Aspects Regarding the Optimization of the Coordinative Capacity of Students in Non-Specialist Higher Education

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Abstract: The aim of this study is to improve the training process of the students in the futsal team through a complex of innovative methods and means by identifying the optimal operational structures in the development of the coordinative capacity and by the experimental validation of their effectiveness. The main research methods used were the following: the pedagogical observation and the verification experiment. The experiment was conducted in UPB's gym on a sample of 20 students (divided into two groups: experimental and control) aged 19-21. The research was carried out between December 2016 and May 2017, during which we intervened in the experimental group training with a series of operational structures focused on the improvement of the coordinative capacity indices. The time allocated to the operational structures was of 25 minutes / training. As a result of the research carried out and the processing of the results obtained, we noticed significant progresses in the experimental group compared to the control group, which emphasizes the efficiency of the methodology used. The validation of the didactic strategy materialized in practice by applying the operational structures developed is a contribution to the efficiency of the instructive-educational process.

Keywords: *coordinative capacities; futsal; action means; students.*

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1. Introduction

The problematics of the coordinative capacity development is a very wide subject of study, both from a theoretical and practical viewpoint, because this conditions both the acquisition and improvement of various motor actions (skills, abilities, technical procedures and technico-tactical actions and the conditioning of the other motor skills (Mitra & Mogoș, 1980: 144). Coordination is the conscious ability to move two or more body parts in delimited time and space, with the right speed and strength, smoothly and efficiently (Rață & Rață, 2006). Recognizing the close relation between strength, speed and endurance, as well as coordination and agility, allows both coaches and athletes to understand this multilateral process (Bompa, 2003: 62).

The coordinative capacity plays a key role in the training process and "its development can be oriented towards: the general coordination or ability and the specific coordination or dexterity" (Buschmann & Pabst, 2002: 15). The relations between them are very closely linked, in the sense that the general one creates the premises for the specific one, and in order to raise the level of manifestation of the specific coordination it is necessary "to gradually diminish the general coordination exercises and to replace them with specific character exercises" (Dragnea & Teodorescu, 2002: 354). There are no established methods for the development of coordinative capacity, as it is the case with the other biomotor capacities, their optimization being achieved mainly by the "repeated practice of motor skills in various conditions, combinations and requirements" by getting the subject used with a wide variety of situations and an adequate number of repetitions in an own rhythm (Rață & Rață, 2006: 257-258). It is considered that "the development of coordination can be done in any lesson, in any motor conditions and with the most different means" (Dragnea et al., 2006: 63).

The issue of optimizing the coordinative components is a very wide subject of study, which demands the permanent enrichment of the knowledge base according to the latest requirements of the modern training process. In the literature, there are numerous studies, both at university level and in high-performance sports, which deal with the optimization of the coordinative components from the different sports branches, such as rhythmic gymnastics, aerobic dance, basketball, volleyball, etc. (Grigoriu, 2012; Grigoriu, Wesselly, & Pelin, 2017; Singh, 2013; Wesselly, Răchită, & Grigoriu, 2015). As far as football sports discipline is concerned, studies show that during a soccer game, players must react faster than ever when they receive the ball as well as making frequent sudden changes of direction,

fast accelerations into free space, abrupt decelerations, instant switches from defense to attack, jumps and kicks. Soccer players should be capable of learning new techniques quickly which requires high levels of coordination, agility, speed, proper timing, strength, power and transfer of energy between body segments (Cortis et al., 2013).

"Achieving superior football performance involves many factors and largely depends on the use of modern methods in the training process" (Ciolcă, 2005: 60).

In the futsal game, the implications of the coordinative components are particularly profound, there becoming obvious the importance of the ability to adapt and transform the movement, the sense of balance, the spatial-temporal orientation, the ability to combine and couple the movements, the ability to anticipate the movements and the kinesthetic differentiation ability (Mordillo, 2017).

Therefore, we considered it appropriate to address this research topic because from the practical experience gained during the training lessons with the representative futsal team of the University Politehnica of Bucharest (U.P.B.), we noticed it was necessary to improve the general and specific coordinative components of the students.

Believing that we cannot include in our research all the aspects regarding the coordinative capacity, we have the intention to limit ourselves to the study of the practical ways to train the coordinative capacity, taking into account, in a first phase, the following components: the general and specific coordination.

2. Material and methods

2.1. Research Aim

The aim of this study is to improve the training process of the students in the futsal team through a complex of innovative methods and means by identifying the optimal operational structures in the development of the coordinative capacity and by the experimental validation of their effectiveness.

2.2. Research Hypothesis

We believe that by creating and implementing, during the physical education and sports lesson, a training program that includes means specific to football, we can facilitate the optimization of the general and specific coordinative capacity of the students.

2.3. Research Methods

The main research methods used were the following: the pedagogical observation and the verification experiment. The following tests and trials were used to evaluate the coordinative capacity:

- determination of the general coordination - the Matorin test (Horghidan, 1997: 164);
- determination of the specific coordinative capacity: trial 1, keeping the ball in the air with both legs by movement 30 "; trial 2, dribbling between the poles with both legs and finishing with a shot at the goal.

The evaluation at trial 1 consists in the quantification of the number of successful attempts for 30 ", and the evaluation at trial 2, refers to the number of goals scored after the completion of 6 successful attempts. During the trial, the ball must not touch the poles, and the shooting at the gate must be executed in such a way that the ball does not touch the playing surface.

2.4. Subjects and location

The research, of the experimental type, was conducted in the U.P.B. sports complex on a sample of 20 students, members of the representative futsal team (distributed in two groups: experimental - G1 and control - G2), aged 19-21.

Before the experiment, the students were informed on the particularities of the test and on the evaluation tools used, and they agreed with the way the experiment was carried out. At the onset of the experiment, the subjects were clinically healthy, with no lesions that could worsen through the tests.

The experimental research was conducted over six months, between December 2016 and May 2017, thus:

- between December 5 and December 9, 2016, the initial testing of the two groups of subjects took place;
- between December 12, 2016 and May 21, 2017, we intervened in the experimental group preparation with the training program, which included a series of operational structures focused on the improvement of the coordinative capacity indices;
- between 22 and 26 May 2017 the final evaluation of the two groups investigated took place.

2.5. Results

After the initial testing in both groups of students, a training program was developed that contained operational structures focused on optimizing the coordinative components that was applied in the training lessons of the students in the experimental group. Each program was applied for 20-25 minutes / training lesson for 23 weeks in 46 training lessons.

In the study, we wanted to find out if there are significant differences between the results obtained by the students at the conclusion of the experimental intervention through the action system for the coordinative capacity development of the students in the futsal team.

The dynamics of the results obtained in the initial phase of the experiment is shown in Table 1 and refers to the value of the parameters determined by evaluation tests and trials for the general and specific coordinative capacity, by comparing at the level of the two groups (experimental and control) the determined statistical indicators. In the processing and interpretation of the research results, we used the following statistical-mathematical indicators: the arithmetic mean, the coefficient of variation, the standard deviation and the independent t-student test.

Table 1. Comparative results of experimental group (G1) and control (G2) at the initial testing

Tests/Trials		STATISTICAL INDICATORS						
		G1	G2	G1-G2	G1	G2	Independent t-TEST	p
		Mean/ $\pm$ SD	Mean/ $\pm$ SD	Dif. mean	Cv %	Cv %		
Matorin Test (right) (Grade)	10	242/16.19	239/17.28	3	6.69	7.23	0.40	>0,05
Matorin Test (left) (Grade)	10	375/20.68	373/21.62	2	5.51	5.79	0.211	>0,05
Keeping the ball in the air by movement (repetitions)	10	9,4/1,5	9,1/1,28	0,3	15.95	14.06	0,47	>0,05
Dribbling between the poles and finishing with a shot at the goal (points)	10	2.4/0.84	2.3/0.91	0,1	35	39.56	0.24	>0,05

Analyzing by comparison the results obtained (Table 1) by the two groups (experimental and control) in the initial phase of the experiment we find the following aspects:

- at the Matorin test with rotation to the right (Table 1), the arithmetic mean value in the initial testing (G1) is of 242 degrees, and (G2) of 239 degrees. The difference in arithmetic mean between G1-G2 is of 3 degrees. The coefficient of variability "Cv" has the value of 6.69% for the initial testing (G1), and of 7.23% for (G2), so the dispersion is average, the samples being homogeneous. The value of the "Student" calculated "t" between G1-G2 is of 0.40, so $0.40 < 2.101$ (at the value of $p < 0.05$), therefore there are no statistically significant differences between the averages of the two groups;

- at the Matorin test with rotation to the left (Table 1), the arithmetic mean value for the initial testing (G1) is of 375 degrees and for (G2) is of 373 degrees. The coefficient of variability "Cv" has the value of 5.51% for the initial testing (G1), and of 5.79% for (G2), so the samples are homogeneous. The value of the "Student" test calculated "t" between G1-G2 is of 0.211, so $0.211 < 2.101$ (at the value of $p < 0.05$), therefore there are no statistically significant differences between the averages of the two groups;

- for the keeping-the-ball-into-air trial (Table 1), the arithmetic mean value at the initial testing (G1) is of 9.4 repetitions and for (G2) of 9.1 repetitions. The coefficient of variability "Cv" has the value of 15.95 at the initial testing (G1), and of 14.06 at the (G2) test, both samples being relatively homogeneous. The value of the "Student" test calculated "t" between G1-G2 is of 0.47, so $0.47 < 2.101$ (at the value of $p < 0.05$), therefore, there are no statistically significant differences between the averages of the two groups;

- at the dribbling trial between the poles and finishing with a shot at the goal (Table 1) the arithmetic mean value at the initial testing (G1) is of 2.4 points and for the (G2) of 2.3 points. The value of the "Student" calculated "t" between G1-G2 is of 0.27, so $0.27 < 2.101$ (at the value of $p < 0.05$), therefore, there are no statistically significant differences between the averages of the two groups.

We present in graphical form the comparative results of the arithmetic mean obtained by the two groups in the initial phase of the experiment

Graph 1
 The arithmetic mean of
 the Matorin test

Graph 2
 Arithmetic mean values at the
 specific coordination test

From the viewpoint of the manifestation degree of the coordinative capacity, the subjects of the two samples present initial results close as value. The tests and trials used in the research evaluate the level of important coordinative components in the execution of the technical elements in football and, in view of the results obtained, we consider that both groups should turn their attention to improving their level of manifestation.

Table 2 shows the results obtained by the two groups at the end of the experiment:

Table 2. Comparative results of the experimental group (G1) and control group (G2) at the final testing

Tests/Trials		STATISTICAL INDICATORS					
		G1	G2	G1-G2	G1	G2	
n		Mean/± SD	Mean/± SD	Dif. mea n	Cv %	Cv %	Independent t-TEST p
Matorin Test (right) (Grade)	10	262/18,13	245/15,27	17	6,23	6,91	2,26
Matorin	1	396.5/18,8	378/17,9	18,5	4,75	4,75	2,24
							<0,05
							<0,0

Test (left) (Grade)	0	6	8					5
Keeping the ball in the air by movement (repetitions)	1 0	14,5/1,05	10,7/1,7 7	3,8	9,81	12,2	5,80	<0,0 5
Dribbling between the poles and finishing with a shot at the goal (points)	1 0	4,1/0,69	2,6/0,99	1,5	26,5 3	24,1 4	3,90	<0,0 5

After the statistical processing of the results obtained by the students from the two groups (experimental - G1 and control - G2) at the final testing we found the following (Table 2):

- at the Matorin test with rotation to the right, the arithmetic mean of G1 is 262 degrees, and 245 degrees for G2, the arithmetic mean

difference between G1-G2 being 17 degrees. The value of the "Student" test calculated "t" between G1-G2 is of 2.26 so $2.26 > 2.101$ (at the value of $p < 0.05$), therefore, there are statistically significant differences between the averages of the two groups;

- at the Matorin test with rotation to the left (Table 2), the arithmetic mean value is of 396.5 degrees for G1 and of 378 degrees for G2 the difference in the arithmetic means between G1-G2 being of 18.5 degrees. The value of the "Student" test calculated "t" between G1-G2 is of 2.101, so $2.24 > 2.101$ (at the value of $p < 0.05$), therefore, there are statistically significant differences between the averages of the two groups;

- at the keeping-the-ball into air trial (Table 2), the arithmetic mean value in the final testing is of 14 repetitions for G1, and for G2 of 10.7 repetitions. The coefficient of variability "Cv" has the value of 9.81% for the (G1) test and of 12.2% for the (G2) test. The value of the "Student" test calculated "t" between G1-G2 is of 5.8, so $5.8 > 2.101$ (at the value of $p < 0.05$), therefore, there are statistically significant differences between the averages of the two groups.

- after the dribbling trial between the poles and finishing with a shot at the goal (Table 2), the arithmetic mean value at the final testing (G1) is of 4.1 points and at (G2) of 2.6 points. The value of the "Student" calculated "t" between G1-G2 is of 3.9, so $3.9 > 2.101$ (at the value of $p < 0.05$),

therefore, there are statistically significant differences between the averages of the two groups.

The comparative results of the arithmetic mean obtained by the two groups in the final phase of the experiment can be seen in the graphs below:

Graph 4
Arithmetic mean values
of the Matorin test

Graph 3
The arithmetic mean values in the
specific coordination test

According to the results obtained, we can conclude that in the final testing there are statistically significant differences between the results of the experimental group compared to the control group at all the parameters evaluated by tests and control trials.

3. Conclusions

The superior results of the experimental group compared to those of the control group at the final testing demonstrate the effectiveness of the newly-introduced and used means specific to football in order to improve the coordinative capacity of the students investigated. These differences can be explained by the different training program of the two groups, which

confirms that the means used in the development of the coordinative capacity produced significant increases of this, thus validating the hypothesis underlying the experiment.

The conclusions drawn from the initial evaluation of the coordinative potential of the students facilitated the elaboration of the training strategy for the coordinative capacity in accordance with the age specifics and the degree of their training. In this sense, the training of the coordinative capacities was based on the establishment of a strategy regarding the systematization of the means, the main way of developing the coordinative capacities, being the acquisition of new and various motor abilities and skills. The means used showed a high degree of difficulty regarding coordination, with ever increasing the exigencies on the precision of the movements, the integral coordination of the movement and the spontaneity of changing the situation.

A successful program for the development of the coordinative capacity is based on the acquisition of a variety of skills through the progressive increase of complexity, achieved through the use of innovative situations, facilities and various sports equipment.

The acquisition of the movement rational structure and the conscious and active participation of the students in the learning process largely contributes to the development of the coordinative capacity, and the more extensive the motor skills are, the better the technique of the game, which poles to higher performances in competitions.

The content specific to football applied systematically to students in the non-specialist higher education has positive effects on the development of the coordinative capacity - a component of their general motor capacity.

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