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Editor of series: Nenad Živanović, email: znenad@filfak.filfak.ni.ac.yu
Address: Univerzitetski trg 2, 18000 Niš, YU
Tel: (018) 547-095, Fax: (018)-547-950

SIMULTANEOUS INFLUENCE OF THE SPECIFIC BASKETBALL MOTORIC AND COGNITIVE ABILITIES ON SUCCESS OF BASKETBALL

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Saša Jakovljević

Faculty of Physical Culture, Belgrade, Yugoslavia

Abstract. *Success in basketball, being polystructural sport game, depends on numerous factor - abilities and characteristics of players. In this study simultaneous influences of specific basketball motoric and cognitive abilities on the success in basketball was investigated (on the basis of these partial influences), at the sample of 87 young basketball players (aged from 17 to 18) from Yugoslavia. Results of regression analysis showed significant simultaneous influence of these abilities on the success, what was expected. Among the all variables from the space of specific basketball motoric and cognitive abilities, the most significant variable was from the space of cognitive abilities (perceptive analysis). Next were variables from the space of specific basketball motoric.*

1. INTRODUCTION

For the sports theory as well as for the practice, scientific investigation which access sport success, are of utmost importance. Investigations of factors which could have important influence on the success in certain sport activity, their structure, interconnectedness as well as quantity and quality of those influences on success are the basic steps towards improvement of sport activity.

In basketball game success depends primarily of personal abilities and characteristics of basketball players. This directs the investigations in basketball towards estimations of basketball player abilities in order to find more rational and more effective steps for improvement of desired abilities and avoidance of less useful ones. In this field it was not much done up to now (Pavlović, M., 1979, Karalejić, M.,1988.....). Most of the research are of descriptive character and are not directly applied or correlate with the game success. Specific basketball motoric (SBM), no doubt, influence greatly the success in the

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game being the main mean of the game. Same counts for the cognitive abilities as the base of mental approach to the play. They are also very significant considering all characteristics of basketball game. Basketball are one of most dynamic sports game with constantly changes of typical and atypical game situations. Players must quickly perceive, analyze and adequately react in the given situation. So, all his cognitive potentials must be used. Reaction of the player in the given situations is actually performance of one or more elements of the specific basketball motoric, with which the player resolves the situations. After perceiving and registering of the position in the game the player react automatically. These two phases are inseparable and can not exist one without the other. That is why it is of great interest to analyze their simultaneous influence on the basketball player success.

The subject of this investigations, therefor, is a nature of simultaneous influence of the specific basketball motoric and cognitive abilities on the success in basketball. The basic aim of investigations is to show the character of simultaneous influence of mentioned abilities on success in basketball game. Then, to notice the variables which have the major level on influence on the success.

2. METHODOLOGY

2.1. Sample of subjects

In this investigation there was 87 high quality juniors basketball players, aged from 18 to 19, who were at list five years in systematic and organized basketball practice. They all were members of most successful teams in season 94/95. for cadets and junior competition in Serbia and Yugoslavia. Among them are almost all members of national teams of Serbia and Yugoslavia.

2.2. Sample of variables and techniques of measurement

Predictive variable are from the space of specific basketball motoric and cognitive abilities. For the specific basketball motoric we performed 15 tests which cover six fields of basketball technique: ballhandlling, dribbling, passing, shooting, whole actions and movement without the ball. This are following tests:

1. Movement with the ball around the waist in 30 s (OLT30)
2. Movement with the ball around the body in 30 s (OLCT30)
3. Figure eight by dribble at the spot in 30 s (ODM30)
4. Direction change in dribble (PSD)
5. Slalom dribble (SD)
6. Chest pass at far (DUD2R)
7. Chest pass in the target (DUM2R)
8. One hand pass in the target (DUM1R)
9. Shot from five perimeter positions ([5SP)
10. Shot from five perimeter positions in 60 s ([5SP60)
11. Mikan drill in 30 s ([IK 30)
12. Lay up shot from X-out in 30 s (PNK30)
13. Dynamic shot in 30 s (D[30)
14. Lateral line in 30 s (KOS30)

15. Movement with direction changing in 30 s (KPS30)

Variables from the space of cognitive abilities are covered with five tests. One of them is D-48 for estimate of general factor of intelligence and four are covering perceptive factor of intelligence:

1. Test S1 - visual spacialisation
2. Test P1 - perceptive differentiation and logical conclusions
3. Test F1 - perceptive identification and structuralisation
4. Test F2 - perceptive analysis and logical conclusions

For the measurement of specific basketball motoric and cognitive capabilities technique of testing is applied. Detail description of these tests can be found at the Faculty of Physical Culture in Belgrade (Basketball cathedra).

Criterion variable is expressed as unique mark, which was gotten as a mean value out of ten marks given by ten independent observers. Estimators were all qualified experts in the basketball field. The homogeneity and reliability of estimators was tested by statistical procedures (table 1). It shows high level of reliability. Similar procedures were also applied in investigation of Blaškovich 1984., Karalejich, M. 1988.,.....

Table 1 Reliability of estimators

alpha	parallel	split (prvih 6)	split (drugih 5)
.9781	.9736	.9548	.9541

2.3 Statistical procedures

For the assessment of influence of predictor variables on criterion variable regressive analysis was applied. They are two methods: Classical and Stepwise method. Following coefficients were calculated: coefficient of multiple regression R, coefficient of determination R², and F test of regression. The data were processed in MII center at the Faculty of Physical Culture in Belgrade, on Macintosh LC, by statistical program Stat Wiew 512.

3. RESULTS AND DISCUSSION

Table 2 shows the results of regression analysis of player qualities simultaneously in the space of specific basketball motoric and cognitive abilities done by classical method. Multiple interconnectedness between predictor and criterion variables is significant at the level 0.01, R=0.801. Quantity of common variance (coefficient of determination R²=0.641) between the group of predictors and successfulness in the game is 64%. This is logical, concerning that player resolves the situations in the game by all components of motoric information and by the components of tactic information. The core of motoric information's components makes actually specific basketball motoric (basketball technique) which represents the main mean of all movements of the players during the game. All the situations in the game are resolved by the use of adequate elements of specific basketball motoric. Without high quality techniques tactical intentions would not be possible to carry on. From the other side, the essence of tactical information's

component forms, so cold, tactical thinking of the player which basis are cognitive abilities. Namely, tactical thinking of the player is defined as specific cognitive acting, ability of the player to resolve problems in typical and atypical situations on the basis on cognitive abilities of perception, education and basketball tactic knowledge. By comparison of coefficient of determination R^2 of simultaneous influence of the level of specific basketball motoric and cognitive abilities, with the values of partial influences of specific basketball motoric ($R^2=0.57$) and cognitive abilities ($R^2=0.49$), we can see that simultaneous influence is higher than partial. Simultaneous coefficient, naturally, is not the summa of partial coefficients. This is acceptable concerning the nature of mentioned capabilities and interconnectedness (85% of cross cases) between treated variables of specific basketball motoric and cognitive abilities (6). All these findings show complexity and polystructure of basketball game where all the capabilities influence the success of basketball game. All are in interaction. The rest factors concerning the other capabilities are functional, basic motoric, tactical, etc.

Table 2 Multiple Regression

DF:	R:	R-squared:	Adj. R-squared	Std. Error
86	.801	.641	.532	1.163

Source	DF:	Sum Squares:	Mean Square:	F - test:
REGRESSION	20	159.476	7.974	5.891
RESIDUAL	66	89.329	1.353	p=.0001
TOTAL	86	248.804		

Parameter:	Value:	Std. Error:	Std. Value:	t - Value:	Probability:
PSD	-.672	.353	-.281	1.906	.051
\$IK 30	.15	.061	.25	2.453	.0168
\$5SP60	.121	.117	.108	1.032	.3059
DUD2R	.076	.11	.064	.69	.4926
F2	.14	.064	.326	2.1767	.0331
P1	.105	.056	.195	1.864	.0668
D48	-.073	.036	-.218	2.044	.0449
S1	.006	.048	.017	.131	.8963
F1	-.014	.043	-.038	.315	.7537
OLT30	.057	.055	.119	1.031	.3062
OLCT30	.004	.051	.01	.075	.94
ODM30	-.025	.071	-.042	.345	.7312
DUM2R	.047	.06	.075	.787	.4339
DUM1R	.008	.054	.014	.147	.884
\$5SP	.087	.121	.081	.721	.4736
PNK30	.242	.267	.103	.906	.368
D\$30	.108	.159	.064	.678	.5004
KOS30	-.015	.084	-.019	.181	.8566
KPS30	.096	.155	.066	.622	.5363
SD	.797	.573	.193	1.391	.169

Analyzing the significance of influences of given variables from the regression equal on the success of the basketball game, variables from the table 2 are striking: [IK30 (level

of significance 0.01) and PSD, F2 and D48 (level of significance 0.05). Variable [IK30 represents accuracy of the shooting from the short distance e.g. under the basket. Percent of success of such shoots is almost 100%, i.e. this are the most efficient shoot in basketball. It is acceptable thesis that the team with less percent of shoots from this positions will be less successful. It is clearly noticed in the praxis. It is often said that the team loose because of number of miss shoot from this positions. Variable PSD represents the quickest change of direction and rhythm of the movements with the ball. Basketball is kinematically defined primarily as a game of rhythm change and so variable PSD could be observable separately. Basketball is first of all the game of accuracy, but also it is necessary to be in optional positions for the shoot and for that high quality of movements with and without the ball is of great importance. Variable F2 from the field of cognitive abilities asses perceptive analysis and logical conclusion. basketball game is full of permanent changes on the court with a lot of players. In order to act adequately and successfully in the given situations the player must have precise perceptive analysis of events in the court and quick decision of the way he should act. It means to chose plays time and wayof action, i.r. he chooses the most adequate element of the technique with which he will get success. Variable D48 from the field of cognitive abilities asses the general factor of player intelligence. If we accept the theory according intelligence is adaptability of a person in new and sudden situations, then this variable is very important in basketball game which is full of quick changes.

In order to obtain classification of applied variables in a frame of simultaneous influence of variables of specific basketball motoric and cognitive abilities the data where processed Stepwise. This way the variables are ordered according to their level of significance of influence on success in basketball. At the tables 3.1. and 3.2. are shown the results gotten by this method. We can see following sequence of variables: F2, PSD, [IK30, [5SP60, D48, P1. Variable F2 which deals with perceptive analysis and logical conclusion is of the utmost importance. Significance of the variable F2, as well as variables PSD, [IK30 and D48 are already discussed. Variable [5SP60 shows level of accuracy in basketball shoots from middle distance with time limit. It is very close to the normal game situations, because the aim of the game is to perform the shoots quickly and accurately. Sine, this is the most common shoot in basketball. It is logical to expect its influence on the success in the game. variable P1 cover perceptive differentiation and logical conclusions. The player perceives during the game the situations in multitude of movements and actions of his own and opponent players. He must differentiate typical and atypical elements and activities of players and to find the best solutions.

The sequence of studied variables shows their respective importance in the basketball game. F2 variable at the first place clearly shows that perceptive analysis of actual "material" (situations in the court) is of primary importance. According to this, it is obvious that its not enough to have high quality specific basketball motoric but also to know to use it efficiently. Separating variable F2 from the variable of specific basketball motoric is quite normal because the last once are derived by the situations tests which are not clearly determined. This is simply because of the nature of the game and methodology in investigations in basketball game has not yet adequate and real situations tests. After "scanning" of the situations on the court one can act and in following steps the variables of specific basketball motoric are derived: PSD, [IK30, [5SP60. Variables in fifth (D48) and sixth step (P1) leads us again in the space of cognitive abilities. After his own action,

the player comes in very new expected and unexpected situations depending of other players and he must quickly find new movements and solutions. This quite simple (linear) commentary of the sequence of variables is to emphasis importance of cognitive abilities in relation with the specific basketball motoric. Specific basketball motoric is the basically mean in basketball, and obviously very important, but all this elements are overlapping and all the abilities must be efficiency used to get best results. In every moment of the game the player must put in action all his cognitive and technical abilities in order to get the best results.

Table 3.1. StepWise Regression

Step No. 1 Variable entered: F2				
R:	R-squared:	Adj. R-squared:	Std. Error	
.562	.316	.308	1.415	
Parameter:	Value:	Std. Error:	Std. Value:	F to Remove:
INTERCEPT	2.093			
F2	.241	.038	.562	39.209
Step No. 2 Variable entered: PSD				
R:	R - squared:	Adj. R-squared	Std. Error:	
.653	.427	.413	1.303	
Parameter:	Value:	Std. Error:	Std. Value:	F to Remove:
INTERCEPT	14.39			
PSD	-.855	.212	-.358	16.286
F2	.185	.038	.432	23.766
Step No. 3 Variable entered: \$IK30				
R:	R - squared:	Adj. R-squared	Std. Error:	
.705	.497	.479	1.228	
Parameter:	Value:	Std. Error:	Std. Value:	F to Remove:
INTERCEPT	11.933			
PSD	-.868	.2	-.363	18.875
\$IK30	.184	.054	.276	11.609
F2	.151	.037	.353	16.523

Table 3.2 Step Wise Regression

Step No. 4 Variable entered: \$5SP60				
R:	R - squared:	Adj. R-squared	Std. Error:	
.738	.545	.523	1.175	
Parameter:	Value:	Std. Error:	Std. Value:	F to Remove:
INTERCEPT	8.252			
PSD	-.76	.195	-.318	15.224
\$IK30	.193	.052	.29	13.929
\$5SP60	.254	.086	.227	8.622
F2	.138	.036	.323	14.895

Step No. 5 Variable entered: D48

R:	R - squared:	Adj. R-squared	Std. Error:
.754	.569	.542	1.151

Parameter:	Value:	Std. Error:	Std. Value:	F to remove:
INTERCEPT	8.625			
PSD	-.708	.192	-.296	13.57
\$IK30	.203	.051	.306	15.966
\$5SP60	.241	.085	.216	8.105
F2	.194	.044	.453	19.533
D48	-.067	.032	-.2	4.466

Step No. 6 (Last step) Variable entered: P1

R:	R - squared:	Adj. R-squared	Std. Error:
.772	.596	.565	1.121

Parameter:	Value:	Std. Error:	Std. Value:	F to Remove:
INTERCEPT	7.309			
PSD	-.668	.188	-.279	12.593
\$IK30	.198	.05	.298	15.898
\$5SP60	.219	.083	.196	6.917
F2	.181	.043	.423	17.647
P1	.099	.043	.184	5.317
D48	-.083	.032	-.247	6.83

4. CONCLUSION

Results of regression analysis of basketball player qualities in the field of the specific basketball motoric and cognitive abilities shows important general interconnections of specific basketball motoric - cognitive abilities and success in the basketball game. The value of the coefficient of multiple regression $R=0.801$ and the coefficient of determination $R^2 = 0.641$ are statistically significant at the level of 0.01. The level of the criterion variance is expected and satisfactory since the success in basketball game depends of numerous factors which are outside of the space of specific basketball motirc and cognitive abilities.

By the Stepwise method following variables are derived in specific sequence: F2, PSD, [IK30, SP60, D48, P1. F2 at the first place obviously explains that player must first "scan" the situation (perceptive analysis) and then on the basis of logical conclusion to choose the way of action (time, place and mean). In next three steps appear variables from specific basketball motoric what is expected. After perceptive analysis the player acts. Last two variables showing cognitive abilities are connected with basic characteristics of basketball game i.e. permanent change of situations due to typical and atypical actions of all players.

On the basis of the results of this investigations the obvious conclusion is that basketball player, before using his specific basketball motoric capabilities, must decide (cognitive abilities): where, when and how to act? This is important from the aspect of understanding and accepting important influence of cognitive abilities on the success in

basketball game. The aim of all this is to find the methods and ways for developing and putting in action cognitive potential of the players. This is specially important for the young players who are in process of learning to play basketball. This should also always keep in mind that some other capabilities influence the quality of the game.

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SIMULTANI UTICAJ SPECIFIČNE KOŠARKAŠKE MOTORIKE I KOGNITIVNIH SPOSOBNOSTI NA USPEH U KOŠARCI

Saša Jakovljević

Uspeh u košarci, kao polistrukturalnoj sportskoj igri, zavisi od niza faktora - sposobnosti i karakteristika igrača. Na osnovu ranije pokazanog parcijalnog uticaja nivoa specifične košarkaške motorike i kognitivnih sposobnosti na uspeh u košarci, tražen je stepen simultanog uticaja ovih sposobnosti na uspeh u košarci. Rezultati regresione analize su pokazali da postoji značajan simultani uticaj tretiranih sposobnosti na uspeh u košarci, što se i očekivalo. U proceduri pronalaženja uticaja pojedinih varijabli iz sistema specifične košarkaške motorike i kognitivnih sposobnosti na uspeh u košarci kao najznačajnija se izdvojila varijabla iz prostora kognitivnih sposobnosti (perceptivna analiza), a tek onda varijable iz prostora specifične košarkaške motorike.