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Альберт ЛИСЕНКО[1], Олена ГОРБЕНКО[2], Вероніка МИШКО[3], Кирило ШКУРЄЄВ[4]
[1, 2] *Харківська державна академія фізичної культури, Україна*
[3] *КЗ ВО «Академія культури і мистецтв» Закарпатської обласної ради, Україна*
[4] *Харківська державна академія культури, Україна*
[1] *https://orcid.org/0000-0001-7235-9985, speksalbert@gmail.com*
[2] *https://orcid.org/0000-0002-5194-6141, horbenkoelen@gmail.com*
[3] *https://orcid.org/0000-0003-3855-8061, nikamyshko@gmail.com*
[4] *https://orcid.org/0000-0001-6574-7955, Shkuryeyev-ki@hotmail.com*

ПЕДАГОГІЧНІ ПІДХОДИ ДО РОЗВИТКУ РУХОВИХ ЯКОСТЕЙ СПОРТСМЕНІВ СПОРТИВНИХ ТАНЦІВ НА ЕТАПІ СПЕЦІАЛІЗОВАНОЇ БАЗОВОЇ ПІДГОТОВКИ

Анотація. *У статті висвітлено проблему удосконалення фізичної підготовки спортсменів спортивних танців на етапі спеціалізованої базової підготовки. Аналіз сучасних наукових джерел, спеціальної літератури та практичного досвіду показав, що традиційна методика навчання змагальних програм, яка ґрунтується на багаторазовому повторенні техніко-тактичних дій, не завжди забезпечує цілеспрямований розвиток провідних рухових якостей. Встановлено, що діяльність змагальних пар потребує високого рівня розвитку швидкісно-силових якостей, статичної витривалості, координаційних здібностей, а також уваги, пам'яті та емоційної стійкості. Метою дослідження було розроблення та апробація комплексної програми фізичної підготовки юних спортсменів спортивних танців віком 10–11 років. Методологія включала аналіз науково-методичних джерел, документальних матеріалів, педагогічне спостереження та тестування. У педагогічному експерименті взяли участь 40 дітей, розподілених на контрольну та експериментальну групи. Контрольна група займалася за традиційною методикою, тоді як експериментальна – за комплексною програмою фізичної підготовки. Результати експерименту засвідчили статистично достовірне ($p<0,05$) покращення показників сили, витривалості, гнучкості, швидкісно-силових якостей та координаційних здібностей у спортсменів експериментальної групи порівняно з контрольною. Додатково зафіксовано позитивні зміни у функціональних показниках дихальної системи (життєва ємність легень, життєвий індекс) та результатах проби Руф'є. Запропонована програма сприяє підвищенню рівня фізичної готовності юних спортсменів, оптимізації тренувального процесу та зниженню ризику травматизму. Практична значущість дослідження полягає у можливості використання розроблених організаційно-методичних рекомендацій у навчально-тренувальній діяльності, підготовці тренерів та викладанні профільних дисциплін. Перспективи подальших досліджень пов'язані з інтеграцією фізичної та психологічної підготовки, застосуванням цифрових технологій і штучного інтелекту, а також розробкою диференційованих програм, орієнтованих на індивідуальні задатки спортсменів.*

Ключові слова: *спортивні танці; фізична підготовка; спеціалізована базова підготовка; рухові якості; координаційні здібності; оптимізація тренувального процесу.*

Albert LYSENKO[1], Olena HORBENKO[2], Veronika MYSHKO[3], Kyrylo SHKURYEYEV[4]
[1, 2] *Kharkiv State Academy of Physical Culture, Ukraine*
[3] *MIHE «Academy of Culture and Arts» of the Zakarpattia Regional Council, Ukraine*
[4] *Kharkiv State Academy of Culture, Ukraine*
[1] *https://orcid.org/0000-0001-7235-9985, speksalbert@gmail.com*
[2] *https://orcid.org/0000-0002-5194-6141, horbenkoelen@gmail.com*
[3] *https://orcid.org/0000-0003-3855-8061, nikamyshko@gmail.com*
[4] *https://orcid.org/0000-0001-6574-7955, Shkuryeyev-ki@hotmail.com*

PEDAGOGICAL APPROACHES TO ENHANCING MOTOR QUALITIES FOR DANCESPORT ATHLETES AT THE STAGE OF SPECIALIZED BASIC TRAINING

Abstract. *This article examines the problem of improving the physical preparation of DanceSport athletes during specialized basic training. An analysis of contemporary scientific sources, specialized literature, and practical experience has shown that the traditional methodology of teaching competitive programs, which relies mainly on repeated execution of technical-tactical actions, does not always ensure the targeted development of leading motor qualities. It was established that the activity of competitive pairs requires a high level of speed-strength abilities, static endurance, coordination skills, as well as attention, memory, and emotional stability. The purpose of the study was to develop and test a comprehensive physical preparation program for young DanceSport athletes aged 10-11. The methodology included the analysis of scientific and methodological sources, documentary materials, pedagogical observation, and testing. A pedagogical experiment was conducted with 40 children divided into control and experimental groups. The control group was trained according to traditional methods, while the experimental group followed the comprehensive physical training program. The results of the experiment demonstrated statistically*

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significant improvements ($p<0.05$) in strength, endurance, flexibility, speed-strength, and coordination in the athletes of the experimental group compared to the control group. Additionally, positive changes were recorded in functional indicators of the respiratory system (vital lung capacity, vital index) and in the Ruffier test results. The proposed program contributes to raising the level of physical readiness of young athletes, optimizing the training process, and reducing the risk of injury. The practical significance of the study lies in the possibility of applying the developed organizational and methodological recommendations in training activities, coach education, and the teaching of specialized disciplines. Prospects for further research include integrating physical and psychological preparation, leveraging digital technologies and artificial intelligence, and developing differentiated programs tailored to athletes' individual predispositions.

Keywords: *DanceSport; physical preparation; specialized basic training; motor qualities; coordination abilities; training optimization; injury prevention.*

Problem Statement. The contemporary development of sport, its growing popularity and globalization, as well as the rapid emergence of new disciplines, necessitate the search for innovative approaches to improving athletes' training and competitive performance. As an integral aspect of modern sports science, the training process requires systematic renewal through the construction and programming of preparation that accounts for the specific features of each sport [1; 5; 13].

An analysis of current theory and methodology of training reveals a clear trend toward differentiation and individualization of training and competitive activity. V. M. Platonov [13; 14] emphasizes the formation of training systems for qualified athletes that correspond to the specific requirements of the chosen discipline. This approach presupposes an increase in the proportion of auxiliary and, particularly, specialized preparation, optimization of competitive activity through the improvement of its components at the stages of preparation for high achievements, and the maximum realization of individual potential. It also requires the creation of a proper functional foundation at the early stages of long-term training [2; 5; 15].

The specificity of DanceSport lies in the fact that basic competitive and training loads directly affect athletes' physical condition and demand the mobilization of significant physical resources. The activity of competitive pairs requires a high level of speed-strength qualities, static endurance, coordination abilities, as well as attention, memory, and emotional stability – factors that determine the reliability of performance in both European and Latin American programs. An additional challenge is the limited availability of real-time competitive information, which increases the dependence on skillful distribution of physical resources to reach the finals and maintain performance quality in decisive rounds.

At the stage of specialized basic training, DanceSport encompasses age categories "Juveniles 2," "Juniors 1," and "Juniors 2" (10-15 years) – a critical phase in completing functional system development, which ensures high special working capacity during intensive dance programs. As an integral link in long-term preparation, this stage is decisive for determining sports orientation, based on innate predispositions and genetic factors [13; 21], followed by the choice of specialization (Latin or Standard) and gradual immersion into the specifics of the chosen program.

A review of the literature confirms the urgent need to develop scientific foundations for organizing the training process in DanceSport, with a critical rethinking of the means, forms, and methods of physical preparation [21]. Despite the contributions of O. V. Putytseva, O. M. Kaluzhna, M. O. Terenova, H. A. Chykalova, T. P. Osadtsiv, and O. M. Demidova, the task of rational development of motor qualities in athletes aged 10-11 at the stage of specialized basic training remains insufficiently studied [4; 11; 12; 21].

Traditional methods of teaching competitive programs, which rely on repeated execution of technical-tactical actions, do not always ensure the targeted development of leading motor qualities. The content of special physical preparation and the optimization of training loads, taking into account age-related, physical, and functional characteristics, remain debatable. Therefore, there arises a need for pedagogical reconsideration: redistribution of general and specialized preparation, regulation of training intensity, and monitoring of functional state – issues that require further study and methodological reflection.

Analysis of Recent Research and Publications. DanceSport represents a unique synthesis of art and sport, combining aesthetic expressiveness with high physical demands. Due to its multidimensional nature, it positively influences the musculoskeletal system of children and adolescents, contributes to the formation of correct posture, develops coordination and flexibility, and stimulates emotional sensitivity and creative abilities. At the same time, DanceSport fulfills an important pedagogical function: it ensures a harmonious combination of physical, moral, aesthetic, and labor education, fostering unity of consciousness and behavior [29].

In recent years, the issue of improving training methods in complex coordination sports has gained increasing relevance. These disciplines – including gymnastics, figure skating, acrobatics, and DanceSport – are characterized by high demands on physical, technical, tactical, and psychological qualities, requiring specific pedagogical approaches to the organization of the training process [17; 19].

Long-term sports training, as a process of learning and competitive activity, presupposes the consistent implementation of tasks, means, and methods at each stage of improvement. Pedagogical methods must ensure synergy between training and competitive loads, since young athletes need to acquire motor skills and abilities in sufficient volume to overcome significant competitive challenges in the future [1].

A significant contribution to the development of training methodology in complex coordination sports was made by D. Smyrnov and O. Kolesnyk, who emphasized the importance of individualizing programs based on the specifics of the discipline and the physiological characteristics of athletes [16]. Preparation in DanceSport requires a comprehensive approach that integrates the development of technical skills, physical endurance, psychological resilience, and tactical mastery. In disciplines with high coordination demands, priority is given to technical development and the expansion of exercise complexes aimed at improving flexibility, balance, strength, and endurance [1].

Many researchers conclude that modern approaches to training athletes in complex coordination sports are impossible without the integrated application of diverse methods and techniques that combine physical, technical, tactical, and psychological components [3]. A scientific review of publications demonstrates that current training strategies are directed toward the development of technical skills, physical conditioning, team interaction, and creative psychological resilience [4].

Specialized literature [5; 13] presents various models of planning physical training within the system of long-term athlete development. For example, British experts recommend focusing on the development of motor qualities according to "sensitive periods" of growth, while other authors emphasize strength development in the post-pubertal stage and endurance training during puberty [2; 14; 17].

V. M. Platonov [13] considers long-term training as a system of seven stages, each with its own goals, tasks, and age boundaries. For DanceSport, the stage of specialized basic training (10-11 years) is of particular importance, as it determines future specialization (European program, Latin American program, or "10 dances") [21]. At this stage, the annual training volume reaches 600-800 hours, with general physical preparation accounting for approximately 20%, auxiliary preparation 30%, and specialized preparation 50%.

Leading experts devote considerable attention to the search for new training methodologies in DanceSport. The works of O. Demidova, O. Kaluzhna, T. Osadtsiv, and T. Trakaliuk address issues of improving physical preparation; studies by T. Hrytsyshyn, T. Dzhala, and foreign authors (Alex Moore, Guy Howard, Walter Laird, Mark Sietas, Natalie Ambrose, Serge Koshel) focus on technical preparation. Textbooks by O. Horbenko, A. Lysenko, and T. Osadtsiv describe the technical execution of basic figures and elements of the Latin American program [29].

A review of the literature shows that most studies concentrate on initial training [10; 11; 19; 21; 27], while the training process of athletes aged 10-11 at the stage of specialized basic preparation remains insufficiently covered. The main focus is placed on the development of special endurance, but adherence to the principle of full recovery after intensive training is equally important [21].

The modern fitness industry offers innovative technologies, such as Pilates, which promotes the development of strength, flexibility, and coordination, while reducing stress and improving body control [21; 23; 41]. Research by M. O. Terenova, H. A. Chykalova, and S. B. Kolesnikov [20] confirms the positive impact of Pilates on the physical readiness of DanceSport athletes.

Strength training is becoming increasingly important as an integral component of complex sports training regimes, school-based physical education, and extracurricular fitness programs. The growing number of young people engaged in sports, combined with health problems associated with sedentary lifestyles and overweight, has led to heightened interest in strength-oriented exercise. The continuous decline in muscular fitness indicators among contemporary youth underscores the necessity of incorporating strength training not only for athletes but also for non-athletes (Stricker et al., 2020) [38].

Another important direction of improvement is the integration of classical exercise (according to A. Ya. Vaganova's methodology) into the training process, which contributes to the development of flexibility, coordination, and strength capabilities [21].

A highly relevant area of improvement in physical preparation is the development of leading motor qualities through differentiated programs specifically designed for DanceSport athletes [21]. Historically, methods of developing motor qualities in DanceSport were oriented toward maximizing training effect, often ignoring the risks of injury. Traditional approaches contain hidden threats of overloading the musculoskeletal system, particularly in the development of flexibility and speed-strength qualities [21].

Contemporary international research significantly expands the understanding of preparation for competitive ballroom dancing. The works of Tao Wu and Peng Fu (2021) [43], Ganna Dorosh et al. (2021) [24], as well as Margaret Wilson and Young-Hoo Kwon (2008) [42], confirm the pivotal role of biomechanical factors in the technical mastery of standard dancers, emphasizing the importance of rise and fall, weight transfer, and sensorimotor integration for the effective execution of movements. Within pediatric sports science, studies by Carolina Pinho et al. (2024) [25], Paul R. Stricke et al. (2020) [38], and Ashwani Saini et al. (2025) [35] demonstrate that the age of 10-11 years is critical for the development of strength and coordination, which serve as the foundation for subsequent athletic specialization. The integration of national and international findings in the field of ballroom dancing strengthens the argument for the inseparable connection between physical preparation and technical development, while providing a broader international perspective on the methodology of training young dancers.

Purpose, Objectives, and Methodology of the Study. The study was conducted at the School of Competitive Ballroom Dance *"Stolytsia"* (Kharkiv). For the pedagogical experiment, two groups were formed: the experimental group (10 boys and 10 girls) and the control group (10 boys and 10 girls), all aged 8-11 years, with 2-3 years of training experience in ballroom dancing and classified at levels "E," "D," and "C." Training sessions were held under standard dance hall conditions, three times per week, from October 2024 to December 2025. A comparison of physical fitness indicators at the beginning and after the experiment allowed for the evaluation of the effectiveness of the proposed program. The research was carried out in three stages: preparatory-analytical, experimental, and systematizing.

The purpose of this study is to develop and test a comprehensive program for improving the physical training of DanceSport athletes at the stage of specialized basic preparation. This aim is driven by the need for pedagogical reconsideration of traditional approaches to the training process, as well as the necessity of integrating modern methods and technologies into the system of long-term athlete development.

To achieve this purpose, several research objectives were formulated:

1. Based on the analysis of scientific and specialized literature, online resources, and practical experience in performance, coaching, and teaching, identify current problems of physical training in DanceSport at the present stage of discipline development.

2. To determine the specific features of physical training of DanceSport athletes aged 10-11 at the stage of specialized basic preparation, taking into account age-related and functional characteristics.

3. To test the effectiveness of a comprehensive program for improving physical training in DanceSport athletes by integrating pedagogical, methodological, and experimental approaches.

The methodology of the study was constructed in accordance with modern requirements of sports-pedagogical science and included a set of complementary methods:

• *Analysis of scientific and methodological sources.* Monographs, dissertations, scientific articles, and collections of research papers were used to generalize current methodological and practical approaches to organizing the training process in DanceSport.

• *Analysis of documentary materials.* A review of methodological recommendations, video recordings of training sessions, and competitive performances made it possible to establish the specifics of implementing physical training programs. In particular, lists of permissible figures for classes "E," "D," and "C," as defined by the rules of the All-Ukrainian DanceSport Federation, were analyzed. Video materials from the World and Ukrainian Championships (2022-2024) in the Latin American program for the age categories "Juveniles 2," "Juniors 1," and "Juniors 2" were examined to identify trends in changes in choreography and workload.

• *Pedagogical observation.* Systematic monitoring of the training process in natural conditions ensured the reliability of data regarding the use of training means and methods. Observations were conducted in dance clubs in Zaporizhzhia, Kharkiv, Dnipro, and Kyiv, allowing consideration of regional specifics in organizing the training process.

• *Pedagogical testing.* Applied to determine the level of physical fitness of DanceSport athletes using well-known motor tests and specialized control exercises [21]. Testing was conducted twice – before the experiment and after its completion – under standardized conditions following dance warm-ups.

The following tests were used to assess motor qualities, as listed in Table 1.

In practice, the indirect assessment of physical performance capacity is often carried out using the Ruffier functional test. Among the simplest hypoxic tests are the Stange and Genchi tests, which allow for the evaluation of the body's adaptation to hypoxia and hypoxemia, thereby providing insight into an athlete's ability to withstand oxygen deficiency. Individuals with higher scores on these tests demonstrate greater tolerance to physical exertion. Spirometry was employed to determine lung vital capacity (LVC) using a dry spirometer, measured by maximal exhalation following maximal inhalation.

Table 1.

Tests for assessing the motor qualities of DanceSport athletes

№	Test name	Description
1	Squats	Performed at maximum pace. The number of squats in 20 seconds was recorded.
2	Jumps	Performed from a squat upward with arching. The number of jumps in 20 seconds was recorded.
3	Push-ups	The number of repetitions in 10 seconds was recorded.
4	Sit-ups	Performed at maximum pace. The number of sit-ups in 10 seconds was recorded.
5	Leg raises	The number of repetitions in 10 seconds was recorded.
6	Romberg test	Balance maintained standing on one leg with eyes closed. Time until loss of balance recorded.
7	Yarotsky test	Rotational head movements with eyes closed. Time until loss of balance recorded.

The method of expert evaluation was applied to assess the performance of Latin American dance combinations by young athletes. The panel of experts consisted of five ballroom dance coaches holding first and highest judging categories, with extensive professional experience in the discipline.

The experimental part of the study included measurements of key indicators of physical readiness (strength, endurance, coordination, and reaction speed) before and after the implementation of the comprehensive physical training program. The research was conducted through two types of experiments: the ascertaining and the pedagogical [6].

The ascertaining experiment aimed to examine the quantitative composition and trends in workload progression in ballroom dancing from class "E" to class "C," to determine the level of athletes' physical preparedness, and to identify leading physical qualities by calculating correlation coefficients between technical performance scores and physical fitness indicators.

The pedagogical experiment sought to refine and verify the effectiveness of applying the comprehensive physical training program for ballroom dancers aged 10-11 years at the stage of specialized basic preparation.

Statistical data processing methods were employed to evaluate the effectiveness of programmatic changes, allowing for the determination of the significance of the obtained results. Standard methods of mathematical statistics were used to establish the reliability of differences between indicators. Statistical analysis included the calculation of sample parameters: mean values ($\overline{X}$), standard deviation (σ), and standard error of the mean ($\pm m$). The reliability of differences between sample means was determined using Student's t-test, with significance set at $p<0.05$. To identify relationships between technical and physical preparedness indicators, paired correlation coefficients (r) were calculated [6]. Comparative analysis of dancers' technical preparedness was conducted using the Van der Waerden H-test. Data processing was performed using Microsoft Office Excel 2010.

The object of the study is the physical training program for DanceSport athletes at the stage of specialized basic preparation, while the subject of the study is the process of its implementation and the effectiveness of its integration into the training system.

The study of specialized literature allowed:

– substantiation of the relevance of the research topic;

– formulation of specific research objectives;

– generalization of modern approaches to the control and organization of physical training in DanceSport.

The generalization of practical experience of foreign DanceSport coaches (Valerio Colantoni, Yuliya Lorenz, and others) made it possible to identify control exercises used in practice to assess dynamic mobility.

Thus, the combination of analysis of scientific-methodological sources, experimental research, pedagogical observation, and statistical analysis creates a scientifically grounded basis for improving the physical training program of DanceSport athletes at the stage of specialized basic preparation.

Results. An analysis of subjective evaluations provided by DanceSport coaches confirms that physical preparation is an integral component of the overall process of athlete development. Most specialists rank it second in importance after technical preparation and actively apply it in their coaching practice [27; 29]. It is important to emphasize that physical preparation in DanceSport is directly linked to the volume of figures and steps that athletes must master in each class, which in turn determines their level of performance mastery.

To identify the dynamics of increasing training loads in DanceSport from the initial preparation stage to the specialized basic stage, a comparative analysis was conducted of athletes' workload in the Latin American program across classification categories "E," "D," and "C." For this purpose, lists of permitted figures corresponding to each class, as established by the rules of the All-Ukrainian DanceSport Federation, were analyzed [9; 41]. The analysis was carried out according to two indicators:

- The number of figures to be mastered in each class;
- The number of steps within these figures.

Statistical processing and comparative analysis of the data revealed that in class "E," athletes, on average, learn 13.3 figures in each Latin American dance and 112 steps. In class "D," these indicators increase to 22.8 figures and 186 steps, while in class "C" they reach 33.8 figures and 304.2 steps, respectively. It is important to note that the observed increase in workload from class to class is predominantly statistically significant ($p<0.05$), confirming the objectivity of the results (Table 2).

Table 2.

Comparative analysis of the number of figures and steps in program dances of classes "E," "D," and "C"

Dance	Class "E" (figures/steps)	Class "D" (figures/steps)	Class "C" (figures/steps)
Samba	14 / 104	24 / 185	34 / 275
Cha-Cha-Cha	14 / 144	24 / 277	35 / 422
Jive	12 / 88	22 / 170	33 / 295
Rumba	– / –	21 / 112	35 / 215
Paso Doble	– / –	– / –	32 / 314
Total	40 / 336	91 / 744	169 / 1521

Average indicators:
- Class "E" – 13.3 figures / 112 steps;
- Class "D" – 22.8 figures / 186 steps;
- Class "C" – 33.8 figures / 304.2 steps

Calculations using Student's t-test confirmed the statistical significance of differences between classes:
• Number of figures: "E"–"D" = 2.96 (p<0.05); "D"–"C" = 2.74 (p<0.05)
• Number of steps: "E"–"D" = 1.87 (p>0.05); "D"–"C" = 2.14 (p<0.05)

Thus, the results of the study indicate that DanceSport athletes must master the full volume of steps and figures in program dances during their progression from class "E" to class "C." At subsequent stages, according to the rules of the All-Ukrainian DanceSport Federation, only refinement of already acquired elements takes place. Therefore, the most distinct dynamics of workload increase, expressed in quantitative units of mastered elements, is observed precisely in DanceSport during the transition from class "E" to class "C."

To further determine the directions for organizing and selecting the means and methods of physical preparation for young athletes at the stage of specialized basic training, preliminary testing of physical fitness was conducted with 40 children aged eight to eleven. This provided baseline data for subsequent analysis and outlined prospects for improving the training process.

The next task of the study was to perform a correlation analysis of the relationships between indicators of technical and physical preparedness in young athletes who already possess sufficient experience in DanceSport. Within this analysis, strength, speed-strength, coordination abilities, as well as the functional capacities of the cardiovascular and respiratory systems were evaluated.

The highest scores in strength and strength endurance tests were observed among boys and girls aged 10-11 years. In coordination tests, the best results were recorded in children aged 8; from ages 9 to 11, boys demonstrated a tendency toward declining performance, whereas 11-year-old girls showed improvement in coordination abilities. In nearly all tests assessing the functional capacities of the cardiovascular and respiratory systems, average scores increased steadily in both boys and girls from ages 8 to 11.

Further correlation analysis of technical and physical preparedness in 10-year-old girls revealed the emergence of significant medium and strong correlations between technical scores and indicators of speed-strength abilities (in 2 out of 5 cases), coordination abilities (in 1 out of 3 tests), and functional capacities of the cardiovascular and respiratory systems (in 1 out of 4 cases) (Table 3). Among boys of the same age, a greater number of significant medium and strong correlations were identified between technical scores and speed-strength abilities (3 significant correlations out of 5), strength endurance (2 out of 5), and functional capacities of the cardiovascular and respiratory systems (3 out of 4) (Table 3).

The study also demonstrated that motor density of training sessions during this period increased to 45-55%. Pedagogical observations confirmed the introduction of general and specialized physical training exercises into the instructional process, primarily coordination and speed-strength exercises.

Analysis of correlations between technical and physical preparedness in 11-year-old boys showed a further strengthening of the relationship between technical performance and results of speed-strength testing (in all cases), as well as indicators of cardiovascular and respiratory functional capacities (in all cases) (Table 3).

Correlation analysis in 11-year-old girls confirmed significant relationships between technical performance and speed-strength abilities (4 out of 5 cases), as well as functional capacities of the cardiovascular and respiratory systems (in all cases). At the same time, new significant correlations emerged between technical performance in ballroom dancing and coordination preparedness (in all cases) (Table 3).

The results of the study indicate that among 11-year-old boys, there is a strengthening of the relationship between technical preparedness and the outcomes of speed-strength tests, as well as indicators of cardiovascular and respiratory system functionality (Table 3). This confirms that physical preparation is a crucial factor in the formation of technical mastery. Among girls of the same age, significant correlations were observed between technical preparedness and speed-strength abilities (in 4 out of 5 cases), as well as functional capacities of the respiratory and cardiovascular systems. At the same time, new significant correlations were recorded between indicators of technical execution in DanceSport and coordination preparedness (in all cases).

Pedagogical monitoring and analysis of training sessions revealed relatively high motor density (50-60%) and the use of selected general and specialized physical training exercises by coaches. It should be noted, however, that the application of these exercises was not systematic or consistent. Nevertheless, the increase in motor density, along with heightened demands on athletes' functional readiness to withstand workloads, led to improvements in physical preparedness indicators and the emergence of correlations between these indicators and technical mastery.

The conducted analysis demonstrates a clear tendency toward strengthening the interrelationship and interdependence of technical and physical preparedness in athletes already at the stage of specialized basic training. This allowed us to outline the main directions for organizing special physical preparation of young DanceSport athletes.

Table 3.

Correlation coefficients of technical and physical preparedness indicators in boys and girls aged 10–11, *n* = 40

№	Test	Boys 10 y.o.	Boys 11 y.o.	Girls 10 y.o.	Girls 11 y.o.
1	Squats (20 sec)	0.697 (moderate, α = 0.05)	0.725 (strong, α = 0.01)	–	0.678 (moderate, α = 0.05)
2	Jumps (20 sec)	0.677 (moderate, α = 0.05)	0.698 (moderate, α = 0.05)	0.643 (moderate, α = 0.05)	0.678 (moderate, α = 0.05)
3	Push-ups (10 sec)	0.738 (strong, α = 0.05)	0.715 (strong, α = 0.05)	–	0.655 (moderate, α = 0.05)
4	Sit-ups (10 sec)	–	0.740 (strong, α = 0.01)	0.658 (moderate, α = 0.05)	–
5	Leg raises (10 sec)	–	0.753 (strong, α = 0.05)	–	0.710 (strong, α = 0.05)
6	Romberg test	–	–	0.798 (strong, α = 0.01)	0.745 (strong, α = 0.05)
7	Yarotsky test	–	–	–	0.715 (strong, α = 0.05)
8	Dynamic mobility	–	–	–	0.738 (strong, α = 0.05)
9	Ruffier index	–	-0.765 (strong, α = 0.01)	–	-0.783 (strong, α = 0.01)
10	Stange test	0.709 (strong, α = 0.05)	0.718 (strong, α = 0.05)	–	0.718 (strong, α = 0.05)
11	Genchi test	0.739 (strong, α = 0.05)	0.809 (strong, α = 0.01)	0.645 (moderate, α = 0.05)	0.725 (strong, α = 0.05)
12	Spirometry	0.648 (moderate, α = 0.05)	0.638 (moderate, α = 0.05)	–	0.702 (strong, α = 0.05)

Note: CC – correlation coefficient; CS – correlation strength; α – significance level.

The content of the proposed program was presented in the form of exercise complexes aimed at general preparation and the development of key physical qualities and functional capacities. Exercises were distributed within individual training sessions, with defined volumes and methods of load regulation. The program was implemented during the preparatory stage (4 weeks) of the first mesocycle of the annual macrocycle.

The program included exercise complexes adapted to the children's level of preparedness and the requirements of general and special physical training, as well as the technical demands of the Latin American program, taking into account age-specific characteristics. Exercises were applied regularly at designated points within training sessions, ensuring systematic implementation and pedagogical relevance.

The program's effectiveness was tested in a pedagogical experiment involving 40 children, divided into control and experimental groups (10 boys and 10 girls in each). The control group was trained according to traditional methodology, while the experimental group followed the comprehensive physical training program.

To evaluate the program's effectiveness, tests were grouped to reflect the development of major physical qualities and functional capacities: speed-strength abilities, strength, coordination, general work capacity, and respiratory system functions.

Analysis of baseline data showed that the control and experimental groups were homogeneous in terms of the studied qualities (differences between mean values were statistically insignificant, $p>0.05$). This confirmed equal conditions for conducting the experiment.

As a result, after the experiment, the most significant positive changes were observed in the experimental group. Among athletes aged 10-11 years, a significant increase in speed-strength indicators was recorded across all tests. Specifically, in the "squats for 20 seconds" and "jumps for 20 seconds" tests, average group results in the experimental group improved by 13.3% and 11.7% for boys, and by 6.8% and 10.9% for girls, respectively. These intra-group changes were statistically significant ($p<0.05$). In the control group, results also showed positive changes: average group scores increased by 4.1% in boys and by 3.9% and 1.7% in girls, respectively; however, these improvements were not statistically significant ($p>0.05$).

Substantial and statistically significant increases were also observed in the experimental group for upper body strength and abdominal and back muscle strength. In the "push-ups for 10 seconds" test, results improved by 17.3% in boys and 17.6% in girls ($p<0.05$). In the "sit-ups from a supine position" and "leg raises from a supine position" (10 seconds) tests, scores increased by 21.4% and 12.7% in boys ($p<0.05$), and by 14.1% and 11.1% in girls ($p<0.05$). In the control group, where training followed traditional methods, similar tendencies were observed, but the improvements were less pronounced and statistically insignificant ($p>0.05$).

An important positive outcome was the significant improvement in coordination abilities during the experiment, as technical mastery in ballroom dancing – similar to other complex coordination sports – Is largely determined by coordination skills, which in turn depend on the functions of the central nervous system and sensory mechanisms [7; 14].

Improvements in coordination test results were observed in both groups of athletes within this age category. However, the increase in scores among children in the experimental group was significantly higher (p<0.05) than in the control group. In the dynamic mobility test, average results improved by 15.9% in boys and 18.8% in girls of the experimental group, with statistically significant gains (p<0.05). No significant changes were recorded in the control group (p>0.05).

Marked improvements in vestibular stability in the experimental group were documented in the Yarotsky test. Average results increased by 7.1 seconds (17.7%) in boys and by 4.2 seconds (18.9%) in girls, with statistically significant differences (p<0.05).

In the Romberg test, average group scores in the experimental group increased by 41.5% (right leg) and 49.6% (left leg) in boys, reaching 23.2 seconds and 21.1 seconds, respectively. In girls, scores increased by 52.7% (right leg) and 50.8% (left leg), reaching 16.8 seconds and 19.9 seconds, respectively.

Positive changes were also observed in tests assessing general work capacity and functional capacities of the respiratory system. Significant increases were recorded in breath-holding times in the Stange and Genchi tests, as well as in vital lung capacity (VLC).

Thus, the positive dynamics of indicators in tests of general work capacity and respiratory function demonstrate an improvement in the functional preparedness of young DanceSport athletes.

In summary, the analysis of the main indicators of physical preparedness in athletes aged 10–11 revealed statistically significant advantages in the experimental group compared to the control group at the end of the pedagogical experiment. Improvements were observed in several physical and functional qualities: speed-strength abilities, coordination, and general work capacity. This provides grounds to conclude that the proposed comprehensive program had a noticeable positive impact on the level of general and special physical preparedness of children and can be recommended for use in the training process of young DanceSport athletes.

According to most specialists in the field of sports training theory and methodology [7; 13; 22], physical preparation serves as an effective foundation for mastering technique in any sport. Therefore, the purpose of our study was not only to verify the effectiveness of the proposed comprehensive physical training program but also to examine its impact on the technical mastery of young athletes.

Prior to the pedagogical experiment, an analysis of the children's technical preparedness was conducted. The participants were asked to perform their competitive routines consisting of four dances from the Latin American program included in the competition schedule for the "Juveniles 2" category (ages 10-11).

Evaluation of the routines was carried out by experts using a specially developed scale that accounted for key components of technical mastery: musicality, choreography, execution of variations, body lines, balance, and expressiveness (Table 4) [9; 11; 18; 19; 21].

Table 4.

Evaluation scale for competitive routines

Error type	Musicality	Choreography	Execution of variations	Body lines	Balance	Expressiveness
Minor – 0.5 points	Slight mismatch with music	Inaccurate position of arms, legs, or head	Errors in routine execution	Inaccurate body positioning	Loss of balance in one element	Insufficient expressiveness
Significant – 1 point	Partial mismatch with music	Incorrect positioning of arms and head, legs and head, or arms and legs	Incomplete routine execution	Torso bends backward/forward; raised shoulders	Partial loss of balance in elements	Noticeable lack of expressiveness
Major – 2 points	Complete mismatch with music	Incorrect positioning of legs, arms, head, etc.	Routine not performed	Severe posture violations	Execution outside balance	Complete absence of expressiveness

At the initial stage of the experiment, statistical analysis of scores obtained by young athletes for the performance of four dances revealed no significant differences between the control and experimental groups (p>0.05) (Table 5). This indicates homogeneity of the groups in terms of technical preparedness at the start of the experiment.

A similar assessment of technical preparedness was conducted at the end of the pedagogical experiment, following evaluation of physical fitness. Analysis of the data revealed divergent changes in the control and experimental groups.

Table 5.

Comparative results of the technical preparedness assessment of young athletes in control and experimental groups before the experiment, *n*=20 (Van der Waerden's *H*-test)

Statistical indicators	Boys	Girls
Control group	40.95	40.81
Experimental group	40.4	39.93
H-test	0.13	0.18
p	>0.05	>0.05

Note: H_{crit} = 3.86 at α = 0.05.

The results show that in boys of the experimental group, the average score for routine performance reached 45.76 points, which is 5.36 points higher than before the experiment. In girls of the experimental group, technical scores increased by 5.01 points, reaching 44.94 points. In the control group, improvements were smaller: 2.7 points in boys and 2.94 points in girls, with average results of 43.6 and 43.75 points, respectively.

The increase in technical mastery among young athletes in the experimental group was statistically significant (p<0.05) and considerably exceeded the indicators of the control group. In the control group, despite some improvement in technical level, the changes were not statistically significant (p>0.05) (Table 6).

Table 6.

Comparative results of the technical preparedness assessment of young athletes in control and experimental groups before and after the experiment, *n*=20 (Van der Waerden's *H*-test)

Statistical indicators	Control group (boys)	Control group (girls)	Experimental group (boys)	Experimental group (girls)
Before experiment	40.95	40.81	40.4	39.93
After experiment	43.6	43.75	45.76	44.94
H-test	1.9	2.27	3.89	3.9
p	>0.05	>0.05	<0.05	<0.05

Note: H_{crit} = 3.86 at α = 0.05.

The results obtained in our study on the development of physical qualities in young ballroom dancers find confirmation and extension in contemporary scientific works devoted to technical-aesthetic sports. Nataliya Mischenko et al. (2021) demonstrated that the period between ages 7-10 is the most favorable for improving coordination abilities, which aligns with our conclusions regarding the critical role of ages 10-11 in the formation of fundamental motor qualities [31]. Smurti Pawar & Borkar (2018) highlighted the effectiveness of ladder drills for developing agility, resonating with our findings on the importance of specialized exercises for enhancing the technical mastery of young dancers [34]. Zuozheng Shi et al. (2023) confirmed that the use of simple tools (such as skipping rope), when combined with technical training, promotes coordination and mastery, underscoring the universality of the methods we applied in our training process [37].

Rafael Visan et al. (2023) and U-Yeong Lee & Chang-Hwa Joo (2024) emphasized the role of modern technologies (BlazePod, proprioceptive training) in improving decision-making speed and balance [40], which corresponds with our conclusions on the necessity of integrating innovative methods into the physical preparation system of ballroom dancers. Amr Shady & Mohamed Abdelkader (2014) demonstrated the relationship between cognitive aspects of coordination (rhythm, spatial orientation) and the quality of technical performance, supporting our results on the significance of rhythmic and spatial organization of movements in ballroom dancing [36].

Nebojša Trajković & Špela Bogataj (2020) [39] and Dario Novak et al. (2023) [33] showed that neuromuscular and balance training contribute to the development of motor competence and precision in technical actions, consistent with our data on the importance of developing balance and trunk stability. Kavinda Malwanage, Vindya Vimani Senadheera & Tharaka Dassanayake (2022) [30] and Ioannis Mitrousis et al. (2023) [32] emphasized the need to complicate balance exercises and employ diverse equipment, which resonates with our recommendations for differentiating physical training programs in ballroom dancing. Finally, Damiano Formenti et al. (2021) demonstrated that non-specific general coordination exercises can sometimes be even more effective than narrowly specialized ones, confirming our conclusion on the advisability of integrating general developmental tools into the training process of young athletes [26].

Thus, the results of the experiment confirm that the comprehensive physical training program positively influenced not only the development of physical qualities but also the improvement of technical mastery in young DanceSport athletes. This provides grounds to assert that the integration of specially selected exercise complexes into the training process contributes to the harmonious development of physical and technical components of preparation, ensuring a higher level of competitive performance.

The comparison of our results with findings from other studies in technical-aesthetic sports confirms their scientific validity and highlights the novelty of our work. Our study not only aligns with international trends but also complements them, offering practical recommendations for the training process in ballroom dancing.

Conclusions. The study demonstrated that physical preparation in ballroom dancing is a system-forming factor that determines the quality of young athletes' technical mastery. Based on the analysis of contemporary national and international research, as well as the results of the pedagogical experiment, it was established that the age of 10-11 years represents the most intensive stage in the formation of interconnections between physical and technical components of training. The proposed comprehensive physical training program ensured a statistically significant increase in speed-strength abilities, strength, coordination, and functional endurance, which, in turn, contributed to the improvement of athletes' technical performance.

The scientific novelty of this work lies in the specification of the role of physical preparation at the stage of specialized basic training and in proving its direct impact on technical outcomes in ballroom dancing. The practical significance of the study is reflected in the development and testing of a comprehensive program that can be recommended for wide application in the training process. Its implementation enables coaches to optimize the balance between physical and technical workloads, to account for age and gender-specific features of motor development, to integrate modern methodologies (Pilates, balance exercises, innovative technologies), and to ensure the harmonious development of athletes.

Thus, the results of the study make a substantial contribution to the advancement of theory and methodology in sports training within complex coordination disciplines, confirm the advisability of integrating physical and technical preparation, and open new perspectives for further research aimed at refining training programs.

Prospects for Further Research. The results obtained convincingly demonstrate that physical preparation in ballroom dancing is a decisive factor in shaping the technical mastery of young athletes. The proposed comprehensive program ensured a statistically significant increase in key physical qualities while simultaneously contributing to the improvement of technical preparedness, thereby confirming its effectiveness and practical relevance. The scientific novelty lies in specifying the role of physical preparation at the stage of specialized basic training (ages 10-11) and in proving its direct impact on the quality of competitive performance. The practical significance is reflected in the possibility of broad application of the program within the training process, opening new perspectives for the development of sports training methodology in complex coordination disciplines.

In this context, the logical continuation of our work involves the following directions for future research:

1) *Integration of physical and psychological preparation* – development of programs that combine the enhancement of physical qualities with the formation of psychological resilience, attention, and emotional regulation.

2) *Application of digital technologies and artificial intelligence* – implementation of systems for monitoring athletes' physical condition, analyzing workloads, and predicting competition outcomes.

3) *Comparative analysis of international programs* – investigation of the experience of foreign ballroom dance schools and adaptation of their methodologies to Ukrainian realities.

4) *Development of differentiated programs* – creation of exercise complexes tailored to athletes' individual predispositions and abilities, thereby increasing training efficiency.

5) *Pedagogical dimension of education* – exploration of the impact of physical preparation on the formation of values, discipline, and professional culture among young athletes.

6) *Injury prevention* – identification of optimal means for developing flexibility and speed-strength qualities without overloading the musculoskeletal system.

7) *Methodological recommendations for coaches* – preparation of practical manuals and educational materials that systematize modern approaches to physical preparation in ballroom dancing.

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Author Contributions (CRediT):

A. Lysenko – conceptualization, setting of aims/objectives, preparation of the original draft, approval of the final version, and agreement to take responsibility for the content.

O. Horbenko – methodology; formal analysis; project administration.

V. Myshko – critical scientific editing; supervision.

K. Shkuryeyev – study design, data collection/analysis/interpretation; validation.

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