

COGNITIVE ABILITIES AND PRECISION IN SKIERS AND SOCCER PLAYERS**Dina Joksimović¹, Aleksandar Joksimović²,
Daniel Stanković² and Rašid Hadžić³**¹ Faculty of Philosophy, University of East Sarajevo, Bosnia and Herzegovina² Faculty of Sport and Physical Education, University of Niš, Serbia³ Faculty of Sport and Physical Education, University of Nikšić, Montenegro*Original scientific paper***Abstract**

The aim of this paper was to investigate the relations and differences in cognitive abilities and precision in skiers and soccer players. Research was performed on a sample of 45 elite young soccer players and elite skiers (30 soccer players and 15 skiers from the Serbian national teams) aged 13.88 ± 0.60 years. The following measuring instruments for the estimation of cognitive abilities were applied: perceptive speed, ability of analytical reasoning on a perceptive material and perceptive differentiation and logical reasoning; also three tests for the estimation of precision were used: hand aiming at the horizontal target, leg aiming at the vertical target and picado. Differences were investigated by t-test, while relations were investigated by canonic correlational analysis. Results point out to the fact that there is statistically significant difference between skiers and soccer players in all three tests of the cognitive abilities in favor of skiers, while in tests of precision statistically significant difference was obtained on most of applied tests. Analysis of corresponding canonic functions point to the assumption that success in precision of skiers and soccer players depends mostly on perceptive speed and perceptive differentiation and logical reasoning.

Key words: skiers, soccer players, cognitive abilities, precision**Introduction**

Success of athletes in sports competitions is always to be considered as dependable variable of the large number of constant and variable factors and as a derivative of the host of factors each exerting its own influence and influencing the system as well. It is evident that (Stefanović, 1977; Havelka & Lazarević, 1981; Špirtović, 1989; Jakovljević, 2000; Rakočević, 2005) efficient results in soccer and skiing encompass a myriad of factors pertaining to the physical and psychological constitution of the individual. Insufficient knowledge of the movements to perform within the motor program results in irrational execution of these movements (Schmidt & Wrisberg, 2000).

Apart from the influence on the movement performance patterns in soccer and skiing motor knowledge through interaction relations impact dimensions of the anthropological area. Also, family structure and family economic status (social – economic status and cultural level) as well as the environment that young athletes share can exert the influence on the total efficiency in certain sports activities. Unfortunately, cognitive area as far as sports needs are concerned is scarcely researched sphere of man's personality. According to Metikoš et al., 2003, all purposeful motor movements can turn into motor information that becomes more successful if "algorithms of commands" that is motor programs are formed. Motor program is formed in the medium nervous system and contains stored and ready muscle commands with all the details necessary to perform a movement (Horga, 1993). Such programs enable direct connection of the exact movement with a certain signal, without the inclusion of indirect phases.

Namely, efficacy of motor reactions is defined by motor informedness that interacts with the level of abilities and characteristics but acts differently in different phases of advancement. If competitor's results of young skiers want to be good reflection of his real potentials is needed to over years of sport preparation effect on development of his capabilities with plan (Hadžić et al., 2009). In the initial phase of the performance of some motor program cognitive functions are intensely included (Adams, 1971; Gentile, 1972) then motor factors of higher order (Metikoš et al., 2003), and especially general factor of coordination. In the course of the improvement of the structure of motor program the influence of the above mentioned factors is diminishing and dimensions of lower order from different segments in the anthropological area substantially directly influence the performance of the acquired motor knowledge. All anthropological potentials of the person can be optimally exploited only in the automatized phase. It is well known that motor abilities are mainly responsible for concrete manifestations of the athletes and are given priority in motor efficacy but morphological area within concrete manifestation represents effectors component and has a vital role. However, successful cognitive functioning is tremendously important for the realization of complex manifestations as modulators of the efficacy within each activity. Motor abilities are forms of motor activities appearing in movement structures and can be described with the equal parameters system, and can be measured with the same set of measures for the analogue, physiological, biological and psychological processes, i.e. mechanisms (Zatsiorski, 1975).

These are partly hereditary and partly nurtured by the training process. Cognitive abilities are human features that enable reception, transfer and processing of the information which all happens in contact with the environment. They represent the basis of the cognitive, conscious activity and without them it would not be possible to analyze methodical procedures of education or sports results, nor to control and manage other thinking operations during training work (Sternberg, 2002). Cognitive functioning of the athlete is of vital importance for his success in sports (Regnier et al., 1993; Brown, 2001; Abbot & Collins, 2002, 2004; Abbot et al., 2005).

During soccer match and skiing competition manifesting of the dimensions of the anthropological status is connected. Both in soccer and in skiing there are loads related to first of all start speed with the alteration of movement direction, speed of reaction, speed of single acyclic and cyclic movements and the manifestation of the maximal explosive power. Within these abilities and characteristics target precision is remarkably important. Skiing is the activity demanding special environment conditions and the success in the alpine disciplines primarily depends on the level of the acquired specific motor knowledge (Franjko, 2007.), and the level of motor and functional abilities (speed, power, coordination, balance, aerobic and anaerobic endurance). According to Cigrovski and Matković (2003.), skiing as sport requires from the skier immense physical and psychological demands relating to extreme agility, coordination, power, endurance because in competitive skiing a winner is decided by the hundredth of the second. Motor abilities such as explosive power, agility and balance are reportedly connected to alpine skiing success (Klika & Malina, 1997; Bosco, 1997; Reid, Johnson, Kipp, Albert & White, 1997; Dolenc & Žvan, 2001). Yet, scarce research exists on the effect of precision on the successful knowledge acquisition in beginning skiers. An extensive research body shows that alpine skiers have excessively strong legs in relation to other types of athletes and that leg strength is an important factor of success in male and female skiers (Tesch, 1995; Song, 1982). In skiing speed and precision is important in competitions while gate crossing as fast as possible, i.e. with the minimal waste of time (Sports academy SkiBoo, The Olympic Council of Asia). Some authors were concluded that the competitors which were more precise and whose line of skiing was shorter and more direct skied through the measured segment faster (Muller & Schwameder, 2003; Pozzo et al., 2005; Žvan & Lešnik, 2007). Soccer is one of the most widely played and complex sports in the world, where players need technical, tactical, and physical skills to succeed (Joksimović et al., 2009). Technical preparation of soccer players is the main precondition for the efficient motion performance. More precisely, technical preparation enables that motor potential of a soccer player reaches its maximum.

We have to stress that further progress in terms of technical improvement of a soccer player is not possible without parallel work on development and maintenance of those motor abilities which are vital for the game of soccer (Smajić & Molnar, 2007). Achieving good results in soccer depends exactly on certain basic-motor abilities (Molnar, 2003). Petrić (1994) has investigated the influence of the specific-motor and cognitive dimensions on the success in soccer of the soccer players aged 16-18. His research revealed five factors in the predicting system: factor 1 – speed of zig zag running with the change of direction, factor 2 – shooting precision, factor 3 – efficacy of the serial processor, factor 4 – efficacy of the parallel processor, factor 5 – ball dribbling speed. Sports results in soccer and skiing cannot be accounted for by the partial approach because of the complex situations within the game. Therefore one should use a multidimensional approach in the explanation of successful results whenever possible (Stevanović, 1973). Such an approach in solving the problem of the influence of cognitive abilities on the successful results in the precision of soccer players and skiers will be realized in this paper. In fact, it has been suggested by some that psychological skills and abilities are not only of tremendous importance in sport, but that these aspects are, in certain instances, of greater significance and can serve as better predictors of success (Abbot & Collins, 2004; Nordin et al., 2006) or, in conjunction with technical abilities and skills, act as more effective discriminators between more able and less able players (Williams & Reilly, 2000; Williams & Ward, 2007), than physical, physiological and anthropometrical variables.

Abbott & Easson (2002) and Andrew et al. (2007) concur that psychological factors are important in identification and selection respectively, and that an integrated approach toward these respective endeavors is needed. The purpose of this study is to advance the knowledge on the correlation of the cognitive abilities and the in fully active athletes and the differences in these abilities in soccer players versus skiers, i.e. those that take up individual and those that take up collective sports. Also the aim of the paper is to determine the relations between the cognitive and parameters of the precision in soccer players and skiers.

Methods

Subjects

Research was performed on a sample of 45 elite young soccer players and elite skiers (30 soccer players and 15 skiers from Serbian national teams) aged 13.88 ± 0.60 years. To be included in the study, subjects had to be healthy, to have regular training sessions attendance, to have willfully attended trainings in soccer or ski club, to have been previously included in training work in soccer or ski club for at least three years, to prove lack of bodily deformities or morphological aberrations, deformities of locomotor apparatus and some substantial pathophysiological aberrations.

Variables

Tests for the estimation of cognitive abilities: Perception of Shape (T7), Spatial reasoning (T3), Figure Classification (T9). All the above-mentioned tests are of the paper-pencil type and are assigned as those of speed. Most of them are not standardized, but they have all been applied in numerous research projects (primarily, those of Bukvić, 1985; Nešić, 1989) in which their metric characteristics have been checked (validity, reliability, objectiveness and ability to discriminate). Otherwise the tests have been chosen in order to record the following psychological operations: visual conclusion-making, visualization, spatial reasoning, conclusion-making by analogy, style of perception (dependence-independence of the field), shaping flexibility, perception of fine distinctions, of complete identity and classification on the principle "it is not like the others". Tests for the estimation of precision: Hand aiming at the horizontal target (GHR), Leg aiming at the vertical target (GVN), Picado (PIK). Tests for the estimation of precision were taken from Kurelić et al., (1975) and they were applied amply in the experimental research and have adequate level of metric characteristics in explaining researched motor dimensions. All tests of precision were administered both by the right and left hand (leg) so each test was applied twice.

Statistical analysis

In order to give adequate answers to the posed aims the following statistical analyses were performed: significance of the differences between the soccer players and skiers obtained by t-test, and determination of relations was performed by the canonic correlation analysis.

Results and discussion

Table 1. Differences in cognitive abilities between the soccer players and skiers

Variables	Group	N	Mean	SD	F	p
T7	Soccer pl.	30	15.73	6.34	17.53	0.000
	Skiers	15	22.48	6.15		
T3	Soccer pl.	30	10.33	4.96	15.77	0.000
	Skiers	15	15.50	5.12		
T9	Soccer pl.	30	13.00	3.57	23.14	0.000
	Skiers	15	18.50	5.14		

The obtained results in Table 1 show the existence of statistically significant difference ($p < 0.000$) between the soccer players and skiers in the quick observation, perceptive speed or the speed of perceptive structuring, registering of perceptive unities in very complex and non-structured perceptive area in favor of skiers. Apart from quick observation one needs selection of observed figure by motor act of nearing from the complex perceptive area. Also, one can see that there is statistically significant difference ($p < 0.000$) between the soccer players and skiers in the analytical reasoning on perceptive material, i.e. logical analysis and synthesis of new unities out of numerous single percepts, also to the favor of skiers.

Here one includes the ability of visual rotation and transformation of subjects into new visual sets, visual flexibility and motor manipulation to reorganize given content. There is statistically significant difference ($p < 0.000$) in the ability of the simultaneous education of relation and correlates that is in the ability of the logical reasoning on the perceptive material to the favor of the skiers. On all tests applied in this research to measure cognitive abilities of the subjects a statistically significant difference was gained which actually confirms our premise that individual sport, in this case skiing, and collective sport, in this case football, exhibit great differences in formation of the individual's personality.

Skiing and football are immanently quite different sports that have great demands and dictate the way of developing different abilities. It is possible that these differences could be less prominent if this research was conducted on the similar sports athletes (futsal, basketball, handball...). This is in accordance with the study of Nešić (1997) who claims that the level of the development of mental abilities in elite athletes depends on the sex, and the type of sports they have been training. The obtained results are to some extent in accordance with the previous research on the population of the athletes. Namely, connection between the motor and cognitive abilities shows that there is significant positive relation between the coordination and less significant in balance, and general factor of the intelligence (Ismail & Gruber, 1967; Momirović, Bosnar & Horga, 1982).

Table 2. Differences in the precision between the soccer players and skiers

Variables	Group	N	Mean	SD	F	p
GHRD	Soccer pl.	30	22.83	10.88	6.64	0.013
	Skiers	15	30.50	12.13		
GHRL	Soccer pl.	30	17.83	9.44	0.12	0.733
	Skiers	15	18.67	9.37		
GVND	Soccer pl.	30	24.50	9.04	6.76	0.012
	Skiers	15	31.33	11.21		
GVNL	Soccer pl.	30	17.00	9.34	0.47	0.497
	Skiers	15	18.67	9.55		
PIKD	Soccer pl.	30	31.23	11.19	11.32	0.001
	Skiers	15	39.77	8.23		
PIKL	Soccer pl.	30	23.00	11.75	8.64	0.005
	Skiers	15	32.07	12.14		

By analyzing the results in Table 2 which shows differences in the precision between the soccer players and skiers it can be seen that there are statistically significant differences in most variables, favoring the skiers. Differences were observed in the tests: picado by the right hand, ($p=0.001$), picado by the left hand ($p=0.005$), right leg aiming at the vertical target ($p= 0.012$) and right hand aiming at the horizontal target ($p=0.013$). In the remaining variables (left hand aiming at the horizontal target and left leg aiming at the vertical target) no statistically significant differences were found. As a sum one can conclude that generally speaking soccer players and skiers do differ in their precision.

Table 3. Canonical factor of the cognitive parameters and the precision of the soccer players and skiers

Canonical - R	Canonical - R-sqr.	Chi-sqr.	p
0.61	0.38	40.89	0.002
0.42	0.18	15.43	0.127

Table 3 shows that in the course of determining the relations between the cognitive abilities and the precision of the soccer players and skiers one canonical factor were isolated. This factor points to the high statistical significance ($p=0.001586$) with 38% of the total variability of these two sets of the variables.

Table 4. Factorial structure of the cognitive parameters and the precision of the soccer players and skiers

Variables	Root 1	Variables	Root 1
T7	0.62	GHRD	0.72
T3	0.20	GHRL	-0.12
T9	0.93	GVND	0.52
		GVNL	0.33
		PIKD	0.09
		PIKL	0.11

The structure of the left set of the first canonical factor of cognitive abilities (Table 4) is characterized primarily as a variable with the highest coefficient of correlation with the first canonical factor a variable for the estimation of perceptive differentiation and logical reasoning (T9) with the coefficient over 0.93 and then a variable for the estimation of perceptive speed (T7) with the coefficient of correlation over 0.61. The structure of the right set of the first canonical factor of the motor abilities is made up of the variables (GHRD, GHRL, GVND, GVNL, PIKD and PIKL). The biggest projection with the canonical factor shows the variable of right hand aiming at the horizontal target (GHRD=0.72), then follows right leg aiming at the vertical target (GVRD=0.52) and finally left hand aiming at the vertical target (GVRL=0.33).

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Analysis of the corresponding canonical functions points to the assumption that success in the precision of the soccer players and skiers mostly depends on the perceptive speed and perceptive differentiation and logical reasoning. The obtained results are to some extent congruent with the previous research results on the population of the athletes. Namely, correlation between the motor and cognitive abilities shows that there is significant positive relation between the coordination and lesser in balance and general factor of the intelligence (Ismail & Gruber, 1967; Momirović, Bosnar & Horga, 1982). This research should raise the question of the selection of children for certain sport. Each child is a distinct individual, each sport demands certain features of the personality and one should find the way to channel a child towards the sport he/she is mostly inclined to. Later on chosen sport will in itself favor a development of some features of personality but in the beginning it is recommendable to perform a selection of children and to direct them towards the sport they have most chances to achieve success.

Conclusion

On most tests applied in this research there was obtained a statistically significant difference which confirms our initial premise that the individual sport, in this case skiing, and collective sport, in this case football, will show significant differences when one takes into consideration their influence on the formation of one's personality and the precision. Skiing and football are immanently different sports that demand development of different abilities. In the course of determining the relation between the cognitive abilities and the precision of the soccer players and skiers one canonical factor was isolated. The analysis of the corresponding canonical functions points to the assumption that success in the precision of the soccer players and skiers mostly depends on the perceptive speed and perceptive differentiation and logical reasoning.

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KOGNITIVNE SPOSOBNOSTI I PRECIZNOST KOD SKIJAŠA I NOGOMETAŠA

Sažetak

Cilj ovog rada je da istraži povezanost i razlike u kognitivnim sposobnostima i preciznosti kod skijaša i nogometaša. Istraživanje je izvedeno na uzorku od 45 vrhunskih mladih nogometaša i vrhunskih skijaša (30 nogometaša i 15 skijaša iz Srpskog nacionalnog tima) uzrasta 13.88 ± 0.60 godina. Instrumenti koji su korišteni za mjerenje kognitivnih sposobnosti su: test za mjerenje perceptivne brzine, test za mjerenje sposobnosti analitičkog rezoniranja na perceptivnom materijalu i test za mjerenje perceptivne razlike i logičkog rezoniranja; takođe su korištena tri testa za mjerenje preciznosti: gađanje horizontalnog cilja rukom, gađanje vertikalnog cilja nogom i pikado. Razlike su ispitivane t-testom, dok su odnosi ispitivani kanoničkom korelacijskom analizom. Dobiveni rezultati ukazuju na činjenicu da postoji statistički značajna razlika između skijaša i nogometaša na sva tri testa koja ispituju kognitivnu sposobnost u korist skijaša, dok na tetovima preciznosti statistički značajna razlika postoji na većini primjenjenih testova. Analiza korespondentne kanoničke funkcije ukazuje na pretpostavku da razina uspješnosti u preciznosti kod skijaša i nogometaša uglavnom zavisi od perceptivne brzine i logičkog rezoniranja.

Ključne riječi: skijaši, nogometaši, kognitivne sposobnosti, preciznost

Received: December 20, 2010

Accepted: June 02. 2011

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