Increasing the level of communicative competence and group interaction of athletes based on the implementation of mobile training plans
Incrementar el nivel de competencia comunicativa e interacción grupal de los deportistas a partir de la implementación de planes de entrenamiento móviles

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Abstract. *The purpose of this work is* to study the impact of using mobile training plans and measuring the physical abilities of athletes on their communicative competence and group interaction during mixed training. The biopsychosocial concept of a person, the unity of the physical and mental components of its personality formed the basis *for the research methodology*. The researchers divided *a sample of respondents* into two groups: an experimental and a control one of the non-team sports. The experimental group used training plans shared by the members using mobile devices and providing their teachers with access. The control group followed the traditional curriculum without the use of mobile technologies. They also assessed the level of interaction twice using valid psychodiagnostic techniques. They also rate the interaction level twice using the valid psychodiagnostic techniques. *The results of our research* prove the greater effectiveness of mobile joint training plans compared to traditional ones. The importance of developing the psychological qualities of athleticism in athletes, improving communicative competence and group interaction to increase the effectiveness of sports training and the possibility of using artificial intelligence technology for this are shown, which can be considered as a promising direction for our further research.
Keywords: communicative competence; group interaction; joint training; mobile learning plans; non-team sports; psychological qualities of athletes

Resumen. El propósito de este trabajo es estudiar el impacto del uso de planes de entrenamiento móviles y la medición de las habilidades físicas de los deportistas en su competencia comunicativa e interacción grupal durante el entrenamiento mixto. El concepto biopsicosocial de persona, la unidad de los componentes físicos y mentales de su personalidad formó la base de la metodología de la investigación. Los investigadores dividieron una muestra de encuestados en dos grupos: uno experimental y otro de control de deportes que no son de equipo. El grupo experimental utilizó planes de formación compartidos por los miembros utilizando dispositivos móviles y proporcionando acceso a sus profesores. El grupo de control siguió el plan de estudios tradicional sin el uso de tecnologías móviles. También evaluaron el nivel de interacción dos veces utilizando técnicas de psicodiagnóstico válidas. También califican dos veces el nivel de interacción utilizando las técnicas de psicodiagnóstico válidas. Los resultados de nuestra investigación demuestran la mayor eficacia de los planes de formación conjuntos móviles respecto a los tradicionales. Se muestra la importancia de desarrollar las cualidades psicológicas del atletismo en los atletas, mejorar la competencia comunicativa y la interacción grupal para aumentar la efectividad del entrenamiento deportivo y la posibilidad de utilizar tecnología de inteligencia artificial para esto, lo que puede considerarse como una dirección prometedora para nuestras futuras investigaciones. .
Palabras clave: competencia comunicativa; interacción grupal; formación conjunta; planes de aprendizaje móvil; deportes que no son de equipo; cualidades psicológicas de los atletas

Introduction

The positive psycho-emotional impact of sports largely depends on both the athletes' satisfaction with the results achieved and the emergence of positive communication and trusting social relationships during the training process (Valle et al., 2019). Communicative competence is the basis of professional communication, gaining professional experience and achieving success, which makes it important to study the issue of communicative competence of athletes (Lakhtadyr et al., 2021; Popovych et al., 2021). However, the specifics of the formation of communicative psychological characteristics of athletes still remain insufficiently studied, especially in the context of using innovative digital educational technologies for their development, which determines the relevance of the topic of this study.

The modern era is characterized by truly revolutionary changes in the lives of all humanity associated with the rapid development of e-technologies. The introduction of mobile educational technologies aims to address the challenges of

sustainable development in the 21st century (Pejovic & Skarlatidou, 2020). Therefore, there is no such sphere of life that would not be affected by the processes of digitalization. The rapid development of mobile technologies has led to an increase in the possibilities of using them in education (Tlili et al., 2023). Among the most popular areas for the development of educational digital mobile technologies, researchers (Aldenaini et al., 2023; Ma, 2022) pay special attention to the field of physical culture and sports, the possibility of using artificial intelligence to achieve the goals of sports education and the formation of personal qualities of athletes. This applies equally to physical education, psychological preparation of professional athletes, and amateur physical education (Chaloupský et al., 2021; Yang et al., 2020). Mobile training plans have been used previously, but the COVID-19 pandemic has amplified the use of mobile and computer applications for tracking the condition of athletes and sports students during training in both developed and developing countries (Ansari & Khan, 2020). Social isolation and restrictions on freedom due to

the COVID-19 pandemic have contributed to decreased levels of physical activity, increased stress levels, and a decreased sense of psychological well-being, with the development of negative mental states of anxiety and depression (Ramos et al., 2023). At the same time, providing adequate physical activity to student-athletes is a fundamental factor in their physical development, emotional intelligence and social interaction, influencing the formation of their personality (Papoutsi et al., 2022; Maciel et al., 2023; Martins et al., 2023). The use of mobile training plans allowed student-athletes to perform the necessary physical activity at home during self-isolation due to the COVID-19 pandemic, which determined the success of their achievements and socialization (Avsiyevich et al., 2021; Meza & López, 2021). Accordingly, the popularization of an active lifestyle and sports makes it urgent to develop and implement innovative digital technologies to increase motivation for training and improve their results (Xing & Qi, 2023; Zhang, 2021; Zhiliang, 2021).

The use of mobile training plans in combination with tracking the fitness of athletes allows you to take into account the individual psychological characteristics of students and increase their motivation to achieve the best results (Chaloupský et al., 2021). However, despite the fact that innovative technologies improve learning, some students find it difficult to adapt to their use (Zhang et al., 2023). Thus, achieving the goals of developing both physical education and professionally significant personal qualities of athletes today is inextricably linked with the introduction of technological innovations, digitalization of the process of training athletes, and the use of mobile training in order to improve both the physical and communicative performance of athletes.

The scientific novelty of this study lies in the theoretical substantiation of the conceptual foundations of using mobile technologies to improve group interaction of athletes during training and monitoring their physical performance, which opens up broad prospects for the use of artificial intelligence technologies in the field of sports, taking into account the psychological component of the professional activities of athletes. **The practical significance of the research results** lies in the possibility of their use for the formation and development of communicative competence of athletes based on the use of mobile training plans.

Formulation of the problem
The significant potential of digitalization of education in relation to the development of communication competencies contributes to the search and development of new teaching methods based on mobile devices (Chen & Wang, 2023). Accordingly, the use of mobile learning technologies for training athletes and physical education is also steadily growing (Yang et al., 2020). The development of smartphones and other high-tech devices for solving the problems of physical culture and sports contributes to the spread of social physical culture. However, the limitations

of the main strategies for teaching mobile learning in physical education, a shift in emphasis towards predominantly dynamic physical education, dictate the need for further study of the possibility of using mobile technologies to solve current problems in the development of professionally significant psychological qualities of athletes (Yang et al., 2020). Therefore, **the purpose of the work is** to study the impact of using mobile training plans and measuring the physical abilities of athletes on their communicative competence and group interaction during mixed training.

Research objectives
1) to analyze the sources of scientific literature on the use of mobile and computer applications in the field of physical education; 2) to study the peculiarities of the influence of the use of mobile training plans and monitoring of physical indicators on the level of communicative competence and group interaction of athletes in the process of joint mixed physical culture lessons. **Research hypothesis:** the use of mobile training plans and monitoring of athletes' physical performance contributes to the development of their communicative competence and improves their group interaction.

Literature Review
The influence of digital technologies on the interaction of students for the joint solution of educational problems
Mobile augmented reality technologies make it possible to create realistic learning situations that contribute to greater student engagement, increasing their learning motivation and learning quality (Zhao et al., 2021). Researchers (Ansari & Khan, 2020; Cukurova et al., 2018) consider the level of students' competence in the field of joint problem solving a fundamental skill that largely determines the success of the educational process, to determine which it is proposed to use non-verbal indicators of students' motor activity. At the same time, instructional video and collaborative work affect students' cognitive load and learning behavior, increase their intrinsic motivation to learn, and improve academic performance (Liao et al., 2019). The intrinsic motivation of students is influenced by constructive pedagogy, collaboration and gamification (Kavanagh et al., 2017). Virtual reality technology in the educational process allows students to use virtual micro-worlds to directly interact with the subject area of study (Diplas & Pintelas, 2000).

Opportunities and challenges of using mobile technologies and the Internet of things in training athletes
The integration of digital technologies opens up many new opportunities for teaching and learning in the field of physical education (Yu et al., 2018). The transition of physical education into an uncontrolled and open environment was due to the development of the Internet of Things, which opened up endless opportunities for education. The creation of an IoT-driven physical activity recognition system provides real-time data collection and monitoring of a

person's state and physical activity. Such a system contributes to the motivation of students, encourages physical education and sports (Wang et al., 2021). Mobile technologies allow calculating the optimal indicators of physiological performance, training efficiency and predicting its results (Dexheimer et al., 2019), providing athletes with a competitive advantage (Luczak et al., 2020). However, there is an alternative point of view based on distrust of innovative technologies, which requires additional research on the adequacy of their application (Luczak et al., 2020). Therefore, in order for physical education teachers and trainers to be more effective in their work, it is important to pay attention to their self-reflection and the acquisition of key competencies in the field of mobile technologies (Casey et al., 2018; D'Elia et al., 2018).

Results and prospects for using mobile technologies to improve the psychological component of athletes' training

As physical education students shift to blended learning with active use of online technologies, the use of hybrid and digital learning improves the development of critical thinking, motivation, social interaction and overall academic achievement (Hinojo-Lucena et al., 2018; Liu et al., 2021). Developers are faced with the task of improving the design and usability of digital tools for physical culture and sports (Papastergiou & Mastrogiannis, 2021), which help to form an optimal training plan and monitor indicators of the state of brain functions, physiological and biochemical parameters, nutrition during training, which contributes to injury reduction by identifying individual risk factors (Fort-Vanmeerhaeghe et al., 2020; Ma et al., 2020).

Researchers (Ávalos et al., 2020; Kozina et al., 2017) argue that the use of mobile technologies has a positive effect on motivation and achievement of better training results, which helps to increase the self-esteem of athletes, develop their independence and critical thinking. The ability to determine the individual characteristics of the range of motion in the joints of athletes allows you to choose the most effective areas of training and the use of mobile technologies to achieve the best results, assess the psychophysiological capabilities and potential of the physical performance of athletes (Kozina et al., 2017; Kukic et al., 2018; Podrigalo et al., 2017; Romanchuk & Guzii, 2020).

Materials and methods

The concept of sampling

The biopsychosocial concept of a person, the unity of the physical and mental components of its personality formed the basis for the research methodology. The researchers sampled the respondents by simple randomization from undergraduate students of physical education, and non-team sports to pronounce the impact of collaborative learning and interaction. This aspect is especially important, since team sports teach to communicate effectively, because sportsmen achieve success together in such sports, and it depends on the coordination of actions of all team members. However, the development of cooperation skills in individual sports is often overlooked.

The procedure for forming a randomized sample

There were two randomized groups of respondents. Each of the groups included three subgroups of students from three different educational institutions. As a result, there were 42 students in the experimental group (16 represented swimming, 15 − gymnastics, 11 − wrestling), and 44 students in the control group (18 − swimming, 13 − gymnastics, 13 − wrestling). According to gender composition, the respondents' distribution was as follows: the swimming group consisted of only girls, there were 8 girls and 7 boys in gymnastics in the experimental group, and 7 girls and 6 boys in the control group; the wrestling group included only boys. The average age of respondents was 18.4 ± 0.2 years in the experimental group and 18.6 ± 0.3 years in the control group.

Description of the procedure for compiling mobile training plans in the experimental group

The experimental group used training plans shared by the members using mobile devices and providing their teachers with access (Figure 1). At the same time, physical indicators were constantly measured, students made videos of their training and discussed them with teachers and other respondents in their group, receiving comments, remarks, advice and support. The control group followed the traditional curriculum without the use of mobile technologies. With the help of psychophysiological methods, a set of indicators of physical condition, the data of participants were measured at the beginning of the experiment and at its end. The level of interaction was also assessed twice using valid psychodiagnostic methods. In addition, the dynamics of indicators of academic success was assessed.

Description of the process of monitoring the motor performance of athletes in the process of training using mobile technologies

To study the mobility of mental processes and their physiological mechanisms, carried out at the systemic, neuronal, synaptic and molecular levels, the methods of sports psychophysiology were used (Moskvin & Moskvina, 2015). Video analysis of motor actions was carried out using Simi Motion, a multifunctional platform that is fast and easy to analyze data and is used to capture and analyze movements. To achieve the goal and objectives of the study, we used the following features of this platform: We recorded the movements of athletes using synchronized cameras, tracking the centers of the joints, analyzing the biomechanical parameters of human movements (joint angles, speed, acceleration, etc.). For the operational control of the functional state of the athletes participating in our study, a computer stabiloanalyzer (stabilometer) with biofeedback Stabilan-01-04 was used.
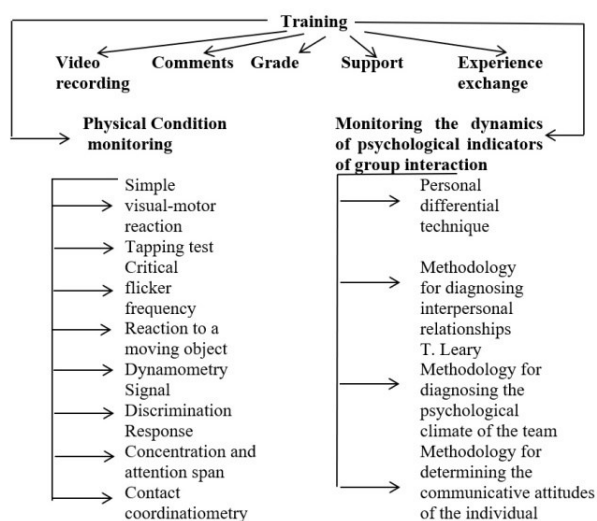
Figure 1. *Graphical model of the experimental course of sports training using mobile applications*

Description of technologies and methods of psychological testing of athletes during the experiment

In order to objectify the psychological and psychophysiological status of the respondents, assess their current state, physical performance, stress resistance and adaptation reserves, at the beginning of the experiment and at its completion, the NS-Psychotest hardware-software complex was used (Volga Region State Academy of Physical Culture, Sports and Tourism, 2022), with the help of which the cognitive functions of the study participants (thinking, memory, attention) were studied in dynamics and the functions of the motor, auditory, visual analyzers were evaluated.

The following psychophysiological tests were used (Figure 1): a simple visual-motor reaction - to assess the functional state of the central nervous system of its excitability, lability and reactivity; tapping test - to assess the lability of the nervous system and the speed capabilities of the motor analyzer; critical frequency of light flashes - determination of the level of psychoemotional stress as an indicator of psychophysiological maladaptation; reaction to a moving object - an assessment of the degree of balance of the processes of excitation and inhibition, the functional state and performance of the central nervous system, the speed and accuracy of the reaction; dynamometry - determination of the degree of muscle endurance and the presence of motor asymmetry; reaction of distinguishing signals similar in wave structure (red and orange) - determining the degree of balance of the processes of excitation and inhibition in the nervous system, as well as tolerance to stress; assessment of concentration and stability of attention by measuring the indicators of the bimanual response to a light stimulus, which also makes it possible to obtain information on the severity of interhemispheric asymmetry; contact coordinatiometry - determination of the ability to voluntary regulation of movements and assessment of the quality of their coordination, which also provides information on the level of autonomic excitability and reactivity of nervous processes.

To study the dynamics of group interaction in the process of joint training were used (Azps, 2023):

- Technique of personal differential (PD), aimed at studying the self-awareness of the individual and interpersonal relationships. Technique PD, based on the study of the internal factor structure of the "personality model". On a 5-point scale, the following were assessed: the level of self-esteem and self-acceptance of the individual, satisfaction with their behavior and level of achievement; development of the volitional sides of the personality, self-confidence and self-control; indicator of extraversion / introversion of personality.

- A method for diagnosing interpersonal relationships, created by T. Leary, G. Leforge, R. Sazek in 1954 and consisting of 128 value judgments that allow you to determine the characteristics of relationships in small groups by evaluating factors such as dominance-submission, friendliness-aggressiveness, emotionality-analyticity and ideas of the researched about his ideal, real and social "I".

- A method for diagnosing the psychological climate of a team - determining the nature of business cooperation in a team on a 7-point scale through the use of a map-scheme of L. N. Lutoshkin. - Methodology for determining the communicative attitudes of the individual - a questionnaire of 25 questions aimed at identifying the characteristics of attitudes towards people.

Table 1.
Chaddock scale

Values of the correlation coefficient r_{xy}	Strength of the correlation relationship
less than 0.1	There is no relationship
0.1-0.3	Tenuous
0.3-0.5	Moderate
0.5-0.7	Significant
0.7-0.9	High
0.9-0.99	Very high

Statistical processing

Statistical processing of the research results was carried out using the methods of parametric and non-parametric analysis. Accumulation, correction, systematization of initial information and visualization of the obtained results were carried out in Microsoft Office Excel 2016 spreadsheets. Statistical analysis was carried out using the IBM SPSS Statistics v.26 program (developer - IBM Corporation). When comparing mean values in normally distributed sets of quantitative data, Student's t-test was calculated, which was used to determine the statistical significance and reliability of the results. The significance of the Student's t-test was determined by comparing the results of the study with the null hypothesis of the absence of an effect in the form of improved group interaction when using mobile training plans and measuring the physical performance of athletes. The significance level that allowed us to reject the null hypothesis conditionally had a value of $p < 0.05$. Considering the relatively small sample size, a confidence interval was calculated for the interval estimation of statistical parameters and the confidence probability of the reliability of the study results was determined, equal to 95%. As an indicator of the closeness of the relationship between the

quantitative indicators x and y, which have a normal distribution, the Pearson correlation coefficient r_{xy} was used, the value of which was interpreted in accordance with the Chaddock scale (Table 1).

Limitations

The sample of the respondents was small, but it is representative for getting an idea of group dynamics during joint training using mobile plans, since the representatives of three different non-team sports participated in the study. We do not think that we would obtain significantly different results when choosing other non-team sports. Nevertheless, it is theoretically possible, which makes it promising to conduct further research in this direction. The researchers also did not compare non-team sports with team sports, since there were enough publications in the literature. Besides, team sports pay considerable attention traditionally to communicative competences, whereas this is not a priority in individual sports. Therefore, the difference is obvious, and they did not set the task of comparing the dynamics of group interaction in non-team and team sports. They also studied the dynamics of physical and psychological parameters of the representatives of the three non-team sports. However, they did not measure the differences between the indicators, comparing generalized averages within the framework of this article. In the future, they plan a more in-depth study of this issue for each sport separately, which will clarify many specific aspects.

Ethical issues

Ethical issues were resolved by observing the principles of informed consent, anonymity, confidentiality, tolerance and other norms of bioethics, as well as academic integrity in the research process.

There was no conflict of interest in the research process, as well as no additional funding allocated.

Results

Table 2 (baseline), Table 3 (indicators of the experimental group at the end of the experiment) and Table 4 (indicators of the control group at the end of the experiment) present the comparative results of the physical parameters of the experimental (A) and control (B) study groups in dynamics at the beginning and at the end of the experiment.

The primary visual-motor reaction reflects the functional state of the central nervous system, and the tapping test allows assessing its lability, the ability to move from excitement to inhibition. The indicator of the critical frequency of light flashes is important, since it characterizes the state of the cortical part of the visual analyser and the central nervous system. A complex hand-eye reaction to a moving object also reflects the balance of excitation and inhibition, and helps to assess the performance of the central nervous system. Dynamometry is an important method of studying muscle strength and endurance of athletes. The red and orange disjunctive reaction shows the degree of stress resistance of athletes, and the balance of excitation and inhibition. Attention indicators are the indicators of overexertion and fatigue. Excitability and reactivity of nervous processes allow evaluating the hand-eye coordination. Table 2 shows that, the parameters of all these physical indicators did not initially have significant differences in the main and control groups. They were not statistically significant ($p > 0.05$) in most cases. However, the physical parameters changed statistically significantly both in the experimental (Table 3) and in the control (Table 4) groups after the experiment.

Table 2.
Baseline of physical indicators of the respondent from the experimental (a) and control (b) study groups.

Psychophysiological indicators	Options	A	B	Student's t-test	p
Simple visual-motor response (average time, ms)		235.61±0.25	235.48±0.22	1.41	>0.05
Tapping test	Average frequency of impacts, Hz	6.86±0.62	6.83±0.81	0.21	>0.05
	Number of strokes (30 s)	360.21±0.24	359.60±0.25	4.24	<0.05
Critical fusion frequency of light flashes (Hz)		43.12±0.86	43.16±0.84	0.28	>0.05
Reaction to a moving object (average time, ms)		-46.82±0.02	-46.84±0.01	0.14	>0.05
Dynamometry	Right-hand dynamometry (kg)	56.42±0.71	56.43±0.72	0.07	>0.05
	Power index of the right hand, %	66.50±0.70	66.40±0.73	0.71	>0.05
Discrimination reaction (average time, ms)		312.65±0.72	312.48±0.74	1.20	>0.05
Attention score (average time, ms)		295.21±0.54	296.14±0.51	6.58	<0.05
Balance of function and quality (%)		94.25±0.58	94.26±0.56	0.07	>0.05
Sudden change in direction of travel (%)		10.07±0.14	10.02±0.12	0.35	>0.05

Table 3.
Group dynamics of physical indicators of reappointed experimental study group at the beginning (a) and at the end (a1) of the experiment

Psychophysiological indicators	Options	A	A1	Student's t-test	p
Simple visual-motor response		235.61±0.25	206.11±0.22	208.60	<0.05
Tapping test	Average frequency of impacts, Hz	6.86±0.62	7.32±0.68	3.25	<0.05
	Number of strokes (30 s)	360.21±0.24	410.32±0.18	354.22	<0.05
Critical fusion frequency of light flashes (Hz)		43.12±0.86	45.18±0.82	14.57	<0.05
Reaction to a moving object (average time, ms)		-46.82±0.02	-50.24±0.06	24.18	<0.05
Dynamometry	Right-hand dynamometry (kg)	56.42±0.71	60.52±0.68	28.90	<0.05
	Power index of the right hand, %	66.50±0.70	73.21±0.52	47.45	<0.05
Discrimination reaction (average time, ms)		312.65±0.72	260.34±0.87	369.89	<0.05

Attention score (average time, ms)		295.21±0.54	286.22±0.56	63.57	<0.05
Balance of function and quality (%)		94.25±0.58	97.20±0.53	20.86	<0.05
Sudden change in direction of travel (%)		10.07±0.14	7.18±0.12	20.44	<0.05

Table 4.
Group dynamics of physical indicators of reappointed control study group at the beginning (b) and at the end (b1) of the experiment.

Psychophysiological indicators	Options	B	B1	Student's t-test	p
Simple visual-motor response		235.48±0.22	218.16±0.26	122.47	<0.05
Tapping test	Average frequency of impacts, Hz	6.83±0.81	7.14±0.64	2.19	<0.05
	Number of strokes (30 s)	359.60±0.25	396.32±0.12	269.65	<0.05
Critical fusion frequency of light flashes		43.16±0.84	44.16±0.82	7.07	<0.05
Reaction to a moving object (average time, ms)		-46.84±0.01	-48.22±0.10	9.76	<0.05
Dynamometry	Right-hand dynamometry (kg)	56.43±0.72	58.84±0.58	17.04	<0.05
	Power index of the right hand, %	66.40±0.73	70.32±0.76	27.72	<0.05
Discrimination reaction (average time, ms)		312.48±0.74	282.35±0.87	213.05	<0.05
Attention score (average time, ms)		296.14±0.51	289.12±0.56	49.64	<0.05
Balance of function and quality (%)		94.26±0.56	95.30±0.52	7.35	<0.05
Sudden change in direction of travel (%)		10.02±0.12	8.11±0.18	13.51	<0.05

From the tables presented, they can concluded that systematic training contributes to the improvement of all physical indicators of the athletes. However, the difference between the indicators is statistically more significant in Table 3 than in Table 4, which indicates a greater effectiveness of mobile joint training plans compared to traditional sports. Table 5 shows the significance of the changes in physical parameters in the experimental group (A1) compared to the control group (B1).

Table 5
Group dynamics of physical indicators of the reappointed experimental (A1) and control (B1) study groups.

Psychophysiological indicators	Options	A1	B1	Student's t-test	p
Simple visual-motor response		206.11±0.22	218.16±0.26	85.1	<0.05
Tapping test	Average frequency of impacts, Hz	7.32±0.68	7.14±0.64	1.27	>0.05
	Number of strokes (30 s)	410.32±0.18	396.32±0.12	98.99	<0.05
Critical fusion frequency of light flashes		45.18±0.82	44.16±0.82	7.21	<0.05
Reaction to a moving object (average time, ms)		-50.24±0.06	-48.22±0.10	14.28	<0.05
Dynamometry	Right-hand dynamometry (kg)	60.52±0.68	58.84±0.58	11.88	<0.05
	Power index of the right hand, %	73.21±0.52	70.32±0.76	20.44	<0.05
Discrimination reaction (average time, ms)		260.34±0.87	282.54±0.87	156.98	<0.05
Attention score (average time, ms)		286.22±0.56	289.21±0.56	21.14	<0.05
Balance of function and quality (%)		97.20±0.53	95.30±0.52	13.44	<0.05
Sudden change in direction of travel (%)		7.18±0.12	8.11±0.18	6.58	<0.05

This table shows the statistical processing of the results using Student's t-test, and it can be seen that the parameters of all measured physical indicators have statistically significant differences ($p<0.05$).

To predict sports achievements, it is not enough to consider the physical component, since the psychological component, the personal characteristics of the athlete are of great importance. However, if team sports form the "team spirit", then the communicative competence of an athlete, as a rule, is not of significant importance in non-team competitions. At the same time, a comparison of the achievements of the studied athletes indicates that group interaction contributes to achieving better results in the process of joint training compared to traditional classes. To objectify this fact and determine which communicative qualities of the athletes' personality of non-team sports can affect the success of achievements, the researchers used valid psychodiagnostic techniques. Table 6 presents the results of studying the dynamics of group interaction of the experimental group during joint training using the Personal Differential (LD) Technique.

Table 6
Comparison of indicators of group interaction of the respondents of the experimental group at the beginning (a) and at the end (a1) of the experiment.

Factor	Level	A n	A %	A1 n	A1 %	Student's t-test	p
Grade	High	6	14.3	16	38.1	8.591	<0.05
	Average	12	28.6	19	45.2		
	Low	24	57.1	7	16.7		
Force	High	8	19.1	11	26.2	3.814	<0.05
	Average	20	47.6	25	59.5		
	Low	14	33.3	6	14.3		
Activity	High	11	26.2	12	28.6	3.344	<0.05
	Average	18	42.8	27	64.3		
	Low	13	31.0	5	11.9		
Total		42	100	42	100		

Thus, 57.1% of the studied athletes of the experimental group initially had low indicators on this scale. In addition, 33.3% of the respondents in this group had low indicators of strength during the initial study, and 31.0% had low indicators of activity. After joint trainings using mobile plans, the indicators improved statistically significantly ($p<0.05$) on all the three scales of this technique, with a clear normalization trend. Table 7 presents the dynamics results of interpersonal relationships in the experimental group in the process of group interaction during training using a mobile application.

Table 7.
Indicators of interpersonal relationships in the experimental group at the beginning (a) and at the end (a2) of the experiment.

Scale	Type of attitude to others	Level (points)	A		A1		Student's t-test	p
			n	%	n	%		
I	Authoritarian	Dictatorial (13-16)	6	14.3	2	4.8	5.023	<0.05
		Dominant (9-12)	21	50.0	13	31.0		
		Confident (0-8)	15	35.7	27	64.2		
II	Egocentric	Smug Independent (13-16)	16	38.1	8	19.0	2.021	<0.05
		Competitive tendency (0-12)	26	61.9	34	81.0		
III	Aggressive	Hostile (13-16)	6	14.3	1	2.3	4.528	<0.05
		Demanding (9-12)	17	40.5	13	31.0		
		Stubborn (0-8)	19	45.2	28	66.7		
IV	Suspicious	Alienated (13-16)	10	23.8	3	7.1	5.820	<0.05
		Unsociable (9-12)	14	33.3	8	19.0		
		Critical (0-8)	18	42.9	31	73.8		
V	Subordinate	Submissive (13-16)	4	9.5	1	2.3	3.527	<0.05
		Shy (9-12)	11	26.2	7	16.7		
		Modest (0-8)	27	64.3	34	81.0		
VI	Dependent	Underconfident (13-16)	9	21.4	2	4.8	5.869	<0.05
		Obedient (9-12)	13	30.9	6	14.3		
		Conformal (0-8)	20	47.6	34	81.0		
VIII	Friendly	Friendly (9-16)	17	40.5	9	21.4	3.106	<0.05
		Compromise (0-8)	25	59.5	33	78.6		
VIII	Altruistic	Hyper-responsible (9-16)	18	42.9	9	21.4	3.344	<0.05
		Responsive (0-8)	22	52.4	31	73.8		
	Total		42	100	42	100		

Here, the maximum score is 16 for each of the scales, divided into four levels: 0-4 points for low, 5-8 points for moderate, 9-12 for high, 13-16 points for extreme. At the same time, indicators from 0 to 8 points characterize adaptive behaviour, and 9-16 points – extreme, up to pathological. As can be seen from this table, a significant number of the respondents had initially inflated indicators, primarily on the scales of selfishness (38.1%), aggression (14.3%), friendliness (40.5%) and altruism (42.9%). In this regard,

the high indicators on the scales of altruism and friendliness have a negative connotation in this technique, since an excessively demonstrative manifestation of these qualities can hide inherently opposite inner experiences. The repeated study showed a statistically significant normalization of the indicators on all scales of the methodology.

The following Table 8 shows the study results of the experimental group in dynamics using the Diagnostic Methods of Psychological Team Spirit by Lutoshkin.

Table 8.
Indicators of the psychological climate of the experimental group of the respondents at the beginning (A) and at the end (A1) of the experiment.

Scale	Indicators	A		A1		Student's t-test	p
		n	%	n	%		
Mood	Cheerful	24	57.1	37	88.1	4.287	<0.05
	Pessimistic	18	42.9	5	11.9		
Relationships	Sympathy	20	47.6	34	81.0	4.528	<0.05
	Conflict	22	52.4	8	19.0		
Relationships between groups within a team	Mutual understanding	26	61.9	35	83.3	3.344	<0.05
	Conflict	16	38.1	7	16.7		
Attitude to the successes or failures of the team members	Empathy	8	19.0	25	59.5	5.289	<0.05
	Indifference, envy, epicaricacy	34	81.0	17	40.5		
Attitude to the opinion of comrades	Respectful	19	45.2	32	76.2	4.287	<0.05
	Indifferent or intolerant	23	54.8	10	23.8		
Prevailing attitude	Approval, support	11	26.2	34	81.0	7.045	<0.05
	Criticism, reproaches	31	73.8	8	19.0		
Behavioural model in difficult situations	Unity, mutual assistance	15	35.7	30	71.4	4.773	<0.05
	Recriminations	27	64.3	12	28.6		
Attitude to newcomers	Help	10	23.8	26	61.9	5.023	<0.05
	Hostility	32	76.2	16	38.1		
Collective energy	Activity	24	57.1	38	90.5	4.287	<0.05
	Passivity	18	42.9	4	9.5		
Attitude to joint activities	Positive	17	40.5	32	76.2	4.773	<0.05
	Negative	25	59.5	10	23.8		
Attitude to the team success	Pride	22	52.4	38	90.5	5.023	<0.05
	Indifference	20	47.6	4	9.5		
	Total	42	100	42	100		

The indicators according to this method correlate with the indicators according to the method of Leary (correlation coefficient 0.978). The respondents expressed sympathy and support (81.0%), showed mutual understanding (83.3%) and respect (76.2%). A positive attitude (76.2%) replaced

a negative one towards joint activities, pride for the jointly achieved successes (90.5%) appeared upon repeated research while argumentative relationships initially prevailed (from 38.1% to 52.4%) with mutual reproaches (64.3%-73.8%) and a negative attitude towards joint activities

(59.5%).

Table 9 shows the negative communicative attitude and the analysis of its dynamic parameters in the experimental group.

Table 9.
Normalization of the respondents' communicative attitude in the experimental group (A is for the beginning of the experiment, A1 is for the end of the experiment).

Negative communicative attitude parameters	Total score (%)		Student's t-test	p
	A	A1		
Veiled cruelty	42.9±0.2	30.6±0.1		
Unveiled cruelty	32.7±0.4	24.2±0.5		
Justified negativism	28.4±0.6	26.1±0.8	3.992	<0.05
Grumbling	16.8±0.2	10.2±0.5		
Negative communication experience	22.6±0.3	18.1±0.4		

It follows from the table that veiled cruelty initially prevailed as a communicative attitude in the experimental group under study. Upon repeated examination, the indicators of negative communicative attitudes did not exceed the standard parameters.

Discussion

Initially, the experimental and control groups of the respondents were comparable in their physical development, there were no statistically significant differences between their indicators in the vast majority of cases. After training, there was a statistically significant increase in physical development indicators in both the groups, but the results of the experimental group were significantly higher than the results of the control group. Based on this fact, the authors can argue that classes are more effective when they aim at comprehensive improvement both of physical (Dexheimer et al., 2019) and psychological qualities of the athletes than traditional physical training. This corresponds to the data of scientific literature (Ávalos et al., 2020; Liao et al., 2019). However, they should note that this study focused on the development of communicative competence, social openness of personality and interpersonal professional interaction of the athletes, which is innovative for non-team sports. Scientists generally assume that joint efforts ensures and effective communication of team members predetermines success in team sports (Kozina et al., 2017; Liao et al., 2019) by contrast with non-team sports where athletes should be focused on themselves, since all other athletes are their potential competitors, therefore cooperation with them is not possible.

However, this research shows that, group interaction has a stimulating effect when teaching the students of non-team sports, while not only increasing the motivation of the students to achieve better results, but also contributing to the joint achievement of goals. Communicating during training, athletes develop clearer criteria for evaluating their achievements and find the best ways to eliminate shortcomings (Cukurova et al., 2018).

Data from scientific literature sources indicate that the success of athletes depends on four main aspects: physical, technical, tactical and psychological. At the same time, the

psychological state of athletes during training and competition is fundamental to achieving better results (Akbar et al., 2024; Ridwan et al., 2023). The significant deviations of the communicative personality traits of the athletes of the experimental group from the standard parameters indicate some psychological deformation associated with incorrect attitudes and stereotypes. However, it is likely that there is also a preliminary feedback here, when the choice of a non-team sport was due to the personal communicative characteristics of the athlete, and communication difficulties. The results of this research refutes the assumption that joint training can reduce the "competitive spirit" of athletes. On the contrary, group interaction during training using a mobile application contributes to achieving better results than ordinary individual training.

Initially, low results on the "Evaluation" scale of the personal differential methodology reflect dissatisfaction with oneself, lack of self-esteem and self-rejection. Wishing to achieve high results as quickly as possible, physical education students who train individually do not have examples to compare, records begin to seem unattainable and there is despondency, discontent, and disappointment. When students train in a group using a mobile application, they receive an objective assessment of their results, can analyse the causes of the backlog and find the most optimal ways to correct mistakes. Accordingly, the researchers observed a statistically significant improvement in this indicator in dynamics, after a training session using a mobile application.

The "Strength" factor shows the degree of self-confidence. Initially, its low value in a third of the respondents indicates a lack of independence, dependence on external circumstances, and increased anxiety. Perhaps this factor indirectly reflects the coach's unsuccessful tactics with the student, the lack of psychological support and excessive authoritarianism (D'Elia et al., 2018). During joint trainings using a mobile application, students form a more balanced relationship of dominance-submission and friendliness-aggressiveness, independence and self-confidence.

If it is about activity, then we got the lowest value of indicators on this scale. The fact is that the "Activity" factor indicates not only emotional reactions in the process of communication, but also reflects the extroverted personality. However, athletes often choose non-team sports because they are initially introverts, according to their personality type. Accordingly, communicative competence results in the increase of the indicators on this scale, and not in a change in such a basic personality trait as introversion. In general, the increase in the indicators on all the three scales of the PD methodology reflects the transformation of the respondents' subjective emotional and semantic ideas about themselves and their relationships with other people in the experiment. This technique contributes to the formation of a group, the improvement of group interaction, the development of independence and critical thinking of physical education students. The methodology of Leary also helps to evaluate the opposite orientations of interpersonal communication: dominance-submission and friendliness-hostility,

reveals adaptability or extremity of interpersonal behaviour. In this study, there is a normalizing effect of group interaction during training when using a mobile application on the types of attitudes towards others, improving the psychological compatibility of the respondents in the experimental group. Comparing achievements between the group members corrects the initial manifestations of authoritarianism and selfishness in the studied respondents of the experimental group during joint training (Cukurova et al., 2018). At the same time, there is a tendency to replace negative traits (authoritarianism) with desirable ones (perseverance in achieving the goal). Excessive external friendliness correlates with a desire for social approval, and turns into a tendency to cooperate in the process of group dynamics. Obsessive hyper-responsiveness often correlates with insecurity and shyness, acting as a compensatory mechanism in such cases. In the process of group interaction, this trait tends to normalization, which manifests in selflessness and generosity, compassion and sympathy towards other people, especially the members of the group.

The authors studied the dynamics of the psychological climate of the group to assess the relationships between the members of the study group that have developed in the process of group interaction. The psychological climate did not initially correspond to the favourable parameters, and an indifferent attitude prevailed in the relationship, as well as rejection and conflict behaviour. However, the students gradually found "common ground", common problems arose, and they found joint solutions in the process of group interaction during joint training using a mobile application. This contributed to the cohesion of the group and the development of students' communicative competence. It is significant in this regard to determine the signs of a negative attitude, which showed the presence of veiled cruelty towards people, alertness and negative expectations, malevolence and unwillingness to help at the beginning of the study. In the process of group dynamics, there was a correction of communicative attitudes, levelling of negative manifestations and normalization of the methodology indicators. The negative energy of a negative communicative attitude contributes to a constant state of tension and, as a result, a decrease in human stress tolerance, which can affect sports results (Popovych et al., 2022). Normalization of the communicative attitude in the process of group dynamics confirms the effectiveness of joint training using mobile plans for non-team sports.

Conclusions

The results of the study allow us to state that in order to predict sports achievements, it is not enough to take into account the physical component, since the psychological component, the personal characteristics of the athlete, are of great importance. It is shown that classes aimed at the comprehensive improvement of not only the physical, but also the psychological qualities of athletes are more effective than traditional physical training.

The hypothesis has been proven that the use of mobile training plans and the measurement of physical indicators of athletes improves communication and group interaction in the process of joint training and contributes to the achievement of better results compared to traditional classes without the use of mobile applications.

In the process of teaching students of non-team sports, group interaction has a stimulating effect, while not only increasing students' motivation to achieve better results, but also contributing to the joint achievement of goals. By communicating in the process of training, athletes develop clearer criteria for evaluating their achievements and find the best ways to eliminate shortcomings.

Initially, significant deviations of the communicative properties of the personality of the athletes of the experimental group from the parameters of the norm were revealed (conflict style of relationship was observed in 38.1% -52.4% of cases), which indicates the presence of psychological deformation associated with incorrect attitudes and stereotypes. It can be assumed that the choice of a non-team sport was initially due to the personal communicative characteristics of the athlete, the presence of communication difficulties. The results obtained allow us to state that group interaction during training using a mobile application contributes to achieving better results than ordinary individual training (decrease in cases of conflict up to 16.8% -19.0%).

With joint training using a mobile application, students form a more balanced relationship of dominance-submission and friendliness-aggressiveness, independence and self-confidence.

Normalization of interpersonal communication indicators in the conducted experiment reflects the transformation of the respondents' subjective emotional and semantic ideas about themselves and about their relationships with other people due to the formation of a group, improvement of group interaction, development of independence and critical thinking of students of physical culture.

The negative energy of a negative communicative attitude contributes to a constant state of tension and, as a result, a decrease in a person's stress resistance, which can affect sports results. The normalization of the communicative attitude in the process of group dynamics confirms the effectiveness of joint training using mobile plans for non-team sports.

Thus, the concept of using mobile training plans for athletes should take into account the importance of improving communication and group interaction as the basis for increasing the effectiveness of sports training using the capabilities of artificial intelligence, which can be considered as a promising direction for our further research.

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