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Петро РИБАЛКО[1], Антон ВЛАСЕНКО[2]
Сумський державний педагогічний університет імені А. С. Макаренка, Україна
[1] https://orcid.org/0000-0002-6460-4255
petrorybalko13@gmail.com
[2] https://orcid.org/0009-0003-0530-2956
antonio03121993vl@gmail.com

УДОСКОНАЛЕННЯ ФІЗИЧНОЇ ПІДГОТОВКИ СТУДЕНТОК ПЕДАГОГІЧНИХ СПЕЦІАЛЬНОСТЕЙ НА ЗАНЯТТЯХ З ВОЛЕЙБОЛУ: АНАЛІЗ БАЗИСІВ ДЛЯ РОЗРОБКИ ДИФЕРЕНЦІЙОВАНОЇ МЕТОДИКИ

Анотація. *Традиційні підходи до фізичного виховання студенток закладів вищої освіти (ЗВО) часто не враховують їхніх індивідуальних особливостей, професійних потреб та фізіологічних характеристик. Жіночий організм має специфічні вимоги до фізичного навантаження, що обумовлено гормональними, анатомічними та функціональними відмінностями. Крім того, майбутня професійна діяльність педагога передбачає не лише статичні навантаження (тривале стояння біля дошки, написання конспектів), а й динамічні дії, пов'язані з організацією освітнього процесу, що вимагає розвитку спритності, координації та загальної витривалості. У цьому контексті волейбол як командний вид спорту має значний потенціал для удосконалення фізичних якостей, формування комунікативних навичок та розвитку когнітивних здібностей, необхідних у педагогічній практиці вчителів різних предметних спеціалізацій (гуманітарний напрям, вчителі STEM-спеціальностей тощо). Метою статті є аналіз можливих базисів для розробки диференційованої методики удосконалення фізичної підготовки студенток педагогічних спеціальностей на заняттях з волейболу. Методи дослідження: системний аналіз, порівняльно-історичний і контент-аналіз наукових публікацій. За результатами охарактеризовано такі базиси для диференціації: (1) урахування індивідуальних характеристик розвитку студенток та рівень їх фізичної підготовки; (2) інтенсивність навантаження; (3) тривалість тренувань. Подальші дослідження можуть бути спрямовані на вивчення довгострокового впливу диференційованих програм на професійну діяльність студенток педагогічних спеціальностей, а також на розробку інноваційних методів інтеграції фізичного виховання з педагогічною практикою. Результати дослідження можуть бути корисними для викладачів фізичного виховання, тренерського складу, а також адміністрації ЗВО, які займаються вдосконаленням системи підготовки майбутніх педагогів.*

Ключові слова*: фізична підготовка; диференціації; студентки; педагогічні спеціальності; волейбол; ЗВО; професійна підготовка; майбутні вчителі.*

Petro RYBALKO[1], Anton VLASENKO[2]
Sumy State Pedagogical University named after A.S. Makarenko, Ukraine
[1] https://orcid.org/0000-0002-6460-4255
petrorybalko13@gmail.com
[2] https://orcid.org/0009-0003-0530-2956
antonio03121993vl@gmail.com

IMPROVEMENT OF PHYSICAL TRAINING OF FEMALE STUDENTS OF PEDAGOGICAL SPECIALTIES IN VOLLEYBALL CLASSES: ANALYSIS OF THE BASES FOR THE DEVELOPMENT OF DIFFERENTIATED METHODS

Abstract. *Traditional approaches to physical education of female students of higher education institutions (HEIs) often do not take into account their individual characteristics, professional needs, and physiological characteristics. The female body has specific requirements for physical activity due to hormonal, anatomical, and functional differences. In addition, the future professional activity of a teacher involves not only static loads (prolonged standing at the blackboard, writing notes) but also dynamic actions related to the organization of the educational process, which requires the development of agility, coordination, and overall endurance. In this context, volleyball as a team sport has significant potential for improving physical qualities, forming communication skills, and developing cognitive abilities necessary in the pedagogical practice of teachers of various subject specializations (humanities, STEM teachers, etc.). The purpose of the article is to analyze possible bases for the development of a differentiated methodology for improving the physical fitness of female students of pedagogical specialties in volleyball classes. Research methods: system analysis, comparative and historical, and content analysis of scientific publications. According to the results, the following bases for differentiation are characterized: (1) consideration of the individual characteristics of female students' development and their level of physical fitness; (2) intensity of load; (3) duration of training. Further research can be aimed at studying the long-term impact of differentiated programs on the professional activity of female students of pedagogical specialties, as well as at developing innovative methods of integrating physical education with pedagogical practice. The results of the study may be useful for physical education teachers, coaches, and university administrators involved in improving the system of training future teachers.*

Keywords*: physical training; differentiation; female students; pedagogical specialties; volleyball; higher education institutions; professional training; future teachers.*

Statement of the problem. The modern system of higher education is increasingly focusing on the comprehensive development of future professionals, where physical training is not only a component of a

healthy lifestyle but also an important factor in professional competence. This is especially true for female students of pedagogical specialties who need physical endurance, emotional stability, and a high level of physical activity for successful self-realization in their future professional activities. In view of this, volleyball as a team sport has significant potential for improving physical qualities, forming communication skills necessary in pedagogical practice, and developing cognitive abilities of graduates of pedagogical specialties.

Analysis of current research. Research [Physical fitness, cognitive functioning, and academic achievement in healthy adolescents] confirms that the optimal level of physical fitness improves cognitive function and reduces the level of professional burnout in teachers. In this context, volleyball as a team sport has significant potential, as evidenced by the following research [8], which proves the positive impact of game sports on the development of professionally important qualities in future teachers. Research [6] shows that traditional approaches to physical education are often ineffective for female students due to the lack of differentiation by gender and professional needs. Research [10] indicates the specific physiological needs of the female body during physical activity, which is especially important to take into account in pedagogical training. Work [19] prove that the professional activity of a teacher requires not only static but also dynamic loads, which confirms the need for comprehensive physical development.

Scientific research in recent years [12; 23] confirms the benefits of volleyball for the physical development of female students. First, the experimental data [22] show that regular volleyball training improves the functional state of the cardiovascular system by 25-30%. Secondly, the study [13] prove that volleyball develops reaction time 15-20% more efficiently than other team games. Thirdly, the publication [16] demonstrates that team sports develop communication skills that are critical for teaching.

The study [1] describes physiological criteria for differentiating training programs. These recommendations are supported by the [3], which shows that a professionally oriented approach to physical education of future teachers improves their professional adaptation by 25-40%. Research by the German Association of Sports Medicine [9] proves the effectiveness of specialized exercises for the development of fine motor skills, which has a direct impact on pedagogical skills. These findings are consistent with the study [17], where it was found that differentiated programs based on individual student characteristics increase learning efficiency by 18-22%. Research [3] proves that the integration of sports exercises with professional skills improves cognitive performance by 15-25%, reduces the level of professional stress, and forms stable motor stereotypes necessary in pedagogical activities.

The recommendations of DGSP (2019) and ACSM (2022) have been successfully adapted for students with special needs, which confirms the possibility of individualizing the load, the importance of taking into account gender characteristics, and the effectiveness of game methods (including volleyball) in professional training. These works form a single scientific paradigm that combines international standards (ACSM), European experience (DGSP), and Ukrainian research, which together allow us to assert that modern approaches to physical training of future teachers have a solid scientific basis, practical foundation, and a clear focus on professional needs.

The idea of our study is based on works that prove the effectiveness of a differentiated approach in physical education. Of particular value are studies that have developed a methodology for individualizing the workload, taking into account the professional needs of future teachers. Thus, the purpose of the article is to analyze possible bases for the development of a differentiated methodology for improving the physical training of female students of pedagogical specialties in volleyball classes..

Research methods. To identify possible bases for the development of a differentiated methodology for improving the physical training of female students of pedagogical specialties in volleyball classes, the following were used: system analysis, which allowed to identify the relationship between the types of differentiation and professional requirements for teachers; comparative and historical method to study the evolution of approaches to differentiation in physical education; content analysis of scientific publications to identify key trends in recent research (in particular, according to Scopus, Web of Science, PebMed).

Results. The study of scientific results (on the physical training of specialists in higher education institutions, the peculiarities of women's physical activity and their individual characteristics, the influence of team games on personal characteristics, etc.) and their generalization gives grounds to assert that the basis for a differentiated methodology for improving the physical training of female students of pedagogical specialties in volleyball classes can be: (1) *consideration of the individual characteristics of female students' development and their level of physical fitness*; (2) intensity of loading; (3) duration of training.

Consideration of the individual characteristics of female students' development and their level of physical fitness

Individual characteristics of female students' development can be of a physiological and psychological nature. Physiological features are determined by: somatotype (asthenics, normosthenics, hypersthenics), which determines the intensity of loads; the state of the musculoskeletal system (MSA, especially the spine), which is important for teachers due to prolonged static work; vegetative status (resting heart rate, blood pressure) as an indicator of adaptation to loads. The specifics of professional loads include: the vocal apparatus

(for philologists), which is supported through breathing exercises during warm-ups and limiting shouting during the game, and visual stability (for STEM teachers), which is supported by peripheral vision exercises and rapid focus training. The individual characteristics also include gender peculiarities: cyclical changes in the body of girls, which lead to the correction of the load by the phases of the cycle.

Psychological factors of differentiation include: motivation (for perfectionists - perfection of technique; for socializers - team tasks), professional identity (analogies between game and pedagogical situations); stress resistance (imitation of stressful game situations and training in noise (as in the classroom); communicative skills (role-playing games in changing captains; collective decision-making); cognitive features, which include the type of thinking (humanitarian direction - emphasis on game images, STEM direction - accurate calculations of passes) and reaction speed (exercises with unexpected signals; changing the rules of the game on the go).

Differentiation is possible after appropriate diagnostics: physiological tests (orthostatic test, Rufier test) and psychological questionnaires (Spielberger-Hanin method and Cattell test). Examples of practical implementation of differentiation by individual developmental characteristics are shown in the figure (Fig. 1).

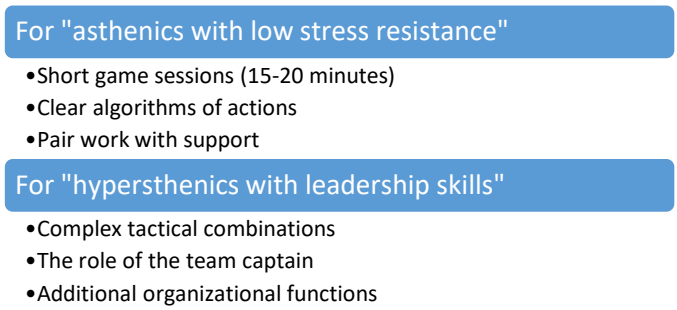

Fig. 1. Examples of differentiated methods

Taking these factors into account allows us to minimize occupational risks (diseases of the eye, voice problems), develop the qualities that will be important for teaching, and transform physical training into professionally oriented training.

We believe it is important to divide into groups according to the level of training: beginner, intermediate, and advanced. For pedagogical specialties, the division into groups can be subject-oriented, taking into account various criteria (Table 1).

Table 1. Criteria for dividing into groups

Level of training	Physical characteristics	Subject specificity	Examples of adaptation	Performance monitoring
Beginner	Low Rufier score (<3.5), lack of sports experience	All specialties, especially humanities	Game elements without strict rules, exercises with the ball on the spot	Coordination tests (number of successful receptions of the ball)
Intermediate	Average endurance performance (recovery heart rate in 3-5 minutes)	STEM area, primary school	Tactical combinations with a reduced platform	Analysis of the reaction rate
Advanced	High level of physical fitness (Rufier test >8)	Physical education, STEM disciplines	Specialization in game roles, complex combinations	Complexity of tactical schemes

For elementary school teachers, the emphasis on fine motor skills development finds scientific support in a study [7], which demonstrates a direct link between the level of development of a child's motor skills and the quality of his or her writing. This is confirmed by the guidelines of the German Association of Sports Medicine [9], where special attention is paid to the use of mini-balls as an effective means of developing fine motor skills in younger students. For STEM teachers, the scientific feasibility of precision passing exercises is based on John Sweller's theory of cognitive load [20], which proves the impact of exercise on optimizing cognitive processes. This approach is confirmed by the practices of the Berlin Technical University, where the positive impact of movement coordination exercises on the development of spatial thinking, a key competency for STEM disciplines, was established. The table integrates medical norms, pedagogical specifics and sports standards to create a subject-oriented physical training system.

Differentiation by load intensity

The choice of the optimal workload for future teachers is based on a professionally oriented approach that takes into account the intensity of the workload, the duration of training, and the complexity of the exercises. The table summarizes information on the intensity of the load for female students of different subject specialties (Table 2). Analysis of the table shows that, for example, interval training (1 min of active play + 2

min of tactical analysis) is appropriate for history teachers, and exercises with the calculation of the ball's trajectory during the game are appropriate for math teachers.

Table 2. Intensity of workload for female students of different subject specialties

Area	Recommended intensity	Rationale
Humanitarian	Moderate (heart rate 110-130 beats per minute)	[11]
STEM	Medium-high (heart rate 130-150 beats per minute)	[14]
Physical education teachers	High (HR 150+ bpm)	Standards in the field of sports and physical education

Table 2 with information on the intensity of the workload was developed on the basis of scientific sources [15 та ін.] taking into account physiological characteristics, professional requirements, cognitive load and motor stereotypes of pedagogical activity, taking into account the load criteria (intensity, duration, complexity) of the American College of Sports Medicine [1, p. 158-192] and research on the relationship between physical activity and cognitive function [21] and the specifics of workloads for different specialties [4, 18 et al..]. These sources confirm that the optimal workload should take into account professional specifics, and the three key parameters (intensity, duration, complexity) correlate with different subject specialties and require different types of workload.

Differentiation based on training duration

The table summarizes the information on the duration of training of female students of different subject specialties (Table 3). In particular, shorter but more frequent game sessions (endurance training for working with children) are recommended for primary school teachers, while longer training sessions with an emphasis on concentration and analysis are advisable for STEM teachers.

Table 3. Duration of training for female students of pedagogical specialties

Area	Active play time	Specifics
Humanitarian	15-20 min/training session	Gradual increase in load
STEM	30-40 min/training session	Play-analyze-play cycles
Physical education teachers	50-60 min/training session	Simulation of a real match

When it comes to choosing the complexity of exercises as an individualized approach to the physical training of future teachers, it is recommended that humanities teachers use exercises with mini-balls (fine motor skills) and role-playing games (for example, "Arbiter" to develop communication). For teachers of STEM disciplines, tactical combinations with elements of calculations (for example, the angle of the ball) and exercises with limited time to make a decision (simulating a quick reaction in class) are important.

The individualized approach to physical training of future teachers, taking into account their health status, is supported by modern research. In particular, the study proves the need to differentiate the load for women with different levels of physical fitness, in particular [2]. Researchers [5] emphasize the importance of monitoring heart rate during classes for people with blood pressure disorders; mandatory warm-up of the shoulder girdle to prevent injuries in teachers due to professional motor stereotypes (writing on the blackboard, holding the arm raised for a long time, etc.).

Conclusions. The study proved the possibility of developing a differentiated methodology for improving the physical training of female students of pedagogical specialties in volleyball classes. It was found that taking into account individual characteristics, level of physical fitness, and subject specialization allows optimizing the training process, increasing its effectiveness, and adapting it to the professional needs of future teachers. In general, the study confirmed that a differentiated methodology for improving the physical training of female students of pedagogical specialties in volleyball classes is an effective tool for the development of both physical and professional qualities of female students. The results of the study can be useful for physical education teachers, coaching staff, as well as the administration of higher education institutions involved in improving the system of training future teachers. Further research can be aimed at studying the long-term impact of differentiated programs on the professional activities of graduates, as well as at developing innovative methods of integrating physical education with pedagogical practice.

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