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## Method of complex development of psychomotor qualities in precisely-targeted sports

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### Abstract

*The purpose of the study:* the determination of the effect of special precision-target exercises on the level and structure of psychophysiological indicators, physical and technical preparedness of players at the initial stage of training. *Material and methods.* The study was attended by 22 young footballers 10-12 years old. The subjects were divided into two groups (control and experimental) for 11 people in each. The control and experimental group trained the same amount of time for the same prolegs, but in the experimental group, in the main part of the class, used the technique of complex development of precision-target movements. Measured the level of physical and technical preparedness, as well as the level of psychophysiological functions of athletes. *Results.* It is shown that the experimental group experienced significant improvements in the techniques of football due to the development of precision-oriented skills. Really improved results of physical and technical preparedness of athletes of the experimental group were revealed. The control group is also characterized by a significant improvement in testing results by level of technical and physical fitness, but not reliable or at a lower level of significance. The positive influence of the method of complex development of precision-target movements on the psychophysiological indices of athletes is shown. It was shown that after the experiment, the number of reliable interrelationships between the indicators of psychophysiological functions and the indicators of technical and physical fitness in the experimental group increased, and in the control remained unchanged. *Conclusions.* The application of the experimental methodology for the development of precision-target movements positively influenced the level of technical and physical preparedness, psycho-physiological indicators, as well as the structure of the complex preparedness of athletes.

**Keywords:** football, athlete, accuracy, strike, psycho-physiological indicators, technical readiness

### Анотація

Козіна Ж.Л., Сирій О.В., Гринченко І.Б., Бочаров К.О., Курят А., Глядя С.О., Васильєв Ю.К. Методика комплексного розвитку психомоторних якостей в точнісно-цільових видах спорту

*Мета дослідження:* визначення впливу спеціальних точнісно-цільових вправ на рівень та структуру психофізіологічних показників, фізичної та технічної підготовленості футболістів на початковому етапі підготовки. Матеріал і методи. У дослідженні прийняли участь 22 юних футболіста 10-12 років. Випробувані були розділені на дві групи (контрольну і експериментальну) по 11 осіб в кожній. Контрольна та експериментальна група тренувалися за однаковими прогпами однаково кількість часу, але в експериментальній групі в основній частині заняття застосовувала методика комплексного розвитку точнісно-цільових рухів. Вимірювався рівень фізичної та технічної підготовленості, а також рівень психофізіологічних функцій спортсменів. *Результати.* Показано, що у випробуваних експериментальної групи достовірно поліпшились показники техніки футболу за рахунок розвитку точнісно-цільових навичок. Виявлено достовірне поліпшення результатів фізичної та технічної підготовленості спортсменів експериментальної групи. Для контрольної групи також характерно достовірне поліпшення результатів тестування за рівнем технічної та фізичної підготовленості, але не достовірне або при меншому рівні значущості. Показано позитивний вплив застосування методики комплексного розвитку точнісно-цільових рухів на психофізіологічні показники спортсменів. Показано, що після проведення експерименту кількість достовірних взаємозв'язків між показниками психофізіологічних функцій та показниками технічної та фізичної підготовленості в експериментальній групі підвищилась, а в контрольній залишилась без змін. *Висновки.* Застосування експериментальної методики розвитку точнісно-цільових рухів позитивно вплинуло на рівень технічної та фізичної підготовленості, психофізіологічні показники, а також на структуру комплексної підготовленості спортсменів.

**Ключові слова:** футбол, спортсмен, точність, удар, психофізіологічні показники, технічна підготовленість

### Аннотация

Козина Ж.Л., Серый А.В., Гринченко И.Б., Бочаров Е.А., Курят А., Глядя С.А., Васильев Ю.К. Методика комплексного развития психомоторных качеств в точностные-целевых видах спорта

*Цель исследования:* определение влияния специальных точностных-целевых упражнений на уровень и структуру психофизиологических показателей, физической и технической подготовленности футболистов на начальном этапе подготовки. *Материал и методы.* В исследовании приняли участие 22 юных футболиста 10-12 лет. Испытуемые были разделены на две группы (контрольную и экспериментальную) по 11 человек в каждой. Контрольная и экспериментальная группа тренировались по одинаковым прогпам одинаковое количество времени, но в экспериментальной группе в основной части занятия применяла методика комплексного развития точностные-целевых движений. Измерялся уровень физической и технической подготовленности, а также уровень психофизиологических функций спортсменов. *Результаты.* Показано, что у испытуемых экспериментальной группы достоверно улучшились показатели техники футбола за счет развития точностные-целевых навыков. Выведено достоверное улучшение результатов физической и технической подготовленности спортсменов экспериментальной группы. Для контрольной группы также характерно достоверное улучшение результатов тестирования по уровню технической и физической подготовленности, но не достоверное или при меньшем уровне значимости. Показано положительное влияние применения методики комплексного развития точностные-целевых движений на психофизиологические показатели спортсменов. Показано, что после проведения эксперимента количество достоверных взаимосвязей между показателями психофизиологических функций и показателями технической и физической подготовленности в экспериментальной группе повысилась, а в контрольной осталась без изменений. *Выводы.* Применение экспериментальной методики развития точностные-целевых движений положительно повлияло на уровень технической и физической подготовленности, психофизиологические показатели, а также на структуру комплексной подготовленности спортсменов.

**Ключевые слова:** футбол, спортсмен, точность, удар, психофизиологические показатели, техническая подготовленность



## Introduction

Among the modern types of sports of particular popularity become precise-target species. These are sports where you need to perform actions that require hits for a specific goal. Among such sports - sports games, boxing, various types of shooting, etc. These sports appeared to be a necessary element of survival in the wild, and in human society they have become a mass phenomenon that attracts people with their tenderness, a complex manifestation of psychomotor functions.

Precision-target movements are manifested in many types of motor activity. For example, it's different types of shooting (Camus, 2017; Clark, 2016). The art of precision-oriented movements arose in the era of primary people (Arnade, 2018; Ditcham, 2017; Pontzer et al., 2017; Sensfelder, 2017; Silverman, 2016).

At the precise stage, precision-oriented sports are actively developing (Park, 2016; Park et al., 2016; Tarigan, et al., 2018). Together with the development of these kinds of sports, the technique of teaching precision-target movements techniques is developed (Choi, and Ok, 2016). For this purpose, in today's world sports science, research is conducted on the determination of biomechanical and physiological parameters (Ariffin et al., 2018; Reddy et al. 2016; Simsek, 2018; Suppiah, 2017; Taha et al., 2017); The simulation of precision-target movements technology (Richards, 2018), Factors of Fatigue (Lankford, and Higginson, 2016), examines time parameters for identifying factors that impair the achievement of a high athletic outcome (Callaway, et al., 2017, Furley, et. al., 2017), cognitive mechanisms are explored (Gonzalez, et al., 2017), the ability of athletes to self-examine technical actions and training processes su (Tan et.al., 2016), as well as opportunities for the use of precise sports as a means of stress (Aysan, 2016).

Precision-target movements technique is used as an example for the analysis of the laws of mechanics and biomechanics in various training programs (Broglio, et al., 2016.). Precision-target movements are also used as an analogy for psychoanalysis (Richards, 2018). Determine the risk from the point of view of traumaticity and suggest solutions to this problem (Prine, 2016). The technique of precision-target movements is also analyzed from the point of view of the training of athletes with disabilities (Shiyya et al., 2017; You, et al., 2016).

Thus, modern scientific research reveals the importance of the formation of the correct technique in precision-oriented movements (Grygorowicz et al., 2017; Hadlow et al., 2017; Hart et al., 2016; Kobayashi et al., 2017). But the question remains

unclear about the development of special techniques for the development of precise actions. The exercises are mainly directly exercises specific to a particular sport without special exercises for the development of target precision as a complex psychomotor quality (Merrell et al., 2017; Prasetyo, D. et al., 2016; Rosli et al. 2018; Ward et.al., 2018; Winchester et al., 2017; Woods et al., 2018). It should be noted that in game precision-target species there are methodological developments for the development of accuracy. Several studies have shown that target precision is a complex quality that requires the display of both physical indicators and indicators of functional preparedness, the development of psychophysiological functions, etc. (Kozina, 2016). A methodology for the development of accuracy in basketball in combination with the development of speed-strength qualities is proposed (Kozina et al., 2011, 2015, 2016, 2017). The development of target precision is an integral part of the athlete's development as a system that is self-regulating. It is logical to conclude that in other precision-oriented sports, in particular in football, the use of special exercises, including - from other sports, for the development of target accuracy, will have a positive impact on the effectiveness of training accuracy of strikes and transmissions. Especially this question is relevant for athletes at the initial stage of preparation, when the versatile preparation is of great importance for the creation of the basis of technology.

**The purpose** of the study: the determination of the effect of special precision-target exercises on the level and structure of psychophysiological indicators, physical and technical preparedness of players at the initial stage of training.

## Material and methods

### *Participants*

The study was attended by 22 young players 10-12 years old. All children and their parents have agreed to participate in the experiment. The research was conducted from 01.03.2018 to 01.07.2018 on the basis of "Arsenal" Youth Sports School. The subjects were divided into two groups (control and experimental) for 11 people in each. Distribution was made by accident.

The study was conducted in accordance with the requirements of the Helsinki Declaration Ethics.

### *Organization of research*

The control and experimental group trained the same amount of time (4 times a week for 2 hours each training session) for the same program, but in the experimental group in the main part of the class, the technique of complex development of precision-target movements was used. In the control group at





that time exercises were applied with the use of mobile games without the special focus on the development of precision-target movements. In the beginning and at the end of the experiment, athletes were tested. By the beginning of the experiment, the groups did not differ significantly from each other (Table 1) according to psychophysiological indices (according to Horbova and Schulte tests), according to indicators of physical preparedness (bending-extension of hands in the emphasis of lying and squatting) and indicators of technical readiness (accuracy of hits at the gate, an exact coordination test, a description of the tests are given below).

#### *Methodology of complex development of precision-target movements*

The technique with the use of special precision-purpose exercises was used in the experimental group. The experimental group was engaged in the standard program, but the time at the common practice was reduced, and in the training were included additional exercises, such as throwing basketball into the basket, throwing the tennis ball into the target with distances of 3-10 m, blows m' Bags of different sizes and different weight with a foot to the target with distances of 5-12 m, juggling with legs and hands with balls of different sizes and different weights. Exercises were conducted using sequential and game techniques.

#### *The test for the accuracy of hits at the gate*

Strike a foot on a stationary ball from a distance of 8 m in the gate. The ball must cross the gate line in the air and descend by 10 m, 12 beats (6 right, 6 left leg). Estimated number of hits.

#### *Precision Coordination Test*

The footballer is in the center of the field (distance 50 m from the goal line). By the signal, without touching hands, juggles (at least 5 times) the ball, moving forward. Before the first stop, the ball stops the foot and successively circles 5 racks (distance to the first rack - 4 m, between the racks - 7 m). Having reached the last stand but does not reach the line of the penalty area, he takes a kick on the ball by the foot to the goal. The ball must intersect in the air through the gates between the racks and under the crossbar. Evaluated quality and time of exercise (2 attempts, rated best) (c).

#### *Investigation of the level of attention in the method of Horbova "Red-black table" [11].*

##### *Aim.*

Estimation of switching and distribution of attention. Can be used to survey people of all ages.

The study is conducted using special tables, in which randomly located 25 red and 24 black numbers. The tester must first find the black numbers in ascending order, then the red numbers in descending order. Immediately after the first task, the

numbers in the table are mixed, and the subject begins to perform the second task. It consists in alternating the search for black numbers in the growing and red in descending order.

#### *Data Processing.*

The time taken for each series and the error are taken into account. The time of execution of the second task is not equal to the time of execution of the first task, because part of the time goes to switching the attention and operational content of the just mentioned numbers. The difference between two time indices will be the time of switching attention (ERV) from one row of numbers to another. The less this difference, the less the number of errors, the better the switching attention. Types of errors: skipping a number, repeating one number twice, choosing the wrong color number.

After completion, the results of the first and second tests, as well as ERW are displayed on the screen and automatically entered in the database.

#### *Research of mental performance according to the method of "Table Schulte" [1, 8].*

##### *Aim.*

Determination of stability of attention and dynamics of efficiency. Used to survey people of all ages. The tested in turn offers five tables, on which randomly numbers are from 1 to 25. The searcher looks for, shows and names the numbers in the order of their growth. The sample is repeated with five different tables.

The main indicator is the time of execution. According to the results of each table, a depletion curve (fatigue) can be constructed, which reflects the stability of attention and performance in dynamics.

With this test, you can also calculate indicators such as performance (EP), degree of exercise (BP), mental resistance (PU).

$$T1 + T2 + T3 + T4 + T5$$

$$ER = \frac{\text{-----}}{5}$$

where T1 - time of work with the first table; T2 - from the second; TK - from the third; T4 - from the fourth; T5 - from the fifth.

The degree of development (BP) is calculated by the formula:

$$BP = \frac{T1}{ER}$$

The result is less than 1,0 - the indicator of good training, respectively, the higher the given figure, the more the subject needs time to prepare for the main work. Mental endurance (endurance) is calculated by the formula:



Indicator of the result (PP) of less than 1,0 says good mental stability and, accordingly, the higher the given indicator, the worse the psychological stability of the researched before performing a given job. After completion, test results are automatically entered into the database.

#### Statistical analysis

The digital material obtained during the study was processed using traditional methods of mathematical statistics. For each indicator, the arithmetic mean value  $\bar{X}$ , the mean square deviation  $S$  (standard deviation), and the validity of the differences between the parameters of the initial and final results, as well as between the control and experimental groups according to the t-student



criterion with the corresponding level of significance ( $p$ ) were determined.

A correlation analysis of the test parameters was also conducted for the experiment and after the experiment (the results of the control and experimental groups were processed separately for each group).

In mathematical treatment of the primary materials of this study, in addition to calculating primary statistics, a correlation analysis of the test indicators was conducted. Mathematical processing of data was carried out using Microsoft Excel's Data Analysis SPSS research programs. Differences were considered to be reliable at a significance level of  $p < 0.05$ .

#### Results

According to the results of the experiment, the control and experimental group did not differ significantly from each other ( $p < 0,05$ ) (Table 1).

Table 1

Indicators of psychophysiological functions of physical and technical preparedness of young players of control and experimental groups for experiment

Title of tests	Group	Statistical Indicators					
		N	$\bar{x}$	S	m	t	p
Method "Schulte Table, Efficiency of Work", c.u.	K	11	36,83	6,94	2,09	-0,59	0,53
	E	11	38,40	5,69	1,72		
Method «Table of Schulte, speed of inclusion in work», c.u.	K	11	1,05	0,04	0,01	0,17	0,86
	E	11	1,04	0,04	0,01		
Method "Schulte Table, Mental Stability", c.u.	K	11	1,08	0,17	0,05	0,56	0,55
	E	11	1,04	0,16	0,05		
Method "Red-black table of Gorbov", mistakes when working on the table number 1	K	11	3,29	2,90	0,87	-0,50	0,60
	E	11	3,95	2,88	0,87		
Method "Red-black table of Gorbov", ponilki at work on the table number 2	K	11	7,38	6,74	2,03	-0,43	0,63
	E	11	8,66	6,53	1,97		
Method "Red-black table of Gorbov", switching attention, c.u.	K	11	69,95	11,39	15,49	-0,46	0,62
	E	11	70,38	11,71	15,59		
The test for the accuracy of hits at the gate, the number	K	11	5,34	1,49	0,96	2,56	0,03
	E	11	5,21	1,13	0,15		
Precision Coordination Test, s	K	11	12,39	3,43	1,84	-3,23	0,007
	E	11	12,45	4,37	1,43		
Bending-extensions of hands in the emphasis lying in 1 minute, the number	K	11	12,35	2,84	0,86	0,37	0,73
	E	11	13,24	3,21	0,97		
Squat for 1 minute, quantity	K	11	30,02	11,97	3,61	0,92	0,32
	E	11	31,21	8,95	2,70		

Note: K is a control group; E is an experimental group



The lack of significant differences between the control and the experimental group prior to the experiment gave rise to a pedagogical experiment.

Repeated testing in 4 months during which the experimental group used the method of integrated development of precision-target movements showed

that there were significant differences between the control and experimental groups according to the technical readiness indicators ("Accuracy test for gate, quantity",  $p < 0,05$  and "Precision Coordination Test, c",  $p < 0,05$ ) (Table 2).

Table 2

Indicators of psycho-physiological functions of physical and technical readiness of young football players of control and experimental groups after the experiment

Title of tests	Group	Statistical Indicators					
		N	$\bar{x}$	S	m	t	p
Method "Schulte Table, Efficiency of Work", c.u.	K	11	34,88	7,65	2,31	0,35	0,02
	E	11	25,48	5,27	1,19		
Method «Table of Schulte, speed of inclusion in work», c.u.	K	11	1,04	0,06	0,02	0,41	0,68
	E	11	1,03	0,05	0,01		
Method "Schulte Table, Mental Stability", c.u.	K	11	1,08	0,15	0,05	1,09	0,29
	E	11	1,01	0,15	0,04		
Method "Red-black table of Gorbov", mistakes when working on the table number 1	K	11	4,18	2,93	0,88	2,61	0,04
	E	11	1,09	2,66	0,80		
Method "Red-black table of Gorbov", ponilki at work on the table number 2	K	11	7,18	6,26	1,89	-2,58	0,03
	E	11	4,82	2,95	0,10		
Methodology "Red-black table of Gorbov", switching attention, c.u.	K	11	67,18	48,61	14,66	-0,68	0,50
	E	11	61,82	52,26	15,76		
The test for the accuracy of hits at the gate, the number	K	11	6,73	1,79	0,35	-2,76	0,02
	E	11	8,45	1,68	0,92		
Precision Coordination Test, s	K	11	12,33	3,79	0,35	-2,54	0,02
	E	11	11,75	3,68	1,92		
Bending-extensions of hands in the emphasis lying in 1 minute, the number	K	11	15,00	3,26	0,98	-1,00	0,33
	E	11	16,64	4,37	1,32		
Squat for 1 minute, quantity	K	11	37,00	14,23	4,29	0,10	0,92
	E	11	36,45	11,40	3,44		

Note: K is a control group; E is an experimental group

Thus, the results of the test showed that the experimental group experienced a significant improvement in the technical readiness due to the development of precision-target skills.

In-group comparison on the test indicators showed a significant improvement in the results of physical and technical preparedness of athletes of the experimental group: "The test for the accuracy of hits at the gate",  $p < 0,01$ ; "Precision Coordination Test",  $p < 0,01$ ; "Flexion-extensions of hands in the

emphasis lying,"  $p < 0,01$ ; "Squatting",  $p < 0,05$  (Table 3).

For the control group there is a tendency to improve the results of testing by the level of technical preparedness ( $p > 0,05$ ), according to the level of physical preparedness, the difference is reliable at a lower level of significance at a lower level of significance: "bending-extension of the hands in the emphasis on lying,  $p < 0,05$  (Table 4).



Table 3

Indicators of psychophysiological functions, physical and technical readiness of young football players of the experimental group before and after the experiment

Title of tests	Group	Statistical Indicators					
		N	$\bar{x}$	S	m	t	p
Method "Schulte Table, Efficiency of Work", c.u.	BE	11	38,40	5,69	1,72	4,30	0,000
	AE	11	25,48	5,27	1,19		
Method «Table of Schulte, speed of inclusion in work», c.u.	BE	11	1,02	0,04	0,01	-0,61	0,550
	AE	11	1,03	0,05	0,01		
Method "Schulte Table, Mental Stability", c.u.	BE	11	1,02	0,16	0,05	0,16	0,876
	AE	11	1,01	0,15	0,04		
Method "Red-black table of Gorbov", mistakes when working on the table number 1	BE	11	3,95	2,88	0,87	3,69	0,002
	AE	11	1,09	2,66	0,80		
Method "Red-black table of Gorbov", ponilki at work on the table number 2	BE	11	8,66	6,53	1,97	-0,06	0,000
	AE	11	4,82	2,95	0,10		
Method "Red-black table of Gorbov", switching attention, c.u.	BE	11	80,36	51,71	15,59	-0,07	0,948
	AE	11	81,82	52,26	15,76		
The test for the accuracy of hits at the gate, the number	BE	11	5,21	1,13	0,15	-3,31	0,003
	AE	11	8,45	1,68	0,92		
Precision Coordination Test, s	BE	11	12,45	4,37	1,43	-3,48	0,002
	AE	11	11,75	3,68	1,92		
Bending-extensions of hands in the emphasis lying in 1 minute, the number	BE	11	13,24	3,21	0,97	-3,51	0,002
	AE	11	16,64	4,37	1,32		
Squat for 1 minute, quantity	BE	11	31,21	8,95	2,70	-2,73	0,013
	AE	11	36,45	11,40	3,44		

Note: BE- before the experiment; AE- after experiment

Thus, in the experimental group, the improvement of the physical and technical readiness rates is more pronounced than in the control group.

It should be noted that the improvement in physiological function was observed in the experimental group in terms of "Table Schulte, efficiency» ( $p < 0,001$ ), «Red and black table by Gorbov errors when working on Table 1» ( $p < 0,01$ ), «Red-black table for Gorbovym ", errors in the work on the table 2" ( $p < 0,001$ ) (Table 3, 4). This can be explained by the fact that psychophysiological indicators are characteristics of a complex manifestation of psychomotor functions. They reflect the harmonious functioning of the nervous system, which is also due to the general development of coordination abilities, one of the manifestations of which is precision accuracy.

To determine the performance of structured training, identify relationships between indicators of physiological function and performance of physical and technical preparedness correlation analysis was

conducted performance testing of athletes control and experimental groups before and after the experiment (Table. 5-8). Prior to the experiment, the number of reliable relationships between psychophysiological indicators and indicators of physical and technical preparedness in both the control and experimental groups was 5-6 interconnections (Table 5, 6).

After the experiment, the number of reliable interconnections between the indicators of psychophysiological functions and the indicators of technical and physical fitness in the experimental group increased to 10 (Table 7). In the control group, the number of reliable interrelations between these indicators remained at the experimental level (5 interrelationships) (Table 8).



Table 4

Indicators of psychophysiological functions and technical preparedness of the young football players of the control group before and after the experiment

Title of tests	Group	Statistical Indicators					
		N	$\bar{x}$	S	m	t	p
Methodology "Schulte Table, Efficiency of Work", c.u.	BE	11	36,83	6,94	2,09	0,30	0,765
	AE	11	34,88	7,65	2,31		
Method «Table of Schulte, speed of inclusion in work», c.u.	BE	11	1,03	0,04	0,01	-0,79	0,442
	AE	11	1,04	0,06	0,02		
Method "Schulte Table, Mental Stability", c.u.	BE	11	1,06	0,17	0,05	-0,30	0,767
	AE	11	1,08	0,15	0,05		
Method "Red-black table for Gorbovym", mistakes when working on the table number 1	BE	11	3,29	2,90	0,87	-0,73	0,473
	AE	11	4,18	2,93	0,88		
Method "Red-black table for Gorbovym", ponilki at work on the table number 2	BE	11	7,18	6,26	1,89	0,07	0,948
	AE	11	7,18	6,26	1,89		
Method "Red-black table for Gorbovym", switching attention, c.u.	BE	11	69,91	51,39	15,49	0,13	0,9
	AE	11	67,18	48,61	14,66		
The test for the accuracy of hits at the gate, the number	BE	11	5,34	1,49	0,96	-1,35	0,29
	AE	11	6,73	1,79	0,35		
Precision Coordination Test, s	BE	11	12,39	3,43	1,84	-0,33	0,31
	AE	11	12,33	3,79	0,35		
Bending-extensions of hands in the emphasis lying in 1 minute, the number	BE	11	12,35	2,84	0,86	-2,79	0,011
	AE	11	20,00	3,26	0,98		
Squat for 1 minute, quantity	BE	11	30,02	11,97	3,61	-1,43	0,169
	AE	11	37,00	14,23	4,29		

Note: BE- before the experiment; AE- after experiment

Table 5

Correlation matrix of tests for young test group players before the experiment (n = 22)

Testing Indicators	1	2	3	4	5	6	7	8	9	10
1	1,00									
2	0,55*	1,00								
3	-0,84*	-0,09	1,00							
4	0,13	0,34	0,07	1,00						
5	-0,41	0,12	0,08	0,30	1,00					
6	-0,27	0,28	0,12	0,51*	0,97*	1,00				
7	-0,16	-0,61*	0,11	0,00	-0,32	-0,38	1,00			
8	0,18	-0,50*	-0,45	0,08	-0,12	-0,15	0,62*	1,00		
9	-0,29	-0,40	-0,24	-0,35	0,29	0,04	-0,18	0,08	1,00	
10	-0,03	0,04	0,07	-0,21	-0,21	-0,28	0,41	0,42	-0,16	1,00

Notes:

- 1- Method "Schultte table, efficiency", c.u.
  - 2- Method "Table Schulte, the speed of inclusion in the work", c.u.
  - 3- Methods "Schulte Table, Mental Stability", c.u.
  - 4- Method "Red-black table of Gorbov ", cuttings at work on the table number 1
  - 5 - Method "Red-black table of Gorbov ", cuttings at work on the table number 2
  - 6- Method "Red-black table of Gorbov", switching attention, c.u.
  - 7- The test for the accuracy of hits at the gate, the number
  - 8- Precision Coordination Test, s
  - 9- Bending-extension of the hands in the emphasis lying in 1 minute, the number
  - 10- Squat for 1 minute, quantity
- \*- the correlation coefficients are reliable at  $p < 0,05$





Table 6

Correlation matrix of testing young testers experimental group before the experiment (n = 22)										
Testing Indicators	1	2	3	4	5	6	7	8	9	10
1	1,00									
2	0,49	1,00								
3	-0,72	-0,02	1,00							
4	-0,28	-0,41	0,45	1,00						
5	-0,16	-0,32	0,19	0,29	1,00					
6	-0,22	-0,29	0,41	0,52*	0,93*	1,00				
7	-0,12	-0,17	-0,16	-0,35	0,38	0,31	1,00			
8	0,15	-0,02	-0,17	-0,39	0,42	0,42	0,94*	1,00		
9	-0,19	-0,08	-0,09	0,11	0,18	0,06	0,32	0,11	1,00	
10	-0,18	-0,11	0,25	0,21	-0,28	-0,27	-0,16	-0,28	0,43	1,00

Notes:

1- Method "Schultte table, efficiency", c.u.

2- Method "Table Schulte, the speed of inclusion in the work", c.u.

3- Method "Schulte Table, Mental Stability", c.u.

4 - Method "Red-black table of Gorbov ", cuttings at work on the table number 1

5 - Method "Red-black table of Gorbov", cuttings at work on the table number 2

6- Method "Red-black table of Gorbov", switching attention, c.u.

7- The test for the accuracy of hits at the gate, the number

8- Precision Coordination Test, s

9- Bending-extension of the hands in the emphasis lying in 1 minute, the number

10- Squat for 1 minute, quantity

\*- the correlation coefficients are reliable at  $p < 0,05$

Table 7

Correlation matrix of the testing of young players of the experimental group after the experiment (n = 11)

Testing Indicators	1	2	3	4	5	6	7	8	9	10
1	1,00									
2	0,02	1,00								
3	0,25	-0,34	1,00							
4	-0,36	-0,49	0,12	1,00						
5	-0,16	0,24	0,15	0,19	1,00					
6	-0,19	0,21	0,27	0,37	0,95	1,00				
7	-0,21	0,35	-0,22	-0,35	0,12	-0,23	1,00			
8	-0,12	0,53*	-0,15	-0,50*	0,23	-0,26	0,94*	1,00		
9	-0,67*	-0,24	-0,07	0,11	0,58*	0,57	0,43	0,17	1,00	
10	-0,31	-0,59*	0,16	0,52*	0,64*	0,69*	-0,23	-0,27	0,67*	1,00

Notes:

1 - Method "Schultte table, efficiency", c.u.

2- Method "Table Schulte, the speed of inclusion in the work", c.u.

3- Method "Schulte Table, Mental Stability", c.u.

4 - Method "Red-black table of Gorbov ", cuttings at work on the table number 1

5 - Method "Red-black table of Gorbov", cuttings at work on the table number 2

6- Method "Red-black table of Gorbov", switching attention, c.u.

7- The test for the accuracy of hits at the gate, the number

8- Precision Coordination Test, s

9- Bending-extension of the hands in the emphasis lying in 1 minute, the number

10- Squat for 1 minute, quantity

\*- the correlation coefficients are reliable at  $p < 0,05$



Correlation matrix of tests for young testers of the control group after the experiment (n = 11)

Testing Indicators	1	2	3	4	5	6	7	8	9	10
1	1,00									
2	-0,14	1,00								
3	-0,42	-0,37	1,00							
4	0,13	0,28	0,16	1,00						
5	-0,43	-0,39	0,72	0,38	1,00					
6	-0,392	-0,12	0,75	0,65	0,93	1,00				
7	0,17	-0,49	0,16	-0,27	0,12	-0,14	1,00			
8	0,24	-0,31	-0,34	-0,67*	-0,45	-0,56*	0,78*	1,00		
9	-0,25	-0,21	-0,23	-0,65*	-0,13	-0,34	-0,27	0,12	1,00	
10	0,38	-0,43	0,21	-0,24	-0,14	-0,27	0,39	0,38	-0,18	1,00

Notes:

- 1- Method "Schultte table, efficiency", c.u.
- 2- Method "Table Schulte, the speed of inclusion in the work", c.u.
- 3- Method "Schulte Table, Mental Stability", c.u.
- 4 - Method "Red-black table of Gorbov ", cuttings at work on the table number 1
- 5 - Method "Red-black table of Gorbov", cuttings at work on the table number 2
- 6- Method "Red-black table of Gorbov", switching attention, c.u.
- 7- The test for the accuracy of hits at the gate, the number
- 8- Precision Coordination Test, s
- 9- Bending-extension of the hands in the emphasis lying in 1 minute, the number
- 10- Squat for 1 minute, quantity
- \*- the correlation coefficients are reliable at  $p < 0,05$

## Discussion

The obtained data show that in the experimental group the harmony of the functioning of the nervous system from the point of view of motion management has increased, as the number of correlation relationships between the psychophysiological indicators and the level of physical and technical preparedness of the athletes has increased. This confirms the results we have received earlier that when the athlete's level of fitness increases, the level of self-organization of the system increases, which is an athlete or team (Kozina et al., 2016). These results confirm the theory of systems that are self-organizing to increase their structuring as they evolve (Kozina et al., 2016, Sobko et al., 2014). The level of structuring of the system reflects the coherence of the work of its various systems, which indirectly reflects the existence of correlation relationships between different indicators of preparedness and work of different systems of the organism.

The obtained data also confirm the results of research on the development of precision-target movements in other sports (Korobejnikov et al., 2012, Kozina, et al., 2016). The results obtained in previous studies (Kozina et al., 2016) showed that

target precision is a complex quality that depends on many factors and the work of different body systems. Precision-target precision is manifested comprehensively, that is, the development of precision-target movements in one kind of activity accelerates the development of precision-target movements in another type of activity (Kozina et al., 2016). That is why the use of special precision-target exercises proposed in our experiment as additional means for the development of accuracy of archers has allowed to significantly affect the target performance of athletes. The obtained data confirm and extend the results on the effectiveness of the integrated development of target accuracy. But in football, such studies have not yet been conducted, and therefore the results are new in terms of improving the method of developing the target accuracy of young players at the initial stage of training.

In addition, the findings confirmed the results of authors' research on the importance of physical fitness for the implementation of precise actions. In the experimental group, the increase in physical fitness indicators is more pronounced than in the control group. This is also confirmed by the results of other authors' research (Ariffin et al., 2018; Reddy et al., 2016; Simsek, 2018; Suppiah, 2017; Taha et al., 2017) on the importance of physical



fitness for the formation of sports movement techniques.

### Conclusions

1. The application of the experimental methodology for the development of precision-target movements positively influenced the level of technical and physical preparedness, as well as the structure of the complex preparedness of athletes.

2. It is shown that the experimental group experienced significant improvements in the technique of football due to the development of precision-oriented skills. Really improved results of physical and technical preparedness of athletes of the experimental group: "The test for accuracy of hits at the gate, quantity",  $p < 0.01$ ; "Precision Coordination Test, c",  $p < 0.01$ ; "Bending-extension of the hands in the emphasis lying",  $p < 0.01$ ; «Squatting»,  $p < 0.05$ . The control group is also characterized by a significant improvement in testing results by level of technical and physical fitness, but not reliable or at a lower level of significance. The existence of significant differences between the control and experimental groups according to the indicators of

technical preparedness and psychophysiological indices was revealed ( $p < 0.05$ ).

The positive influence of the method of complex development of precision-target movements on the psychophysiological indices of athletes is shown. There was an agreement improvement of the psycho-physiological functions in the experimental group according to the indicators of Schulte's table, the efficiency of work ( $p < 0.001$ ), the red-black table for Gorbovyim, the errors when working on Table 1 " $p < 0.01$ ," red-black table for Gorbovyim", errors at work on table 2" ( $p < 0.001$ ).

3. It was shown that after the experiment, the number of reliable relationships between the indicators of psychophysiological functions and the indicators of technical and physical preparedness in the experimental group increased from 5 to 10. In the control group, the number of reliable interrelations between these indicators remained at the pre-experimental level ( 5 interconnections).

### Conflict of interest

The authors declare that there is no conflict of interest.

### References

- Ariffin, M. S., Rambely, A. S., & Ariff, N. M. (2018). Wrist Muscle Activity of Khatrah Approach in Mameluke Technique Using Traditional Bow Archery. In K. Ibrahim, M. M. Hanafiah, M. H. H. Jumali, N. Ibrahim, & S. A. Hasbullah (Eds.), *2017 Ukm Fst Postgraduate Colloquium* (Vol. 1940).
- Arnade, P. (2018). Archery and Crossbow Guilds in Medieval Flanders, 1300-1500. *American Historical Review*, 123(1), 308-309. doi:10.1093/ahr/123.1.308
- Aysan, H. A. (2016). The Effects of Archery as a Sports Branch on Coping with Stress. *Studies on Ethno-Medicine*, 10(1), 39-43.
- Broglio, S. P., Williams, R., Rettmann, A., Moore, B., Eckner, J. T., & Meehan, S. (2018). No Seasonal Changes in Cognitive Functioning Among High School Football Athletes: Implementation of a Novel Electrophysiological Measure and Standard Clinical Measures. *Clinical Journal of Sport Medicine*, 28(2), 130-138. doi:10.1097/jsm.0000000000000420
- Callaway, A. J., Wiedlack, J., & Heller, M. (2017). Identification of temporal factors related to shot performance for indoor recurve archery. *Journal of Sports Sciences*, 35(12), 1142-1147. doi:10.1080/02640414.2016.1211730
- Camus, R. M. (2017). Comparison by Metaphor: Archery in Confucius and Aristotle. *Dao-a Journal of Comparative Philosophy*, 16(2), 165-185. doi:10.1007/s11712-017-9545-y
- Choi, S., & Ok, G. (2016). The Role of Gukgung in the Success of South Korean Archery. *International Journal of the History of Sport*, 33(9), 990-1007. doi:10.1080/09523367.2016.1237507
- Clark, G. A. (2016). *Philosophy as Practice Zen and Archery* (Vol. 72).
- Ditcham, B. G. H. (2017). Archery and Crossbow Guilds in Medieval Flanders, 1300-1500. *Sixteenth Century Journal*, 48(2), 485-487.
- Furley, P., Noel, B., & Memmert, D. (2017). Attention towards the goalkeeper and distraction during penalty shootouts in association football: a retrospective analysis of penalty shootouts from 1984 to 2012. *Journal of Sports Sciences*, 35(9), 873-879. doi:10.1080/02640414.2016.1195912
- Gonzalez, C. C., Causer, J., Grey, M. J., Humphreys, G. W., Miall, R. C., & Williams, A. M. (2017). Exploring the quiet eye in archery using field- and laboratory-based tasks. *Experimental Brain Research*, 235(9), 2843-2855. doi:10.1007/s00221-017-4988-2
- Grygorowicz, M., Michalowska, M., Walczak, T., Owen, A., Grabski, J. K., Pyda, A., . . . Kotwicki, T. (2017). Discussion about different cut-off values of conventional hamstring-to-quadriceps ratio used in hamstring injury prediction among professional male football players. *Plos One*, 12(12). doi:10.1371/journal.pone.0188974
- Hadlow, S. M., Pinder, R. A., & Sayers, M. G. L. (2017). Influence of football size on kicking performance in youth Australian rules footballers. *Journal of Sports Sciences*, 35(18), 1808-1816. doi:10.1080/02640414.2016.1239023
- Hart, N. H., Cochrane, J. L., Spiteri, T., Nimphius, S., & Newton, R. U. (2016). Relationship between Leg Mass, Leg Composition and Foot Velocity on Kicking Accuracy in Australian Football. *Journal of Sports Science and Medicine*, 15(2), 344-351.



15. Kobayashi, N., Sato, S., Matsuzaki, Y., & Nakamura, A. (2017). Basic Study on Appearance-based Proficiency Evaluation of the Football Inside Kick. In A. Howard, K. Suzuki, & L. Zollo (Eds.), *2017 26th Ieee International Symposium on Robot and Human Interactive Communication* (pp. 1234-1239).
16. Korobejnikov, G.V., Korobejnikova, L.G., Kozina, Zh.L. (2012). *Evaluation and correction of physiological states in sports*, Kharkiv, KNPU. In *Ukrainian*
17. Kozina, Z., Repko, O., Kozin, S., Kostyrko, A., Yermakova, T., & Goncharenko, V. (2016). Motor skills formation technique in 6 to 7-year-old children based on their psychological and physical features (rock climbing as an example). *Journal of Physical Education and Sport*, 16(3), 866-874. doi:10.7752/jpes.2016.03137
18. Kozina, Zh.L., Prusik, Krzysztof, & Prusik, Katarzyna (2015). The concept of individual approach in sport. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 3, 28-37. <http://dx.doi.org/10.15561/18189172.2015.0305>
19. Kozina, Z., Barybina, L., Mishchenko, D., Tsikunov A., & Kozin A. (2011). The program "Psychodiagnostics" as a means of determining psycho-physiological characteristics and functional state in the physical education of students. *Physical education of students*, 3, 56-59.
20. Kozina, Z., Prusik, K., Görner, K., Sobko, I., Repko, O., Bazilyuk, T., et al. (2017). Comparative characteristics of psychophysiological indicators in the representatives of cyclic and game sports. *JPES*, (17)2, 648 – 655.
21. Lankford, D. E., & Higginson, B. (2016). The Effect Of Fatigue And Elevated Heart Rate On Archery Shot Performance. *Medicine and Science in Sports and Exercise*, 48(5), 858-858. doi:10.1249/01.mss.0000487571.81523.18
22. Merrell, A. J., Christensen, W. F., Seeley, M. K., Bowden, A. E., & Fullwood, D. T. (2017). Nano-Composite Foam Sensor System in Football Helmets. *Annals of Biomedical Engineering*, 45(12), 2742-2749. doi:10.1007/s10439-017-1910-9
23. Park, J. L. (2016). Winning major international target archery competitions. *Proceedings of the Institution of Mechanical Engineers Part P-Journal of Sports Engineering and Technology*, 230(3), 186-194. doi:10.1177/1754337115590277
24. Park, J. W., Tan, T. C., & Park, H. U. (2016). Interrogating the Key Policy Factors Behind South Korea's Archery Success. *International Journal of the History of Sport*, 33(5), 523-544. doi:10.1080/09523367.2016.1173673
25. Pontzer, H., Raichlen, D. A., Basdeo, T., Harris, J. A., Mabulla, A. Z. P., & Wood, B. M. (2017). Mechanics of archery among Hadza hunter-gatherers. *Journal of Archaeological Science-Reports*, 16, 57-64. doi:10.1016/j.jasrep.2017.09.025
26. Prine, B., Prine, A., Leavitt, T., Wasser, J., & Vincent, H. K. (2016). Prevalence And Characteristics Of Archery-related Injuries In Archers. *Medicine and Science in Sports and Exercise*, 48(5), 874-874. doi:10.1249/01.mss.0000487618.71221.4d
27. Prasetio, D., Dra, H., & Ieee. (2016). *Predicting Football Match Results with Logistic Regression*.
28. Reddy, A., Al-Smadi, Y. M., & Asme. (2016). *Inverse dynamic analysis of shoulder muscle activity during archery draw back*.
29. Richards, A. K. (2018). An analytic journey: from the art of archery to the art of psychoanalysis. *Journal of the American Psychoanalytic Association*, 66(3), 590-594. doi:10.1177/0003065118776201
30. Rosli, C., Saringat, M. Z., Razali, N., Mustapha, A., & Iop. (2018). A Comparative Study of Data Mining Techniques on Football Match Prediction. In *1st International Conference on Computing, Technology, Science and Management in Sports* (Vol. 1020).
31. Sensfelder, J. (2017). Archery and Crossbow Guilds in medieval Flanders 1300 - 1500. *Waffen-Und Kostumkunde*, 59(1), 63-65.
32. Shiya, K., Zin, T. T., Jomoto, M., Watanabe, H., & Ieee. (2017). A Study on Automatic Display System of the Archery Score for the Visually Impaired. In *2017 Ieee 6th Global Conference on Consumer Electronics*.
33. Silverman, D. J. (2016). Gifts from the Thunder Beings: Indigenous Archery and European Firearms in the Northern Plains and the Central Subarctic, 1670-1870. *Ethnohistory*, 63(1), 189-190. doi:10.1215/00141801-3135514
34. Simsek, D., Cerrah, A. O., Ertan, H., & Soylu, R. A. (2018). Muscular coordination of movements associated with arrow release in archery. *South African Journal for Research in Sport Physical Education and Recreation*, 40(1), 141-155.
35. Sobko, I.N., Kozina, Zh.L., Iermakov, S.S., Muszkieta, Radosław, Prusik, Krzysztof, Cieślicka, Mirosława, & Stankiewicz, Błażej (2014). Comparative characteristics of the physical and technical preparedness of the women's national team of Ukraine and Lithuania basketball (hearing impaired) before and after training to Deaflympic Games. *Pedagogics, Psychology, Medical-Biological Problems Of Physical Training And Sports*, 18(10), 45-51. doi:10.5281/zenodo.10490
36. Suppiah, P. K., Kiet, T. W. K., Musa, R. M., Abdullah, M. R., Lee, J. L. F., & Maliki, A. (2017). The effectiveness of a core muscles stability program in reducing the postural sway of adolescent archers: a panacea for a better archery performance. *International Journal of Physiotherapy*, 4(5), 296-301. doi:10.15621/ijphy/2017/v4i5/159425
37. Taha, Z., Musa, R. M., Abdullah, M. R., Hassan, M. H. A., Razman, M. A. M., & Majeed, A. (2017). *Reliability testing of inertial measurement units in the analysis of physiological variables in archery*.
38. Taha, Z., Musa, R. M., Abdullah, M. R., Razman, M. A. M., Lee, C. M., Adnan, F. A., . . . Haque, M. (2017). The Application of Inertial Measurement Units and Wearable Sensors to Measure Selected Physiological Indicators in Archery. *Asian Journal of Pharmaceutical Research and Health Care*, 9(2), 85-92. doi:10.18311/ajprhc/2017/11046





39. Tan, S. L., Koh, K. T., & Kokkonen, M. (2016). The perception of elite athletes' guided self-reflection and performance in archery. *Reflective Practice*, 17(2), 207-220. doi:10.1080/14623943.2016.1146582
40. Tarigan, U. P. P., Mardhatillah, A., Budiman, I., Sembiring, A. C., Ramadhan, M. S., & Iop. (2018). Feasibility Study Analysis of Establishing Archery Sports Special Place. In *International Conference on Mechanical, Electronics, Computer, and Industrial Technology* (Vol. 1007).
41. Ward, P. A., Ramsden, S., Coutts, A. J., Hulton, A. T., & Drust, B. (2018). Positional differences in running and nonrunning activities during elite american football training. *Journal of Strength and Conditioning Research*, 32(7), 2072-2084. doi:10.1519/jsc.0000000000002294
42. Winchester, N. (2017). Is It Time to Shake up National Football League Rankings? *International Journal of Sport Finance*, 12(1), 32-48.
43. Woods, C. T., Veale, J., Fransen, J., Robertson, S., & Collier, N. F. (2018). Classification of playing position in elite junior Australian football using technical skill indicators. *Journal of Sports Sciences*, 36(1), 97-103. doi:10.1080/02640414.2017.1282621
44. You, B. C., Lee, W. J., Lee, S. H., Jang, S., & Lee, H. S. (2016). Shoulder Disease Patterns of the Wheelchair Athletes of Table-Tennis and Archery: A Pilot Study. *Annals of Rehabilitation Medicine-Arm*, 40(4), 702-709. doi:10.5535/arm.2016.40.4.702

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