

Information and digital educational environment for sports at a university (Russian experience)

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Abstract:

Purpose: to experimentally confirm the concept of information and digital educational environment for sports activities at the university to increase physical activity and improve the functional status of students. Materials and methods: the study involved students (n = 6812). The experiment was performed from 2017 to 2020 at the Plekhanov Russian University of Economics (Moscow, Russia). Physical culture facilities were transformed, and fitness training was increased. Digital tools and diagnostic measures were expanded to improve students independent training, level of knowledge about their health, means of monitoring physical activity, use of mobile applications in monitoring nutrition, body composition, and functional status. Results: the proportion of students who regularly participate in sports changed from 20.2% to 38.4% for young women and from 52.0% to 71% for young men. Sport preparedness indicators, obtained by the «Omega-M» method, changed in the group of girls from 33% to 48%, while the maximum values of athletic form were 100%. In the group of young men, the athletic form at the beginning of the study was 62%; at the end of the experiment, it was 73%. Owing to the expansion of fitness tools in the physical education of students, the «low» level of reaction to physical activity changed from 33 to 17.1%; the «satisfactory» level changed from 33 to 28%; the «good» or «average» level of reaction increased from 25.3 to 41.2%. The dynamics of the «excellent» level increased from 6.7 to 12.8%. Conclusions: this experiment, that which was performed carried out among students, showed that the adequacy of the regulation processes in both young men and women significantly changed. The positive dynamics of the level of regulation of cardiovascular system and other morphofunctional indicators was observed, which confirmed the effectiveness of the applied means of physical culture, means of stimulating classes in sports sections, as well as information and digital technologies that help to quickly assess health indicators and allow, to manage their health status.

Keywords: physical activity, mobile applications, fitness, functional status, digitalization.

Introduction

The information and digital educational environment for sports at the university involves the creation of a new knowledge industry. Expansion of software platforms, means of communication and informatization. New forms of activation of students' physical activity. Tools of operational control of the physical condition, rethinking the type and presentation of information. Modern students belong to the «digital» generation, they clearly show a tendency to use digital technologies in everyday life. Consequently, the digitalization of the educational system becomes an integral pedagogical condition for learning and communicating with students. For university teachers, the requirements for proficiency in information and digital technologies are increasing (Astrakhankina et al., 2020; Kasatkina, 2019; Toksonbayev & Abdikadyrov, 2019; Shutova et al., 2020). It requires dominant knowledge of the «digital format», competence in the field of information technology, online training, health monitoring tools using mobile applications.

In Russia, the operational efficiency of information in the field of education, physical culture and sports is not sufficiently developed (Ataeva, 2020; Bikhullina & Fazleeva, 2020; Bilenko et al., 2019; Burnashev & Artemyeva, 2018; Burnashev & Varlamova, 2018; Vinogradov et al., 2017; Barakhsanova et al., 2016). There are insufficient developments related to the program content on health improvement within the university, which is available on the phone. Such content is exclusive.

At the same time, 62% of trainers are at a critical level of using modern methods of collecting information, processing and storing information. The need for advanced training in the field of information technology was expressed by 32% of specialists in physical culture and sports. 68% do not represent the essential content characteristics of the digital educational environment, the requirements for the new format of education (Andryushchenko et al., 2019; Shutova et al., 2020; Shutova, 2020). Especially during the pandemic and forced restrictions on offline learning.

University teachers do not know enough about digital services, mobile applications for sports, nutrition, and self-training to recommend them to students in the educational process. There is also a lack of experience in creating video lessons that students can implement at home, due to the pandemic. The level of proficiency in computer technologies is low, starting with working in electronic libraries, Excel documents, online registration for competitions, marking attendance in sports sections by QR code, and ending with the creation of online courses in certain sports, health-improving physical culture, conducting surveys and tests in Google Forms, and implementing blockchain technologies in the educational process.

A survey of physical education teachers of the Russian Federation in 2020 (184 teachers aged 25 to 62 years) showed an insufficient overall level of computer literacy (38% of respondents). 46% of teachers experience difficulties when working with computer programs for organizing and conducting the educational process. 78% of respondents use the global computer network Internet to search for information in preparation for classes. In the field of working with documentation and information and communication technologies, 68% of teachers want to improve their level (Danilov et al., 2020).

Based on a questionnaire survey (Russia, 678 people, January-February 2020), 83% of respondents reckon that in the future, basic means and methods of sports activities will be applied with the use of additional electronic training tools. 87% of teachers denoted the need to navigate in a huge information field. The teacher of the future should have a good command of skills that are closely related to personal qualities and attitudes, as well as social skills and managerial abilities (Firsinet al., 2020). Global information challenges require an increase teacher-student communication in an online format. They involve the use of digital tools and the expansion of electronic educational resources, including for self-study sports. Thus, the formation of an information and digital educational environment for sports at the university is an relevant problem.

The purpose of the study: to experimentally prove the concept of information and digital educational environment for sports activities in university to increase physical activity and improve the functional status of students.

Material & methods

Participants. Students have taken part in research (n=6821). The experiment took place in period from 2017 to 2020 on the basis of the Plekhanov Russian University of Economics (Moscow, Russia).

Organization of research. Following methods and instrumental procedures were applied for development of the basic directions of the research:

- theoretical methods: the analysis and generalization of the scientifically-methodical literature, systemization and theoretical modelling;
- practical methods: pedagogical experiment, pedagogical control tests, pedagogical observations, medical-pedagogical methods, survey, development of a register of electronic and digital resources;
- instrumental techniques and software: questionnaires and tests in «Google Forms», the test on digital literacy of physical education teachers and coaches, complexes of computer research «Esteck System Complex», «Omega – M», mobile applications (Health, Muscle and Motion, Nike Run Club, Nike+ training club, Seven);
- searching systems and databases Yandex, Rambler, Mail.ru, ORCID, Elibrary, Scopus, Mendeley, Google Scholar, Web of Science, Journal of Human Sport and Exercise, Gale, Microsoft Word, Microsoft Excel computer programs.

In pedagogical experiment means of physical training are transformed — increased fitness training. Digital tools and the diagnostic measures are expanded, allowing to improve students' independent training, the level of knowledge about personal health, means of controlling motor activity, the use of mobile applications in food control, the structure of a body, the functional state.

The concept of sports information-digital educational environment and its structural components are developed. Online courses on sports activity and the mechanism of their alignment are created. A classification of mobile applications in the health and fitness category has been developed. The registry of digital resources, as the tool of formation of the sports information-digital educational environment in university is generated. The levels of teachers' digital competence are developed for an assessment of a level of information-digital qualification.

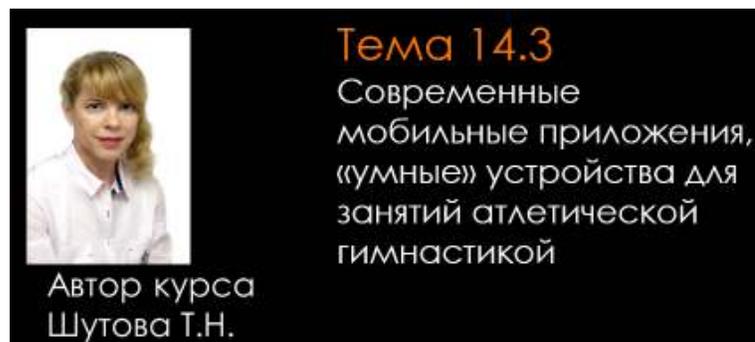
The mobile application «Fizra», being the key tool for digitalization, is developed. Functionality in mobility and availability of sports information of the application. Functionality in the automation of the educational process, a feedback in the form of an assessment of the quality of training, interactivity of information, including video lessons and animation complexes.

The means of determining the functional state of students using hardware techniques «Esteck System Complex» (Klochkov et al., 2016) (picture 1), «Omega - M» (Stepanov, 2009) are expanded. The methods were used to improve the information components of the educational process and the personality-oriented direction of physical education, as well as to expand students' knowledge about their health.



Picture 1. Determination of body structure by the method of “Esteck System Complex” during pedagogical experiment

Transformation of training included preparation of an additional theoretical and practical material on separate subject matters of students' physical training. For example, in section «athletic gymnastics», video-lectures (picture 2), online-course «Athletic gymnastics» on the Russian platform «Stepik» with detailed elaboration of the types of classes, comments and recommendations, video material, including for classes in house, were created.



Picture 2. Interface for video-lectures in mobile applications and smart devices for athletic gymnastics

Moreover, a blockchain platform is being developed, where students can find useful information, video-lessons, anatomical knowledge, training and nutrition programs, taking into account the level of motor activity, body mass index, gender, personal preferences and conditions for independent study.

In experiment categories of digital resources are created: 1) educational platforms and online-courses on physical training and sports (MOOK); 2) sports' digital services; 3) electronic international publications and databases; 4) Russian electronic libraries; 5) programs, services on fitness and a healthy lifestyle; 6) electronic libraries of physical education universities (13 universities); 7) online-resources abroad aimed on involving the population in playing sports; 8) new Russian textbooks and manuals on physical training for students (2015); 9) the Russian registry of databases, patents, copyright certificates in area of physical training and sports.

Statistical analysis. Statistical processing of the data was carried out on generally accepted methods of variation statistics with the calculation of average arithmetic, average standard deviation and verification of the results of the study on the reliability of differences at a five percent level of significance (Ivanov, 1990). The student's t-criteria was used to evaluate the significance of the differences. Mathematical processing was carried out using the MS Excel 2016 tool.

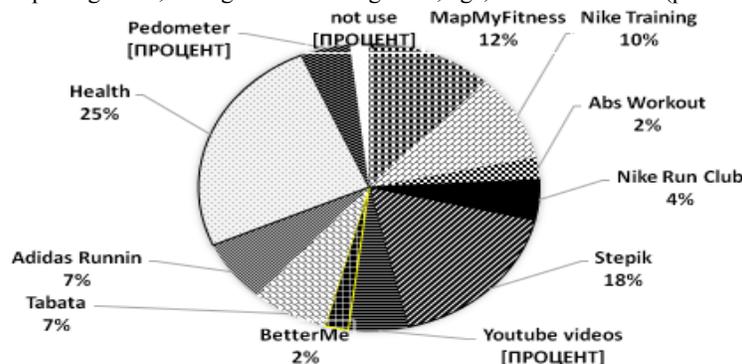
Results

Developed classification of mobile applications and the registry of digital services, have allowed students to choose a preferred way of training, a way of the control of motor activity, a way to motivate on educational, independent sports activities and to receive additional theoretical knowledge in area of physical training and sports.

A Google Form survey of students of the Plekhanov Russian University of economics, has shown their preferences:

- 25 % — monitor motor activity by means of the built in application «Health»,
- 18 % — use online-courses of the university, provided by the «Stepik» platform,
- 12 % — prefer the application «MapMyFitness».

One of the leading applications in a category «health and fitness» is «Nike Training» which is preferred by 10% of respondents. This mobile application offers trainings on yoga, cardio, functional trainings, trainings at home and at the open sports ground, taking into account gender, age, and fitness level (picture 3).



Picture 3. Popular mobile applications, pedometers and platforms among students of the Plekhanov Russian University of Economics

Trainings on Youtube channels use 6% of students, functional trainings on the «Tabata» method use 7%, racing programs from «Adidas» company prefer also 7% of respondents (picture 3). Different versions of pedometers use 5% of students. Only 2% of modern students do not use anything to exercise, control their motor activity, to manage their physical condition or nutrition.

More than 30% of students suggest to discuss at lectures frequent misconceptions on physical education (myths and legends about effectiveness of training). 30% of pupils stand up for addition issues dedicated to interesting facts about fitness trainings. 26.7% of students are interested in the topic of fast and effective methods of strengthening the muscle corset and increasing muscle tone. 15% — suggest to reveal at lectures all sports directions of university, effectiveness of sports trainings. In a rearrangement of physical training 45% of students recommended to expand implementation of mobile applications.

The analysis morphofunctional state of students in experiment has allowed to reveal authentic differences in results of the number of steps per day, as indicator of motor activity of students. Both girls, and boys showed significant differences in adequacy of the regulation processes according to «Omega – M» method (table 1).

Table 1 — Dynamics of students' morphofunctional state

Indexes	18-22 years ($\bar{X} \pm \sigma$)			
	2017		2020	
	girls	boys	girls	boys
Body mass index (conv. units) standard 18.5-24.9 conv. units(online calculator)	20.4±2.0	22.6±2.4	19.5±3.4	21.1±4.1
Fat(%), standard 24-26%	22.5±2.8	20.7±5.3	23.1±3.8	19.8±4.3
Large vessel stiffness index (m/sec) 6.1-9.4 - standard	6.1±0.3	6.3±0.5	6.2±0.2	6.3±0.4
Index of blood circulation system (%), standard - 30-48, over 48% - high tone of small muscle arteries	31.8±3.9	30.3±2.8	33.5±4.2	30.9±3.1
Periphelar vascular resistance (Pa·s/min ³) 1287-1331 - standard	1406.0±162	131.6±198	1356±174	1340±201
Cardiac output (liter/min) 4,3-6,1 л/мин - standard	5.0±0.6	5.6±0.8	5.3±0.8	5.8±0.5
Heartrate (bpm)	82.5±15.3	81.6±19.1	83.1±10.0	77.1±9.2
Bloodpressure (mm. Hg)	76/129	82/124	79,1/124,5	82/125
SDARR (cardio intervals) (conv. units)	45.6±4.3	47.2±4.9	43.1±3.9	45.2±5.1
Frequency indicator of the activity of the autonomic nervous system (conv. units), 0.8-1.7 - standard, increases with hyperthermia and fibromyalgia	1.2±0.2	1.1±0.2	1.09±0.4	1.1±0.3
Blood oxygen saturation level (%), 96-99% - standard	96.7±0.9	96.2±1.6	96.9±1.4	97.2±0.8

Integral assessment of the functional state (points, up to 100 points), according to the «Esteck System Complex» method	86.5±7.8	90.1±6.9	92.3±5.4	93.8±2.1
Muscle mass (%)	39.7±3.1	49.5±12.8	42.9±4.3	51.7±6.4
Lung capacity (ml)	2215±240.8	3905±510	2570±358	4110±380
The Ruffier index (усл. ед.), 7-9 conv. units – average level (the level of heart' readiness for physical activity)	12.4±2.7	12.6±3.6	11.3±3.1	10.8±1.9
Number of steps per day (amount) application «Health»	4500-6000		8062*	
Biological age (years), computer program «Omega - M»	24.5	20.1	21.9	20.0
Adequacy of regulatory processes (conv. units) «Omega - M» (standard 15-50 conv. units)	44.2±5.1	42.7±6.6	38.6±5.6*	30.6±3.6*
Physical shape (%) max. 100%, «Omega - M» methodology (general level of sports fitness)	33	62	48*	73*
Level of regulation of the cardiovascular system («double product», conv. units); 81-90 – average; 91-100 – below average; 101 and over – Low-value of regulation.	101.1±13.2	94.6±10.0	92.3±11.8	90.2±7.3

Note: \bar{X} - the arithmetic mean, σ – mean square deviation, * - significant differences in result.

Within the framework of regular classes and increase of motor activity it was possible to achieve positive dynamics of results (table 1). The proportion of students, who regularly participate in sports sections, has changed: girls from 20.2% to 38.4%, boys from 52% to 71%.

Parameters of the physical shape (the general level of sports fitness) according to «Omega – M» method have changed for girls from 33% to 48%, thus the maximum of the physical shape make 100%. For boys the physical shape in the beginning of research has made 62%, in the completion of experiment - 73%.

It should be noted, that results of morphofunctional state for boys are higher in comparison with girls' results. Results investigated at the beginning of each academic year were higher, in comparison with those in the end of academic year (April-May). The mean square deviation of results is higher at the beginning of experiment and slightly decreases to its end. The Ruffier index (heart' readiness for physical activity) in group of boys has changed from 12.6 to 10.8 conv. units, differences are not accurate, in group of girls from 12.4 to 11.3 conv. units – differences of results are not accurate. As a result of expansion of fitness' means in sports education of students the «low» level of reaction to physical activity has changed from 33 to 17.1%, a «satisfactory» level from 33 to 28%, the «good» or «average» level of reaction has increased from 25.3 to 41.2%. Dynamics of an «excellent» level has changed from 6.7 to 12.8% (2017-2020). It indicates, that students respond to physical activity more appropriately at the end of experiment. The increase in the proportion of students who regularly participate in sports sections also contributed to the achievement of this result.

The analysis of the scientifically-methodological literature has shown the tendency to reduce morphofunctional state of students from 1st to 3rd year. The research managed to achieve positive dynamics due to the transformation of physical culture facilities, the reform of the student's sports club, the provision of an individually-typological health card, the expansion of digital tools for monitoring and stimulating motor activity.

Discussion

Foreign pedagogical experience has shown (China, Great Britain) that today training in the «STEM» format (immersive education) is in demand (Churchill, 2018; Kelly & Knowles, 2016). Which contains a research approach, an activity-oriented attitude to the subject, «digital literature», the concept of immersive education, new forms of learning «STEM», including those based on libraries (Great Britain) (Khomenko, 2019). Experts from Bulgaria state that modern e-books should contain: 1) animated GIF-files; 2) built-in audio and or video applications; 3) dynamic generated content from web sources; 4) dynamic tables with data from external sources; 5) links to external sources, multimedia applications; 6) polls and research. All these requirements should relate to educational materials on sports, an active lifestyle, and independent trainings. To create a «file-like» e-book you should use: MS Office, Apache Open Office, Libre Office (for Windows); a web environment for creating and sharing documents, such as MS Office 365, Google Documents, Only Office, and others (Ilieva, 2019; Stoyanov, 2018; Stoyanova, 2018).

Not to forget to mention online resources that make population to do sports are rapidly developing abroad (Canada, USA, Great Britain, Germany, Australia, France). Majority of online resources are aimed at helping in individual physical education, choosing the type of physical activity, section and a sport facility. The main indicator of the development of online resources in the sports industry is the proportion of the population regularly involved in sports.

Considering mass sports and physical recreation, let us highlight the experience of USA research. In 2019, was held an experiment on the health effects of walking in the range from 7500 to 12500 steps per day. To assess motor activity, pedometers were used (New-Lifestyles, USA). The researchers examined the body composition, resting blood pressure, blood lipid profile, fasting blood glucose, and a 3-minute walk test to assess cardiorespiratory fitness. These measurements were made at the beginning of the experiment and after 4 months of control. The studied men and women of the second mature age tried to take 12.8 thousand steps a day. To do this, they had to increase their range of motion by 3300 steps per day (Masi et al., 2019).

As a result, a decrease in body mass index from 27.2 to 26.9 units; a decrease in the total percentage of body fat from 35.7 to 34.3%. A decrease was revealed in waist volume from 83.8 to 81.5 cm ($P = 0.001$). Along with this, there was an unexpected increase in low density lipoprotein cholesterol from 109.7 to 117.6 mg / dL. The level of fasting blood glucose decreased, with an average decrease of 13 mg / dL.

American researchers proposed to classify people based on pedometer data: daily activity <5000 steps per day – «sedentary work», 7500-9999 steps / day – «somewhat active work», 10-12 thousand steps – «active lifestyle» and over 12.5 thousand steps – «very active lifestyle» (Finkelstein et al., 2016; Jakicic et al., 2016; Masi et al., 2019).

Conclusions

A high assessment (10 points) of the information-digital educational environment in sports at the university is expressed by 21.7% of students, an assessment at the level of 9 points - 19.1%, an assessment corresponding to 8 points - 24.7% of the surveyed students-economists.

At the end of the experiment, 75.3% of the respondents emphasized their preference for full-time education in all disciplines, including physical education. Distance learning was preferred by 2.8% of respondents. With Nuisance training chosen by 21.9% of students. In the restructuring of physical education, 45% of students recommended expanding the introduction of mobile applications. Further, 26.7% of students are interested in the topic of fast and effective methods of strengthening the muscle component, increasing muscle tone, and reducing body weight.

As a result of the experiment, the adequacy of the regulation processes for both boys and girls significantly changed in students. The positive dynamics of the level of regulation of the cardiovascular system and other morphological and functional indicators was revealed. These indicators testify the effectiveness of the used means of physical culture, means of stimulating classes in the sports sections. As information, digital technologies, helping the operator explicitly assess the health indicators, and so guides to manage their health status.

As a result of the expansion of fitness means at physical culture lessons, the «low» level of response to physical activity changed from 33 to 17.1%, «satisfactory» level from 33 to 28%, «good» or «average» level of response increased from 25.3 up to 41.2%. The dynamics of the «excellent» level of response to the load is 6.7-12.8%, which indicates that students respond more adequately to physical activity at the end of the experiment; the achievement of this result was also facilitated by an increase in the proportion of students regularly involved in sports the dynamics of girls ranged from 20.2% to 38.4% for girls, and for boys from 52.0% to 71%. The exception was the pandemic period of March-June and November-December 2020. Data on the number of trainees is given at the beginning of March 2020.

The expansion of fitness facilities and the transformation of the information and digital educational environment for sports at the university have proven their effectiveness.

Conflict of interest

The authors state that there is no conflict of interest.

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