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Intersegmental coordination and the performance of junior football players

Cojocaru Viorel[a], Tüdös Ştefan[a], Predoiu Radu[a] *, Coliţă Eugen[b], Coliţă Daniela[c]

[a]U.N.E.F.S. Bucharest, Constantin Noica, No. 140, 060057, Romania
[b]Dinamo Bucharest Sports Club, Calea Floreasca, No. 18-20, 014452, Romania
[c]Ministry of Foreign Affairs, Muzeul Zambaccian, No. 18, 011871, Romania

Abstract

The purpose of this study consists of analyzing the existing correlations between the intersegmental coordination and sports performance. The RCMV test, included into the PSISELTEVA battery, developed by RQ Plus, evaluates the intersegmental coordination, expressed through some psychomotor-related parameters. The subjects who took part in this study are 24 junior football players, from Dinamo Bucharest Sports Club. Using the Spearman correlation there have been important relations highlighted between the perceptual-motor learning coefficient, the resistance to time pressure coefficient and the marks obtained by the football players depending on their evolution on the field.

Keywords: intersegmental coordination; perceptual-motor learning; resistance to time pressure; sport; performance capacity; football

1. Introduction

Sport is a competitive activity involving at least two competitors, requiring physical skills, following formal rules and occurring within a formal organizational framework (LeUnes, 2008). Sport is a performance related domain; in the world of sports, performance is among the most important objectives. Performance can be looked as the result obtained in a specific activity, usually in a competition, expressed in absolute marks, based on the system of official ranks or based on the ranking position (Epuran, Holdevici, & Toniţa, 2001). Performance capacity represents the sum of the stabilized behaviors (overlearned), which remain efficient in terms of difficult competition (Tüdös,

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* Radu Predoiu. Telephone number.: +4-072-913-4360
E-mail address: radu_predoiu@yahoo.com

2000). Achieving the athletic performance may be, to some athletes, the main motivation of training, preparation and involvement in the competing system.

As a component part of the psychomotor domain, coordination is regarded by most of the authors (Mitrache & Tüdös 2004; Hirtz, 2001) as one of the most challenging topics of investigation, relevant to sport psychologists and coaches, as well as a complex quality conditioning motor control capacity, motor learning capacity, adaptation and re-adaptation capacity, vigilance, all these conferring the athlete self-confidence, accuracy and efficiency when performing the specialized skills. Specialized literature (Aniței, 2007) indicates the importance of coordinated movements as an indicator that allows a correct evaluation of instrumental movements (those movements associated with device manipulation, tools, machines, movements that can be done at superior precision indices, dexterity and timing). Coordinated movements represent a distinct category of instrumental movements, which give to the subject the possibility to economize effort, motor action, in predictable situations (stereotypical) and unpredictable (of adjustment). The level of movement coordination is influenced by the level of knowledge of the motor skills, as well as by the disruptive factors or the desultory characteristics of the environment. The quality of the coordination is influenced by the position of the subject – the precision of the manipulation movements is maximum for the objects set in front and under the level of the shoulders. The coordination difficulties manifest through: temporal discrepancies between processing the information and executing the motor act, errors of non-synchronization of individual movements, order errors (inversions or substitutions of movements) or commutative errors (persevering with the anterior movement, interferences between movements). The movements of skilled individuals are characterized by a flowing quality that suggest more efficient control and a smoother coordination of joints and muscles – the movements become less stiff-looking after practice (Schmidt & Wrisberg, 2000). In football, a multiple experience of gestures is required, which shortens the learning and makes the training process more efficient (Cojocaru, 2002). Thus, becomes necessary to give a great importance to the development of a large repertory of gestures.

2. Organization of the research

2.1. The purpose of the research

The main purpose of our research was to investigate the intersegmental coordination, expressed through some psychomotor-related parameters (personal optimum rhythm, resistance to time pressure, perceptual-motor learning, mean of the latency time needed for a bi-segmental or multi-segmental response, resistance to disruptive factors) and the sports performance of the junior men's football players.

2.2. Subjects

The sample included 24 football players, aged between 14 and 15 years, from Dinamo Bucharest Sports Club. The football players represent the Junior Team II of Dinamo Bucharest.

2.3. Methods

To solve the research issues, we used: observation, conversation, test – RCMV Test, within PSISELTEVA tests, elaborated by RQ Plus, statistical processing methods – SPSS and data interpreting.

2.3.1. Description and development

The RCMV test is included into the PSISELTEVA computerized battery, developed by RQ Plus in 2001. The test consists in displaying a soft made up of different images that present, at variable time intervals and in a randomized order, square-shaped centrally-left/-right, upward/downward positioned relevant stimuli, as well as a green-coloured upward-right positioned circle which becomes red at variable time intervals. The subject must respond through a motor reaction of his upper limbs (button pressing) and lower limbs (pedal pushing), by a homogeneous/heterogeneous bi-segmental or multi-segmental combination, depending on the number and position

of the displayed squares. The red circle in the upward-right corner claims the hand one-segmental movement. The test is individually applied and lasts about 10 minutes.

2.3.2. Results of the test

Among all the coefficients provided by the battery soft, we shall present the following parameters:

- Perceptual-motor learning ability (rapid adaptation of movements at new perceptual conditions);
- The mean of the complex reaction time, measured in miliseconds;
- Resistance to disruptive factors (faces a problem - unpredictable appearance of signal-stimuli, distraction - the subject gives correct answers);
- Personal optimum rhythm (qualitative measure statistically calculated by correlating the number of errors to the total number of stimuli);
- Resistance to time pressure (ability to perform motor tasks under stress conditions expressed by increasing the dynamic of the situations).

The results obtained by the football players at RCMV have been correlated to the marks offered by the coach, considering the evolution of the athletes both in training and in competition.

3. Results

Preliminary data analysis (box-plot chart) has emphasized that in the case of the results obtained at RCMV (personal optimum rhythm, resistance to time pressure, perceptual-motor learning, mean of the complex reaction time, resistance to disruptive factors) and in the case of the marks given by the coach, there were no excessive values – marginal or extreme. We present, for example, the box-plot for the scores obtained at the perceptual-motor learning ability and for the resistance to time pressure.
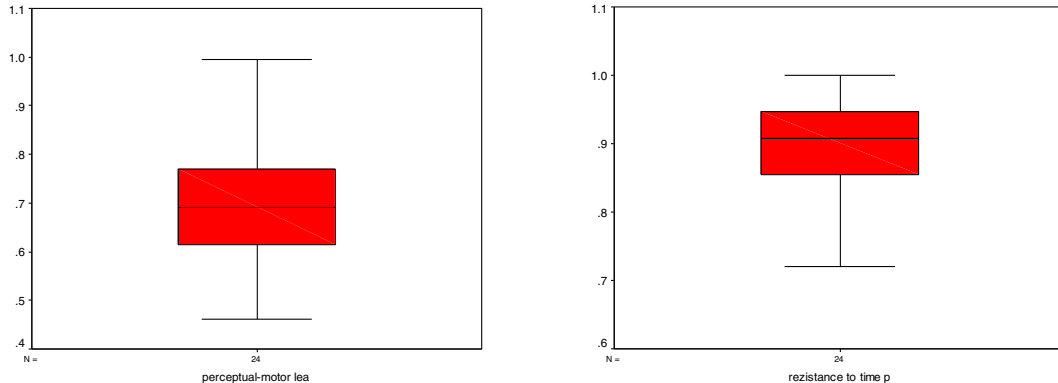

Fig.1. Extreme values (a) perceptual-motor learning; (b) resistance to time pressure

Using the Spearman correlation, we have verified if there were any relations between the intersegmental coordination - expressed through the following psychomotor-related parameters: personal optimum rhythm, resistance to time pressure, perceptual-motor learning, mean of the latency time needed for a bi-segmental or multi-segmental response, resistance to disruptive factors, and sports performance – the scores given by the coach, considering the evolution of the athletes both in training and in competition.

The following conditions for the application of the Spearman correlation are fulfilled:
- Both variables are ordinal or one of them is quantitative and the other ordinal;
- The sample does not have a large volume (24 subjects);

- The scores of a variable are monotonously related to the scores of the other variable, meaning that, once the values of a variable register growth, the values of the other variable will also grow (decrease) – but not necessarily in a linear manner.

Table 1. Results for RCMV and for the scores obtained by the football players, given by the coach depending on their evolution on the field

Variables	N	m	s	sports performance
				Spearman's rho Correlation Coefficient
sports performance	24	8,04	0,13	1,000
perceptual-motor learning	24	70,19	3,09	0,485[*]
complex reaction time	24	101,91	3,21	-0,005
resistance to disruptive factor	24	102,93	3,17	-0,070
personal optimum rhythm	24	10,18	1,73	-0,197
resistance to time pressure	24	90,08	1,48	0,540[**]

[**]. Correlation is significant at the .01 level (2-tailed).
[*]. Correlation is significant at the .05 level (2-tailed).

The analysis of the results indicated in table number 1 emphasizes:
- There is a positively significant correlation (0,485) between the perceptual-motor learning ability and the marks obtained by the football players, offered by the coach depending on the evolution of the athletes on the field ($p < 0,05$);
    As for correlation, a proper indicator for the effect size index is the determination coefficient (r^2) whose value is 0,24. We can say that 24% of the variation (spread) of one of the two variables is determined by the variation of the other or, in other words, 24% of the variation of the two variables is common, the rest being due to other influences. It means that the relation between the perceptual-motor learning ability and the performance registered on the field is moderate.
- There is no correlation between the complex reaction time (mean of the latency time needed for a bi-segmental or multi-segmental response) and the scores obtained by the football players, given by the coach depending on the evolution of the athletes on the field ($p > 0,05$);
- There is no correlation between the results registered for resistance to disruptive factors (unpredictable appearance of signal-stimuli, distraction) and the marks obtained by the football players depending on their evolution on the field ($p > 0,05$);
- Also there is no correlation between personal optimum rhythm (calculated by correlating the number of errors to the total number of stimuli) and the marks obtained by the athletes ($p > 0,05$);
- There is a positively significant correlation (0,540) between the results for resistance to time pressure and the scores obtained by the athletes, offered by the coach depending on their evolution on the field ($p < 0,05$);
    The determination coefficient (r^2) has a 0,29 value, meaning that the relation between resistance to time pressure and the performance of the football players is moderate. We can say that 29% of the variation (spread) of one of the two variables is determined by the variation of the other or, 29% of the variation of the two variables is common, the rest being due to other influences.

4. Conclusions

This study demonstrates the existence of several significant statistic correlations between the results obtained at RCMV - evaluates the intersegmental coordination (expressed through some psychomotor-related parameters: personal optimum rhythm, resistance to time pressure, perceptual-motor learning, complex reaction time, resistance to disruptive factors) and the football players performance. There is a positively significant correlation between the perceptual-motor learning ability and the marks obtained by the football players, offered by the coach depending on the evolution of the athletes on the field. If, in a testing situation, the athletes show a fast adaptation of movements at new perceptual conditions, this aspect is related to a better performance of the athletes on the field. Through an adequate mental preparation completed by modeling the competition in training, the athletes will develop a large repertory of gestures and will be able to quickly adapt their movements to various perceptual conditions. Consequently, this may positively influence the evolution of the football players on the field. Also, there is a positively significant correlation between the results obtained for resistance to time pressure and the marks registered by the athletes, depending on their evolution on the field. If, in difficult conditions – increasing the dynamic of the situations which requires intersegmental coordination, the athletes manifest a good synchronization of one's own limb movements, this aspect is associated with a better evolution of the football players on the field. Modeling the competition in training and performing an adequate mental preparation, the athletes will acquire a multiple experience of gestures and will develop the ability to perform motor tasks under stress conditions expressed by increasing the dynamic of the situations. When talking about the personal optimum rhythm, the complex reaction time (mean of the latency time needed for a bi-segmental or multi-segmental response) and the results registered for resistance to disruptive factors (unpredictable appearance of signal-stimuli, distraction), no correlations were revealed. Our research has been limited by the physical and mental state of the subject during testing (fatigue, affective-motivational factors) which may cause variations in the answers. Observation and conversation as research methods support the value of our research, which is based on the study of intersegmental coordination. This study results provide information useful to coaches in their training strategy, for scientifically conducting the sports training. The research data will also be used by the sport psychologist, who will conceive stimulation programs for the characteristics (perceptual-motor learning, resistance to time pressure) associated with sports performance. The RCMV may be used as a complementary mean of psychological preparation, may offer data with respect to the intersegmental coordination which may become objective points in specific training and may also represent an element of selection of the football players for the representative team.

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