The combined impact of student sports, physical education, and outdoor activities, based on the digital Triple Helix model, creates a synergistic effect

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Abstract

Objective of the study. This research is aimed at expanding the possibilities of the "triple helix" integration model, combining student sports, physical education and active recreation, through the use of digital tools.

Methods and structure of the study. As part of the research, using the methods of the FactoMineR package, a digital triple helix platform was developed for managing physical education in the student environment. The project involved students of both sexes aged 18-19 years, representing 286 academic groups. The effectiveness of the proposed model was evaluated on the basis of a number of confirmed indicators recorded in such disciplines as 100-meter running, 100-meter swimming, pull-ups, push-ups, as well as when passing the TRP standards.

Results and conclusions. The results of the work confirmed the scientific validity of the approach to integrating the key elements of the discipline "Physical Culture and Sport" – student sports, physical education and active leisure – based on the Triple Helix platform. The introduction of digital technologies into various aspects of physical education contributes to the expansion of the management capabilities of the Triple Helix in the context of the interaction of student sports, physical education and active leisure. It has been confirmed that digital regulation makes it possible to achieve a synergetic effect in the development of the scientific and technical potential of students' physical education. The effectiveness of the use of digital technologies to optimize the use of state and public resources in order to promote health, develop physical activity and improve athletic skills of students has been proven.

Keywords: *triple helix, integration, student sports, physical education, active leisure, digital technologies, digital platform, physical education management, managerial functionality.*

Introduction. At the XII International Forum "Russia – a sporting power", President of the Russian Federation Vladimir Putin revealed the main directions of the reform of domestic sports[1]. Digitalization of management is one of the key areas for improving the effectiveness of physical education and sports. The solution to this problem involves the use of artificial Intelligence, machine Learning, and deep Learning technologies [1]. Digital services provide additional opportunities for monitoring, processing and verifying a large amount of data used in assessing the dynamics of student sports, physical education and leisure activities [3, 6].

Excessive politicization of student sports at the university can block the development of physical education, where more than half of the students who are classified as preparatory, special departments and groups of HIA are engaged. Digital Triple Helix model services have a high potential in overcoming this problem [2]. The focus is on achieving coherence in the processes that increase the effectiveness of educational tracks in sports, basic/preparatory and special departments. To optimize the development of physical culture and sports in 1056 universities of the Russian Federation, the solution of this problem is relevant.

It was assumed that the digitalization of the "Triple Helix" management algorithms provides additional incentives for the comprehensive development of stu-

[1] Vladimir Putin's speech "Sport – a comprehensive look into the future" at the XII International Forum "Russia – a Sporting power" [Electronic resource] // https:// URL: ura.news/articles/1036289987 (accessed: 10/18/2024).

dent sports, physical education and active leisure, improving the effectiveness of training practice, the quality of academic/elective and independent forms of classes.

Objective of the study – is to actualize the possibilities of the "triple helix" integration of student sport, physical education and active leisure using digital technologies.

Methods and structure of the study. The key tasks are defined according to the stages of the study. Among them: – determination of the capabilities of the digital regulator of the "triple helix" in the organization of student sports, physical education and active leisure; – development of a management algorithm that increases the effectiveness of physical education in improving physical culture and developing students' physical condition. The object-subject area of research consists of the attributive and subject boundaries of the discipline "Physical Culture and Sport", which define the specifics of student training in the framework of problem-based, developmental and project-based learning.

The theoretical and methodological basis of the research consists of interdisciplinary theories, methods and approaches (theory of systems, synergetics, self-organization) related to the development of subjectivity of physical culture (A.I. Zagrevskaya, L.I. Lubysheva, I.V. Manzheley, N.V. Peshkova). The pedagogical observations conducted at the first stage of the study involved students of 286 study groups, men and women aged 18-19 years of 1st, 2nd and 3rd years of full-time education. Based on FactoMineR, a digital construct of student sports, elective physical education and active leisure has been synthesized.

At the second stage, using the resources of the Content Management System (CMS), the effectiveness of sports, professionally applied, adaptive, recreational and rehabilitation training of students was assessed. To assess the effectiveness of the digital platform of the "Triple Helix" control, verified results were selected in running 100 m, swimming 100 m, pulling up from the temple, bending the arms while lying down, and passing the TRP standards. Screening of PWC_{170} operational parameters, heart rate, general metabolism (GBI), visual-motor reactions of WATERS, RDO, and T-tmax was performed in groups of athletes. According to Spearman's criterion (R-statistics), a correlation analysis was performed.

Results and conclusions. The digital infrastructure of the first link of the spiral (student sports) includes a set of indicators and their thresholds reflecting the compliance of the training results with the set goals. The differences between the software packages and the resource support for the training of national (national teams) and student teams are revealed, showing the shortage of all types of resources in the work of university sports clubs. It takes from 900 to 1000 hours to train elite athletes, and from 240 to 360 hours at the university. At the same time, the number of athletes who are ready to combine university education and training is 2.3% of the total number of students [1].

Digitization of the links between the results of work (trained masters of sports, champions and prize-winners of All-Russian competitions) and resource support polynomials (R=0.670) will make it possible to format training within the boundaries of achieving peak results (R=0.501), education of citizenship and patriotism (R=0.401). Coding of training polynomials, training and training schedules, functional status, coach competencies, financing, and access to information resources increases the possibilities of work analysis and planning.

Digitalization of dynamic parameters of speed, power of work, amplitude, tempo, rhythm of motor actions allows you to adjust the links between physical, technical, tactical and competitive training. The analysis of the resonances of the training effects allows us to assess the depth of the training effect within the limits of the metabolic potential. The digital training standard is expressed in a linear code: customization of the training mode achieving peak results in competitions. It reflects the speed of adaptation to intensive training within the boundaries of functional, morphological, organic and energetic transformations. The use of e-sports simulators in the educational process gives new meanings to motor practices. The technology is included in the editing of the "weakened bonds" of gaming, which stimulate the dynamism and emotional intensity of interactive workouts. The effectiveness of training gamification is demonstrated by the participation of students in the Dota 2 tournament of the Games of the Future platform.

The analysis of the digital infrastructure of the second link of the spiral (physical education) shows dependence on the resource base of student sports. The strategic vector of development is aimed at "Sportization" of student training [4]. This relationship is expressed in the generation of goals, training stimuli,

and biotic load parameters implemented in different academic departments. The digitization of the theoretical (72 hours) and elective modules (328 hours) of the study program of the main department, where 52% of students study, focuses on mastering basic knowledge, the formation of motor culture and the development of physical qualities. It is obvious that digitalization makes it possible to synchronize learning processes, diversify physical education resources, and expand access to digital assets.

Digital tuning of kinesiological reserves leads to a synergy of functional adaptation and muscle hyperplasia. Digitization of physical activities performed in the PO2 mode of 70-75% MPC, heart rate 170-180 beats per minute is included in the adjustment of work power, correction of muscle and fat components of body weight in the range of 7.0-10.0% ($p<0.05$). Monitoring of physiologically appropriate connections allows you to regulate the dynamics of the development of students' motor functionality – endurance, strength, speed, coordination qualities. The productivity of digitizing training is expressed in an increase in test results: bending the arms in the prone position, deadlift, pull–ups from hanging on the crossbar, in the 100 m run, long jump from a place in the range of 9.0-16.0% ($p<0.05$). The introduction of user bots and personal assistants into the work of the preparatory department, where 17% of students study, makes it possible to manage the sliding effects of adaptation to stress. The special department, where 26% of students study, is dominated by physical therapy/rehabilitation technologies. The functional level is provided by standards of a healthy lifestyle, tolerance to ethnic practices, and national identity [6]. Digitization of the load parameters will allow you to adjust the energy intensity of the workout online.

A 16% increase in attendance ($p<0.05$) and a 20% decrease in the number of school absences due to illness ($p<0.05$) proves the effectiveness of the regulator. The increase in students' fitness is indicated by the strengthening of intra–system connections between the polynomials of physiological functions, hemodynamics, energy metabolism and performance of PWC_{170} in the range of 8.0-14.0%.

It should be noted that the imperatives of "sportization" have become the basis of patriotic education and adherence to traditional values. The adequacy of the model is indicative of the participation of St. Petersburg State University students in 23 large-scale projects, in particular, in the Russian Walking Walking Championship, the TRP festival (1.5 thousand students fulfilled the standards), a table tennis tournament, and Russian bast shoes competitions.

Digitization of physical activity thresholds used in the special medical group (26%) is associated with the clinical stratification of students. It allows you to differentiate the learning process by signs of damage to the musculoskeletal system (NODE), heart, central nervous system, respiratory organs, hearing and vision.

Digitalization of polynomials in an accessible/barrier-free environment is focused on synchronizing the incentives for adaptive training of students with disabilities (AFC). Optimization of barrier-free space leads to regulation of their social atomization, generation of motor addictions, and improvement of the quality of life. Load correction within the boundaries of the pathological/regenerative process, students with disabilities have improved their activity parameters, functional reserves, mental sphere, and motor functions. The depth of the impact is expressed in the settings of cognitive functions, bioenergetic reserves, and a decrease in phobic syndrome.

The correction of motives and value orientations inherent in students with disabilities is associated with cognitive domains included in the structure of adaptive reserves, compensatory capabilities and psychophysical balance. Within the boundaries of clinical symptoms, a reassessment of the prospects for remission of motor skills is achieved, an increase in the parameters of "life satisfaction" in the range of 9.0–12.0 points ($p<0.05$). The effectiveness of the digital transformation of classes has been proven by the participation of the St. Petersburg State University team in an inclusive sports festival in six sports. The digital structure of the third link (active leisure) includes operational models that increase the effectiveness of physical education through digital, physical and biological measurement of physical activity, academic productivity and quality of life of students [5]. The structural codes of the third link are expressed in projects of personality harmonization and physical fitness maintenance. The model has great potential in minimizing dissipative processes, which ensure the cross-cutting focus of active leisure programs, promoting the health and well-being of students.

As a result of the diffusion of sports and physical

education, cascading effects are achieved related to the personal routing of motor practices. Digitization of the active leisure polynomials will allow monitoring the value sphere of students. This practice stimulates the growth of weekly activity up to 12 hours, increases the involvement of students in physical education and sports activities. The information that captures the dynamics of the transformation of the content of independent studies in the structure of active leisure is of interest. The boundary parameters of the motor-energy functional correlate with an increase in background activity to 8-9 thousand locomotives (2.0–2.5 hours), 3450-3600 kcal.

Conclusions. Digitalization of physical education polynomials increases the managerial functionality of the “triple helix” in the interaction of student sports, physical education and active leisure. The diffusion of components takes place in an objective cultural and historical field, associated with the updating of priorities, the development of targeted programs. The coordinates of the structural and technological renewal of the discipline are generated on the Triple Helix platform. The effectiveness of the digital regulator is confirmed by the achievement of a synergetic effect in the development of the scientific and technical potential of students’ physical education.

References

1. Grigorev V.I. Strategiya razvitiya fizicheskoj kultury, fitnesa i studencheskogo sporta: monografiya. SPb.: SPbGEU, 2024. 160 p.
2. Ickovic G. Trojnaya spiral: universitety – predpriyatiya – gosudarstvo: innovacii v dejstvii. Tomsk: Tomskij gosudarstvennyj universitet sistem upravleniya i radioelektroniki, 2010. 237 p.
3. Kostyuchenko V.F., Rudenko G.V., Dubrovskaya Yu.A. Formirovanie fizicheskoj kultury grazhdan v kontekste strategii razvitiya fizicheskoj kultury i sporta v RF. Teoriya i praktika fizicheskoy kultury. 2019. No. 3. P. 35-38.
4. Lubysheva L.I.., Zagrevskaya A.I., Peredelskij A.A. Sportizaciya v sisteme fizicheskogo vospitaniya: ot nauchnoj idei k innovacionnoj praktike. M.: NIC «Teoriya i praktika fizicheskoy kultury i sporta», 2017. 200 p.
5. Peshkova N.V., Lubysheva L.I. Polisub”ektnoe upravlenie v studencheskom sporte: monografiya. M.: NIC «Teoriya i praktika fizicheskoy kultury», 2022. 192 p.
6. Selyukin D.B., Zajcev A.V. Vovlechennost studentov tekhnicheskogo vuza v sistematicheskie zanyatiya fizicheskoj kulturoj i sportom. Teoriya i praktika fizicheskoy kultury. 2023. No. 3. P. 58- 60.