

**Original research article**

**DETERMINANTS OF COGNITIVE ABILITIES  
IN COMPETITORS OF SPORTS KARATE**

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**Abstract.** *Successful karate depends on several factors mutually integrated in a karate athlete as a multidimensional anthropological system. Cognitive abilities are necessary for the successful performance sports karate, we need to start from the existence of the problem of general cognitive (intellectual) abilities depending on: the state of the reception system, decoding processor, the structuring and research of incoming information, the processor for serial analysis of information and processor for the simultaneous analysis of information. The performed empirical research had the aim of establishing the status of cognitive features of Serbian karatists and indicating the importance of their specific identification as an important factor for successful realization of the training process in sports karate. The current study was realized as an empirical transversal study, with the implementation of a survey method, on a sample of 100 male karatists between the ages of 18-27. The model of cognitive abilities applied in this study was in accordance with the metric features of cognitive measuring instruments, the KOG-3 battery of tests. The factor structure of the intellectual abilities of the participants was analyzed on the basis of all the information given by matrix of significant main components. On the basis of Momirović's B6 criteria, one latent dimension (54.45% of the common variance) was isolated, and which could be marked as a general cognitive factor.*

**Key words:** *karate, kumite, cognitive abilities, sportsmen.*

INTRODUCTION

The concept of contemporary sports karate has changed significantly in the last few decades. The original system and way of competition, which is now upheld by followers

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of "traditional karate", was based upon the concept of the "final punch", which basically included the idea of learning techniques that would be efficient enough, strong and properly done to disable the rival-attacker. At the same time, this concept meant opposing every rival, disregarding their body constitution (weight, strength, height, etc.). Thus, the entire karate match was based upon one point, and therefore the training technology was based upon practicing individual punches and blocks or, some simple combinations. This system of training, especially of sports competitions in fights, has quickly led to the "satiation" of competitors, especially the audience expecting dynamics, attractiveness and excitement in every sports discipline. Of course, they could not get that from a one point fight concept. By transforming into a modern sport, karate has been looking for new contents and forms so it, inevitably, had to change its rules of fighting and judging. Participation in sports fights and achieving competition success has become one of the basic motives and aims, and the karate concept had a tendency towards dynamics and attractiveness. So, the accent is therefore no longer on expressing real force of punches or the demonstration of the idea of "the final-fatal punch", but on outsmarting and outplaying the rival by taking technical points. One of the main postulates of contemporary sports karate are speed and skill, which contribute to the efficient achievement of points, unlike the earlier opinion on the development of the "fatal punch" (Radoš & Nešić, 1999).

A contemporary karate competitor (kumite fighter) is featured with a rich fund of techniques, which enables him to achieve a dominant position during the sports fights. At the same time, the karate match features variable intensity of effort reached by athletes, that is, periods of maximal work and low intensity periods, or short intervals (Sterkowicz & Franchini, 2009). So, with well-made technical form, as well as with good physical preparation, a contemporary karate competitor gains safety in keeping a dominant position during an attack, and at the same time, he maintains a stable defense. Unlike earlier karatists, a contemporary karatist has to keep in mind the idea reflecting an efficient course of a sports fight: "I am attacking - I am ready to defend myself; I am defending myself-I am ready to attack" (Nešić, Nešić, & Kovačević, 2012). Among the first researches studying the structure of athletes anthropological dimensions there are those who were occupied with segment of cognitive abilities. These abilities are related to mechanisms of reception, processing and conservation of information, so they could all be regarded functional structures responsible for processes of reception, decoding and transformation of information with a clear goal of making decisions and performing activities. On the basis of studies carried out to date a common conclusion could be drawn that the structure of cognitive abilities is of a hierarchical type (Eysenk, 1967; Kvaščev, 1981; Momirović & Horga, 1999; Wolf, Momirović, & Džamonja, 1992). In that hierarchy there is a central processor controlling and integrating three separate processors (perceptual, serial and parallel) used for the reception, processing and transformation of information. The functions of these processors were defined by Momirović, & Horga (1999), as well as by Wolf et al. (1992), on the basis of which standardization of cognitive tests was done (KOG-3).

Cognitive abilities, that is intelligence, are often differently defined in dependence on the approach and theoretical model of their author, especially among early theoretical discussions of Cattell (1963), but also others occupied with this problem (Guilford, 1982; Thurstone, 1938). However, it can be considered that a common determinant of intelligence, necessary for successful sports fight in karate, that is achieving top sports results, was defined as the ability of adjustment and successful reaction to new and unpredictable

situations in a very short time period (Banić, 2012). That means that a karatists in a match has the ability to see a certain situation and find a solution in a very short period of time, disregarding whether it is a moment of attack or a moment of defense. The ability of fast and proper anticipation of the rival's movement or preparation activities before the attack also represents a high cognitive level of a karatist. Therefore it can be concluded that sports with poly-structural acyclic movements are highly related to cognitive abilities, so for success in karate, among other things, a high level of intelligence is necessary as well (taking into account that results in this sport is a binary variable: defeat-victory). The determination of some segments of the anthropological space of karatists and their relationship in relation to specific physical activities, among which an important place is taken by cognitive abilities, is certainly one of the relevant issues of sports-training theory and the practice of karate. For that reason, a study was designed and its aim was to establish the status of cognitive features of Serbian karatists and to indicate to importance of their specific identification, taking into account that they represent a significant factor for the successful realization of the training process in sports karate.

#### THE METHOD

The population of the athletes from which the sample of participants was taken was defined as a population of karatists-competitors (N=100), males aged between the 18 and 27. The participants were physically healthy, without any distinct psycho-physical aberrations and they are actively involved in training and competitive activities in the sports discipline *kumite*. They are members of the master clubs of the highest range of competition and National Karate Team of Serbia.

Besides the general criteria for such research, the participants had to satisfy the following characteristics as well: a) that they had been regularly subjected to the training process during the study period in their clubs or the national team of Serbia which was established through insight into club evidence and the number of trainings, and b) that they had never had any somatic deformities and aberrations, and that they were physically and mentally healthy. The research was realized as an empirical transversal study, with the implementation of survey methods. The model of cognitive abilities implied in this study was in accordance with metric features of cognitive measuring instruments, which in this case was a KOG-3 battery of tests (Wolf et al., 1992).

The KOG-3 battery is a minimal battery for the evaluation of the efficacy of perceptive, serial and parallel processors. A version of that battery was used to achieve the basic aim, which was to establish the level of general cognitive abilities. The battery consisted of three tests:

- 1) For the evaluation of input processor efficacy, that is, of perceptive reasoning, the measuring instrument chosen is: the test of comparing pictures (IT-1),
- 2) For serial processor efficacy evaluation, that is, for symbolic reasoning, the chosen measuring instrument is: the test of synonyms (AL-4),
- 3) For the evaluation of parallel processor efficacy, that is, perceiving of relations and correlations, the applied test is: the test of visual specialization (S-1).

During statistical data processing, the procedure of comparative statistics was used, i.e., a causal parametrical procedure – the Factor Analysis. The chosen method was considered to be suitable for the nature of the problem and did not put too big a restriction on

the basic information, and is based upon the postulates: a) that latent dimensions that are the subject of measurement with applied measuring instruments have multivariate normal distribution, and b) that relations between manifest and latent variables can be approximated with generalized linear model of Gaus, Markov and Rao.

#### RESULTS WITH DISCUSSION

The factor structure of the intellectual abilities of the participants in this research was analyzed on the basis of all the information given by the matrix of important main components (chart 1). On the basis of Momirovic's B6 criteria only *one latent dimension* was isolated, which marks the whole space of three cognitive tests with about 54.45% of the common variance, which could be accepted as satisfactory for this type of research.

**Chart 1.** The main components of cognitive variables of karatists.

Indicator	FAC1 h2
It-1	,71 ,51
AL-4	,78 ,61
S-1	,71 ,51
Lambda	1.63
% Variance	54.45
Cum. %	54.45

A separate latent dimension could be interpreted as a *general cognitive factor*. The biggest projections with the first and only component was determined for the AL-4 test of synonyms-antonyms for the evaluation of serial processor efficacy (symbolic reasoning), and then the same projection was determined for the S-1 used to estimate the efficacy of the parallel processor (the perception of relations and correlations) and IT-1 used to evaluate the efficacy of input processors (perceptive reasoning).

The best connection with isolated cognitive dimension was determined for the variable for the evaluation of symbolic reasoning, as well as perceptive abilities. Taking into account that motor activities are dominantly found in activities of karatists, so far studies (involving athletes in general) have established a positive connection between perceptive and motor abilities. Although perceptive measuring instruments are significantly saturated by cognitive factors (cognitive functioning on the perceptive level is often written about), on this occasion it would be too unsubstantiated to pronounce them cognitive measuring instruments, although in a certain sense they are. A positive connection, most often of the middle level between perceptive and motor abilities was earlier established by Horne, Fits, Harison, Flajšman, Niman, Hempel, etc. Also, these authors have determined that motor activity has a positive effect on the development of perceptive abilities. In our case, an isolated cognitive dimension was clearly defined by test S-1 with quite a high projection for parallel processor efficacy evaluation which is equal to Katel's factor of crystalized intelligence, as well as other detected cognitive dimensions of the participants.

A karatist, as well as a man in general, has a central nervous system showing dominantly integrative function, that is, it enables adaptable behavior. For proper functioning

during the training process, and later during the competition activities, the most important aspect is integration on the cortical level (although it is less flexible). Integration of functions on the subcortical level enables reaction in standard situations, situations requiring automatic performance of routine programs. So, cognitive processes and cognitive functioning are central mechanisms of cortical integration, which can be regarded as a significant determinant when it comes to athletes as well.

Sports karate fight (*kumite*) represents a complex and poly-structural dimensional sports activity, in which success depends on several factors, among which there are certain psychological characteristics and abilities. Success in a sports fight (*kumite*), it can freely be stated, also quite depends (besides specific motor qualities - karate technique) on the ability of the karatist to optimally realize their sports-technical potential in competitive conditions. On the basis of such abilities, among others, there is a *tactical opinion*, which can be defined as a specific cognitive functioning of a karatist and his ability of solve problems on the basis of cognitive abilities of perception, education and tactical karate knowledge in typical and atypical situations of sports karate fights. Therefore, it could be justifiably claimed that cognitive abilities are very important for success in sports karate and that their continued diagnostics is necessary in the creation of long-term training processes. This approach in the realization of the training process (and competition) is based upon practice and positive experience in certain circumstances of the external and internal surroundings of the karatist, in actual and real times. Here, knowledge and skills are in a harmonic balance, which means that individual situational management quite engages intellectual abilities of karatists (Fratrić, 2009).

#### CONCLUSION

By implementation the research instrument (KOG-3) it was determined that the general cognitive factor is identified as a separate latent dimension of the participants, Serbian senior karatists in the *kumite* competitive discipline. It is saturated by indicators of: symbolic reasoning (test AL-4 for estimation of serial processor efficacy) with the biggest projection on the first and only component, that is, perceptive reasoning (test IT-1 for the estimation of input processor efficacy) and noticing relations and correlations (test IT-1) as indicators with the same projection intensity. It should also be taken into account that the quality of the training process of karatists, achieved in the integrative "coach-athlete" system, does not depend only on mechanical implementation and following principles for managing the transformation processes in karate, but also on the level of intellectual abilities of their indirect actors. Therefore it can be stated that cognitive abilities, although they are basically very highly genetically predisposed, can be subjected to learning and improving, taking into account that intelligence is a dominant function of the right brain hemisphere. Anyway, it has to be emphasized that sports and training practice at all bases can only be developed under the condition that it is in balance with the amount of useful information being in the function of knowledge. Therefore, knowledge of status and values of cognitive features of karatists and the indication of the importance of their concrete identification, tracking and development, represent one of the very important factors of the training process realization and success in sports karate, as well as in sports competitions.

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## DETERMINANTE KOGNITIVNIH SPOSOBNOSTI TAKMIČARA U SPORTSKOM KARATEU

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*Uspešno bavljenje karate sportom zavisi od niza faktora koji su međusobno integrisani u karate sportisti kao višedimenzionalnom antropološkom sistemu. Kada je reč o kognitivnim sposobnostima koje su potrebne za uspešno bavljenje sportskim karateom, mora se poći od problema egzistencije generalne kognitivne (intelektualne) sposobnosti koja zavisi od: stanja receptorskog sistema, procesora za dekodiranje, struktuiranje i pretraživanje ulaznih informacija, procesora za serijalnu analizu informacija i procesora za simultanu analizu informacija. Sprovedeno empirijsko istraživanje imalo je za cilj utvrđivanje statusa kognitivnih karakteristika srpskih karate sportista i ukazivanje na značaj njihove konkretne identifikacije, kao bitnog činioca za uspešnost realizacije trenaznog procesa u sportskom karateu. Istraživanje je realizovano kao empirijska transversalna studija, uz primenu Survey metoda, na uzorku od 100 karatista takmičara muškog pola, uzrasta između 18 i 27 godina. Model kognitivnih sposobnosti koji je primenjen u ovom istraživanju bio je u skladu sa metrijskim karakteristikama kognitivnih mernih instrumenata, baterijom testova KOG-3. Faktorska struktura intelektualnih sposobnosti ispitanika, analizirana je na osnovu svih informacija koja pruža matrica značajnih glavnih komponenti. Na osnovu Momirovićevog B6 kriterijuma izolovana je jedna latentna dimenzija (54.45% zajedničke varijanse) koja se može označiti kao generalni kognitivni faktor.*

Ključne reči: karate, kumite, kognitivne sposobnosti, sportisti.