestlers from the Republic of Macedonia, Kosovo and Albania. The wrestlers who conduct a sample of 103 participants are at the age of 18.6 ± 0.6, and with average wrestling experience of 4.88 years of wrestling. In order to determine the relationship between different groups of variables, a canonical correlation analysis was made. From the analysis it was determined that statistically significant impacts in the performance of specific-motor tests have tests of visual specialization, perceptual reasoning and perceptual speed test and visualization.

Key words: *wrestlers, specific-motor, canonical correlation*

INTRODUCTION

Wrestling belongs to the group of polycrystalline acyclic sports dominated by acyclic movements, where the result is represented as a binary matrix of victory-defeat, and where the struggle is carried out and confined to a direct conflict with the opponent as a symbolic destruction of the opponent (Kajcevski et al., 2003). It's very small, even impossible, the number of athletes who have achieved some result in big games thanks to their great talent or other random factors. These coincidences are even less likely if it is a sport with greater complexity. Free-style wrestling belongs to a group of highly complex sports, in which the number of basic elements of technique (defense, counterattack, and combination) range from a few dozen to more than a hundred. Modern sport and the achievement of top sports results are more dependent on the results of scientific research and their application in practice. (Marić et al., 1986). Modern wrestling requires that the fight be carried out in a relatively short time, with a very intense pace and abounds in various technical-tactical activities. The top wrestlers must be diverse, and in their repertoire they must be obliged to know several "special" techniques from different groups of techniques, different tactics for every effort, and to fight with different opponents. (Mikić et al., 2008).

The quality of sports results in wrestling largely depends on the quality of the technique's performance (or techniques) and the psychological characteristics of athletes. For this reason, improving the psychological dimensions and increasing the efficiency of the technique is the basic task in the training process of the wrestlers.

MATERIAL AND METHODS

Participants

The sample of the participants in this research is made up of top wrestlers from the Republic of Macedonia, Kosovo and Albania. The wrestlers who make up a sample of 103 participants are at the age of 18.6 ± 0.6, and with average wrestling experience of 4.88 years of wrestling, which is sufficient data that the motor stereotype is defined when performing specific techniques.

The sample of variables

The example of variables in this research is composed of two systems:
(1) A system of variables for assessing the specific motor abilities of wrestlers.
(2) A system of variables for assessing the psychological dimensions of wrestlers.

Information about the basic motor abilities of the wrestlers is a very important segment for each coach, but it is even more important to have information about the specific motor abilities of wrestlers. This information can be obtained on the basis of a system of variables used to evaluate the specific motor abilities of wrestlers, ie situational tests that are actually important segments in the execution of the fight. For this purpose, the following are applied:

- backward roll KONAUZ
- bridge and back MOVRUS
- pioreto from bridge PIORMO
- coordination with and without doll KOSLBL
- throwing doll 15 times BAKLUT

The sample of variables for assessment of the cognitive abilities was selected so to evaluate those abilities that have already been applied to a certain group of athletes. The cognitive dimensions in this study are defined as the ability to determine the process of reception, retention, and transformation of information, and which come to the fore especially in problem solving and problem situations. Given the fact that athletes solve many problematic situations in the sport combat, it is considered that the assessment of the wrestlers' cognitive abilities may be one of the important indicators of the psychological status of wrestlers. The following cognitive dimensions were analyzed in this study: visual specialization and perceptual reasoning. The following were applied:

- Test for spatial orientation - visual specialization KOGS1
- Test for perceptual reasoning KOGF1
- Test for perceptual speed and visualization of KOGNF2

The test for spatial orientation - visual specialization KOGS1, was taken from the SVPN1 battery (M.Reuchlina E.Valina and adjusted by Matic, Kovacevic, Momirovic and Volkot).
The test for perceptual reasoning (KOGF1), was taken from A. Bukvic 1982
The test for perceptual speed and visualization of KOGNF2 is a test of the BEG series (Bukvić and Steinberger, 1971).

Statistical analysis

For all variables that are the subject of the survey, the basic statistical parameters are calculated. The variability of the results is determined on the basis of the standard deviation obtained from the calculated variance. For calculating the variability of the results, the maximum (max) and the minimum (min) value for each variable are calculated. In order to determine the normality of the distribution of the results, Skewness (Skew) and Kurtosis (Kurt) were calculated.
In order to determine the relationship between different groups of variables, a canonical correlation analysis was made. With the canonical analysis, the level of connection between the two groups of variables was determined. According to Tabachnik and Fidell (2001), all correlation analyzes take into account only those correlations between the variables that have a higher value of 0.23. Such a correlation corresponds to a statistical significance of 0.05 (Tabachnik and Fidell, 2001, according to Šoše, 2009).

RESULTS AND DISCUSSION

For the purpose of this research, the specific-motor abilities are defined by six variables (Table 1). Analyzing the dispersion parameters, it is evident that the participants represent a non-homogeneous group in all variables.

Table no. 1 Basic central and dispersion parameters of specific motor abilities

	N	Range	Min	Max	Mean	Std. Dev	Skew	Kurt
KONAUZ	103	18	5	23	11,54	5,35	0,45	-1,13
MOVRUS	103	19	3	22	10,50	5,33	0,57	-0,98
PIORMO	103	15	2	17	7,39	4,62	0,52	-1,21
KOBELU	103	191,9	85,7	277,6	185,39	63,01	0,05	-1,40
KSABEL	103	210,7	88,6	299,3	201,17	71,05	-0,02	-1,39
BACLUT	103	948,1	315,3	1263,4	765,62	327,86	0,26	-1,56

The obtained results concerning the distribution of the same indicate that the distribution is normal.
The Skewnees (Skew) values that indicate the distribution of the results after the Gaussian curve move around the unit for most variables have a positive sign. The values of Kurtosis (Kurt), in most variables, are platykurtic.Cognitive abilities in research have been defined with three variables (Table 2).

The participants of the wrestlers also showed that they are non-homogeneous in cognitive abilities.

The Skewnees (Skew) and Kurtosis (Kurt) values are with lower values, and they point to platykurtic.

Table no. 2 Basic central and dispersion parameters of cognitive abilities

	N	Range	Min	Max	Mean	Std. Dev	Skew	Kurt
COGNS1	103	24	5	29	18,04	6,42	-0,07	-1,04
COGNF1	103	29	6	35	19,17	8,27	0,18	-1,06
COGNF2	103	23	3	26	14,18	6,22	0,25	-1,03

In order to determine the relationship between the sets of different groups of variables, a canonical correlation analysis was made. Canonical analysis determines the level of association between the following groups of variables: variables for the assessment of specific-motor abilities and variables for assessment of cognitive abilities.

According to Tabachnik and Fidell (2001), all correlation analyzes take into account only those correlations between variables and variants that have a higher value of 0.23. Such a correlation corresponds to a statistical significance of 0.05 (Tabachnik and Fidell, 2001, according to Šoše, 2009). From the analysis of the results obtained in the cross correlation matrix (Table 3), it can be noted that in this sample of participants, statistically significant and multiple relationships between specific-motor and cognitive abilities have been achieved.

Table no.3 Cross correlation matrices of specific motor abilities and cognitive abilities

Correlations, left set with right set			
	COGNS1	COGNF1	COGNF2
KONAUZ	0,85	0,85	0,87
MOVRUS	0,86	0,88	0,90
PIORMO	0,85	0,88	0,89
KOBELU	-0,90	-0,90	-0,91
KSABEL	-0,89	-0,89	-0,90
BACLUT	-0,88	-0,90	-0,89

With the Hoteling canonical analysis of the correlation and testing the significance of the canonical correlation coefficients, the Bartler test showed that the spaces between specific motor abilities and cognitive abilities are interconnected with two pairs of canonical factors at a statistically significant level: p = 0.00 (Table 4). On the basis of the obtained canonical correlations R = 0.94 and R = 0.53 we can conclude that a high degree of connection between the latent structures of these two sets of variables has been achieved.

Table No.4 Coefficients of canonical correlation

	Chi-Square Tests with Successive Roots Removed					
	Canonicl R	Canonicl R-sqr.	Chi-sqr.	df	P	Lambda Prime
0	0,94	0,89	248,51	18,00	0,00	0,08
1	0,53	0,28	38,06	10,00	0,00	0,67
2	0,25	0,06	6,30	4,00	0,18	0,94

Based on the data presented in Table 5, we can conclude that the first pair of canonical factors in the field of specific-motor abilities statistical significance was determined in all of the applied variables.

Table No.5. Isolated canonical function in the area of specific motor abilities

Factor Structure, left set			
	Root 1	Root 2	Root 3
KONAUZ	0,91	0,25	-0,19
MOVRUS	0,95	0,08	-0,25
PIORMO	0,95	-0,01	-0,11
KOBELU	-0,96	-0,19	0,01
KSABEL	-0,95	-0,22	0,01
BACLUT	-0,96	-0,07	-0,27

Based on the data shown in Table 6, we can conclude that the first pair of canonical factors in the area of cognitive abilities is statistically significantly determined by all applied variables.

Table 6 Isolated canonical function in the space of cognitive abilities

Factor Structure, right set			
	Root 1	Root 2	Root 3
COGNS1	0,96	0,26	0,11
COGNF1	0,99	0,02	0,14
COGNF2	0,99	0,05	-0,10

If we perceive the canonical factors obtained in the specific motor space and cognitive space, we can conclude that participants with higher number values in the most specific-motor tests had higher values in cognitive tests.

CONCLUSION

The applied variables in this study were determined with appropriate standard and descriptive methods, where the central and dispersion parameters were calculated, so the function of their distribution was determined, where it was established that no significant significance of normal distribution was found in any variable. The reasons for such results it should probably be required in the fact that a deliberate sample of participants was selected, in which all anthropological dimensions are in one harmony. From the tests for assessment of the cognitive abilities of wrestlers, statistical significant influence in the performance of the specific-motor tests has the tests of visual specialization, perceptual reasoning, and the test for perceptual speed and visualization. From some previous studies it has been found that in free-style wrestling, are important variable speed of visibility, perception of space, perceptual differentiation, as well as the anticipation of the movement of the opponents, decision-making (Tubic, 2004). Although, earlier it was emphasized the existence of the so-called "sports or motor intelligence", today, particularly actual is the theory of multiple intelligence Huard Gordmera (Armstrong, 2004), which promotes among others the kinesiological activity.

From the analysis of the specific-motor tests and their structure it can be concluded that in order to succeed in wrestling, techniques should be used on the ground as well throwing techniques.

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