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Theoretical Aspects of the Concept of Forming a Future Engineer's Professional and Applied Physical Culture in a Technical University

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Abstract. Theoretical aspects of the formation of a future engineer's professional and applied physical culture in a technical university are based on the fact that professional and applied physical training should be focused on the process of professional development and implemented along the lines of “training goal → competence → readiness for work.” For this purpose, the concept of professional and applied physical training of bachelors was explicated as a mechanism for implementing the formation of professional and applied physical culture of bachelors in a technical university, aimed at developing professionally important physical and personal qualities, as well as adaptive abilities of future engineers, ensuring their readiness for work.

Keywords: concept, bachelor's degree, physical education, physical culture, formation, professional and applied physical culture.

Research area: theory and methodology of physical education, sports training, health-improving and adaptive physical culture.

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Теоретические аспекты концепции формирования профессионально-прикладной физической культуры будущего инженера в техническом вузе

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Аннотация. Теоретические аспекты формирования профессионально-прикладной физической культуры будущего инженера в техническом вузе базируются на том, что профессионально-прикладная физическая подготовка должна быть ориентирована на процесс профессионального становления и реализовываться по принципу «цель обучения → компетентность → готовность к труду». Для достижения этого была эксплицирована концепция профессионально-прикладной физической подготовки бакалавров как механизма реализации процесса формирования профессионально-прикладной физической культуры бакалавров в техническом вузе, направленного на развитие профессионально важных физических и личностных качеств, адаптационных способностей будущих инженеров, обеспечение их готовности к труду.

Ключевые слова: понятие, бакалавриат, физическое воспитание, физическая культура, образование, профессиональная и прикладная физическая культура.

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Introduction

Modernization of tertiary education contributes to the stable economic and social development of a state. The program documents and resolutions of the Government of the Russian Federation on education policy emphasize that providing the modern bachelors with the necessary knowledge, competencies and behaviors, as well as their ability to adapt to the constantly changing requirements of technological progress now and in the future, are one of the decisive factors for the success of the state and society as a whole. The world economy is currently developing in the context of globalization, presenting its requirements for national economies, which should be competitive under the conditions of the scientific and technological revolution. At the

present stage of the Russian economy development, one of the strategic goals is to improve the quality of vocational education. The main task of vocational education under modern conditions of the economy's priority areas development is formation of the readiness of specialists with a high level of professionally important qualities development that will allow them to improve the adaptive abilities of future engineers in the educational process of a technical university to ensure their effective work.

Discussion

The modern Federal State Educational Standard of Higher Education (Federal State Educational Standard of Higher Education 3++), based on the competence approach, is aimed

at forming such competencies that will allow a future engineer to be a subject and object of labor activity, a qualified performer of professional functions, and to act effectively in various industrial situations. The educational process of the discipline «Professional and Applied Physical Culture» is aimed at developing and improving professionally important physical and personal qualities, providing a social mandate for the professional training of a future engineer who is ready for productive work that meets the high requirements of the future economy. The State Duma has submitted a draft law on amendments to the Federal law «On Education in the Russian Federation» in the direction of modernization of professional students' training. The high level of complexity of modern production and the economy of the future make high demands not only on professionally important personal qualities of future engineers but physical ones, that enhance the adaptive ability of a bachelor to ensure efficient labour activity of a future engineer.

Russian scientists have conducted deep and diverse studies in the field of formation of professional and applied physical culture of a future engineer in a technical university, but they are insufficient. Western researchers pay little attention to these problems, since the formation of physical culture in foreign universities is of a sport-specific nature, which, in our opinion, does not allow to fully use the university capabilities to form readiness of future specialists for effective work. Since the aim of modern higher education is training of competitive specialists in accordance with the ever-changing demands of the economy, we believe that training in high school should be directed, in particular, on the formation of professional and applied physical culture of future engineers. In this regard, the development of theoretical aspects of the concept of formation of professional and applied physical culture of a future engineer in a technical university is still timely and relevant.

The main idea of the concept of formation of professional and applied physical culture of a future engineer in a technical university is expressed in the fact that educational process, as a space of various opportunities, has a multifactorial influence and acts as an acting driving

force, which is based on a variety of potentials for the pedagogical activities' implementation. The educational process of a technical university allows to create the necessary pedagogical conditions and carry out pedagogical actions, contributing to the formation of a future engineer's readiness for work.

The mechanism for implementing the formation of professional and applied physical culture of a future engineer in a technical university is professional and applied physical training, which includes certain methods, means and forms of physical culture aimed at readiness for work in various professions. Therefore, professional and applied physical training at university should have a special orientation, taking into account the features of a future engineer's job functions.

In order to determine the special orientation of professional and applied physical training of bachelors in a technical university, we conducted a creative understanding of professional standards of engineers. This led to the development of author's educational practice-oriented programs for year-round and long-term training, which harmoniously combines the forms of educational and extracurricular activities in the «teacher-student» system. Our research has shown that a specially oriented focus of professional and applied physical training provides cognitive and professional and applied physical training for future engineers who develop and improve professionally important physical and personal qualities, ensuring readiness for specific work activities. We found out that professional and applied physical training is focused on the process of professional development of a future engineer in the line «training goal → competence → readiness for work.»

As a part of the study of the theoretical aspects of the concept, the concept of professional and applied physical training of bachelors is explicated. It is shown that this is a purposeful process of developing and improving professionally important physical and personal qualities that increase adaptive abilities of future engineers in the educational process of a technical university, mastering professional and applied knowledge and methods of activity that ensure

their readiness for work (Biglov, Seluianov, 2018; Borisov, 2012; Zhegalova, 2012). The readiness of future engineers to work in the educational process of a university is an active and effective state of an individual, an integral characteristic expressed in an individual's capabilities and abilities to carry out professional activities in the engineering field effectively. As a part of the development of theoretical aspects of the concept, we have identified and justified result-oriented pedagogical factors as the driving force of the educational process that determine the goal, content, and pedagogical activity (Martirosova, Byzov, 2012). The first factor in the formation of professional and applied physical culture of a future engineer in a technical university is a special orientation of professional and applied physical training. Its essence is to take into account the requirements of a particular profession for the development and improvement of professionally important physical and personal qualities necessary in the workplace. The second factor follows from a number of characteristics of the integral educational process of the university. It is connected with the development of a comprehensive system training approach to professional and applied training of a future engineer. Professional training should be carried out both during school and out-of-school time with the active use of various methods, forms and means of physical culture, which is due to the development of professionally important physical and personal qualities, organized year-round in the order of long-term training, carried out within the organization of the continuous educational process. The third factor is the organization of effective interaction in the «teacher-student» system, which allows a teacher to implement pedagogical actions, carry out pedagogical support, and provide a future engineer with an opportunity for individual development, personal and professional self-realization, and professional development.

The successful implementation of the pedagogical plan is facilitated by pedagogical conditions as parameters of the educational process factors, which represent a set of measures that ensure pedagogical activity and the implementation of the goal of pedagogical in-

fluence. Pedagogical conditions for the impact of the selected factors of the university educational process are focused on: determining the essence of the specially oriented professional and applied physical training of a future engineer; pedagogical organization of continuous specially oriented professional and applied physical training; organizational and pedagogical support of specially oriented professional and applied physical training in a technical university by a teacher.

The theoretical aspects of the concept of formation of professional and applied physical culture in a technical university developed by the authors determine the potential that ensures readiness for work of a future engineer, achievement of the proper level of cognitive and professional, as well as professional and applied physical fitness necessary for the development of professional knowledge and skills for full-fledged professional activity, forming universal competencies and professionally important qualities.

We have shown the formation of a professionally applied physical culture at a technical university using the example of training a future engineer in the forest industry. According to the Federal State Education Standard of Higher Education 3++, future engineers in the forest industry should have: developed thinking with the ability to perceive information, analyze and generalize it; the ability to work in a team, build effective relationships, make organizational and managerial decisions in unusual situations; the ability to critically evaluate their strengths and eliminate shortcomings; desire for self-development. We have conducted an analysis of professional competencies. It is concluded that the knowledge and skills gained in the process of professionally applied physical training will help a future engineer to overcome various natural obstacles (water barriers, difficult terrain: mountain trails, steep slopes, talus, glaciers, swamps, forest debris and etc.), to deal with natural disasters and extreme situations (orientation in the forest, making a fire, setting up a tent, the ability to provide first aid, etc.). Developed physical qualities will help a future engineer to perform certain types of labor activities. Analysis and understanding of

the characteristics of the labor activity of forestry engineers showed that they also need to be strong-willed, have organizational and communicative abilities, responsibility, endurance, the ability to maintain emotional stability, high working capacity in various stressful situations, and relieve emotional stress. The labor activity of forestry engineers is mainly related to work in the field: special working conditions, characterized by unsettled work and life of workers and location of production facilities outside urban settlements. That caused the selection of professionally important physical qualities of an engineer in the forest industry: endurance, strength, speed, flexibility, agility. These qualities are developed and improved by the means of physical culture (M. Ya. Vilensky, G. P. Gribov, I. G. Damanskas, Yu. P. Derganov, E. P. Yezhkov, P. F. Lesgaf, R. T. Raevsky, N. F. Storcheva, O. V. Tsarkova, V. T. Chichikin and others). As a set of body properties, providing the ability to carry out active motor activity, these qualities need constant development and improvement, that is, a long process of targeted comprehensive impact of physical exercises (Dudkina, 2006; Martirosova, Byzov, 2012; Sergeeva, 2012). Professionally-applied physical training activates functioning of all body systems, strengthens the musculoskeletal system, develops applied physical and psychological qualities, enriches the experience of sports and fitness activities (Yu. G. Berdnikov, I. R. Vyshakovskaya, Yu. I. Grishina, G. P. Guk, A. I. Davidenko, Yu. I. Evseev, Yu. S. Zhdanov, O. L. Zhukova, U. I. Ibragimov, V. I. Ilyinich, O. A. Kozlyatnikov, N. G. Lipskaya, A. L. Madelyan, O. M. Samokhvalova, N. F. Storcheva, J. K. Kholodov, E. V. Shulga and others). The labor activity of forestry engineers requires a great deal of physical and mental strength, which make up a complex of professionally important physical and personal qualities as individual qualities of the subject of labor activity that determine its effectiveness (A. A. Derkach, E. F. Zeer, A. K. Markov, V. D. Shadrikov).

A specially oriented professional and applied physical training of a future engineer at a technical university is a pedagogical process aimed at the formation of professionally important physical and personal qualities neces-

sary in a particular work activity and contributing to the achievement of readiness for it, including certain means, methods, techniques and forms of physical education. The specially oriented professional and applied physical training of a future engineer takes into account the features of the profession of engineers, provides for general and special physical training, is based on the principle of continuity, implemented both in academic and extracurricular time using all the possibilities of physical culture, takes up a significant part of the training time, and promotes the development of professionally important qualities (Il'ich, 2007; Martirosova, Byzov, 2012; Nемов, 2003).

The theoretical aspects of the concept of the formation of professional and applied physical culture in a technical university which is being developed using the example of a future engineer in the forest industry, should be implemented through pedagogical content structured into organizational and methodological blocks based on the leading principle of physical culture – the principle of continuity: professionally oriented, climate-friendly biorhythmic, individually independent, control and correction step by step: the first step is compulsory analytical (1 year); the second step is correctional and developmental (2nd year); the third one is formative-training (3 year, 5th semester); the fourth step is the final presentation (3rd year, 6th semester) with the help of: the developed generalized experimental practice-oriented curriculum of specially oriented professional and applied physical training, including programs for the development and improvement of professionally important physical and personal qualities of a future engineer. It has been established that professionally important physical qualities are applied motor skills and skills necessary in the labor activity of forestry engineers. They ensure the performance of certain types of work (for example, field work), contribute to the effective implementation of production tasks, increase the body's functional capabilities and adaptive abilities of a future engineer.

Professionally important personal qualities include a set of psychological (volitional, communicative, organizational qualities, the

ability to self-regulate mental states, etc.) and applied special qualities (the body's ability to withstand the specific effects of the external environment) that determine the effectiveness and are essential for the work of future forest engineers' industries, the development and improvement of which is provided by a variety of forms, means and methods of physical education (Nemov, 2003).

During the study time, the professional and applied physical training of a future forestry engineer provided for theoretical and practical training using a set of physical culture and sports means that selectively develop the necessary professionally important physical qualities. These qualities were developed by long walking, moderate and variable intensity running, skiing, orienteering, athletics, biathlon, used elements from weightlifting, exercises of sports and auxiliary gymnastics with weights and resistance, sprinting exercises, outdoor and sports games. We applied methods of teaching movement over rough terrain (walking, skiing, cycling, etc.), methods of self-control, additional means of increasing general and professional performance, theoretical lessons on the prevention of occupational diseases and injuries, first aid, etc. We actively used climbing vertical surfaces (to foster a sense of balance), special obstacle courses (to overcome difficult sections of the forest), as well as hanging, swinging and rotating sports equipment, a visit to the pool to learn different methods of swimming, diving, and the rules of rescue on water.

At out-of-school time, professional and applied physical training of a future engineer continued during the summer training and production practices. To do this, we have developed a special program of pedagogical support, including special training classes in specially applied sports, mass events with professionally applied goal setting, and individually-independent classes. Reshetnev Siberian State University of Science and Technology (Sib-SU) students train and practice in the territory of the Karaulny forestry, the climatic and geographical conditions of which present a unique opportunity for the development and improvement of professionally important physical qualities of a future forestry engineer. The

territory with a diverse landscape (flat terrain, terraces with elevations, taiga forest, lowland marshes, etc.) allows to walk a lot; rivers – to develop skills of behavior on water, master the basic methods of swimming, carry out tempering procedures; fresh air, a bathhouse, sports grounds, and sports equipment – to carry out various sports and recreational activities. The pedagogical activity is aimed at organizing a specific regime of the day, morning hygienic gymnastics, physical training, hygienic and tempering procedures, air baths, terrain, walking combined with running, game sports, outdoor games, sports events, and competitions in various sports.

During examination sessions and vacations, future engineers develop and improve professionally important physical qualities on their own using individually developed sets of exercises (applied physical exercises and individual elements from various sports, applied sports, health-improving forces of nature and hygiene factors), control and correction systems in collaboration with the teacher. The proposed concept recommends the use of independent analysis, control, correction of the physical and psychophysical state, monitoring the dynamics of professionally applied physical fitness and keeping personal diaries. In the third year, future engineers are recommended to demonstrate practical skills in performing individual professionally oriented complexes of physical exercises, knowledge of techniques and methods of controlling physical fitness, protecting abstract works, and presentations of professionally oriented projects. The interaction of the teacher and students significantly enhances the effect of classes on the development and improvement of professionally important physical qualities, ensures the continuity of the pedagogical process in the academic and extracurricular time.

The development of theoretical aspects of the formation of professionally applied physical culture of a future engineer in the forest industry in a technical university includes development and improvement of professionally important personal qualities carried out in three areas: theoretical, practical, as well as control and correction. The theoretical direction pro-

vides the formation of students' motivation; practical includes training and development of certain physical exercises and methods of psychophysical self-regulation; control and correctional provides an assessment of the level of formation of professionally important personal qualities. To develop and improve professionally important personal qualities, we suggest using appropriate physical culture means (physical exercises, various sports) and methods of psychophysical self-regulation (autogenic training, relaxation, meditation, self-hypnosis, psychophysical training, recreation). The process of development and improvement of professionally important physical and personal qualities of a future forest industry engineer in the educational process of a university provides for an individual style of pedagogical activity, based on the knowledge and skillful use of students' physical and psychological resources, includes the development of individual recommendations for optimizing their preparation for work within the framework of the educational discipline «Professional and Applied Physical Culture».

Conclusion

According to the developed theoretical aspects of the concept of forming a future engineer in a technical university of professional and applied physical education, the organization of pedagogical activity in modern conditions must be carried out in accordance with the Federal State Educational Standard of Higher Education 3++, which focuses on the formation of universal competencies, to develop and improve professionally important physical and personal qualities that help to perform various types of work and activities. To do this, it is necessary to develop the content of specially oriented professional and applied physical training, reflecting the features of a future

engineer's work with an emphasis on the principle of continuity, consisting in year-round and long-term training, taking into account the periodization of the educational process, according to the developed plans and programs with their step-by-step implementation. The mechanism for the implementation of the formation of professional and applied physical education in a technical university is professional and applied physical training, which is aimed at the formation of cognitive and professional and professional and applied physical readiness of a future engineer, expressed in the acquisition of professionally-applied knowledge, in the development and improvement of professionally important physical and personal qualities required in specific labor activities aimed at achieving the readiness to work with the help of certain means, methods, techniques and forms of physical education in the educational process of the university.

The analysis of the results of introducing the theoretical aspects of the concept of forming a future forestry engineer at a technical university as a future forestry engineer showed that most bachelors correlate scientific knowledge about the possibilities of physical education with professional and personal values; analyze the requirements of the future profession for personal characteristics; express a selective attitude to the proposed means of physical education and methods of psychophysical self-regulation; demonstrate the ability to self-control emotional states. It is active in the development and improvement of professionally important qualities using methods and means of physical education to prepare for work. The obtained results indicate that the introduced theoretical aspects of the concept of the formation of professional and applied physical culture of a future engineer at a technical university are quite effective.

References

Biglov, M.M., Seluianov, A.A. (2018). Formirovanie urovniia kompetentsii vypusnikov IVTO metodami fizicheskoi kul'tury [Formation of The Level of Competence of IMTE Graduates by Physical Culture Methods]. In *Aktual'nye problemy fizicheskoi kul'tury, sporta i turizma: materialy XIII Mezhdunarodnoi nauchno-prakticheskoi konferentsii* [Topical Issues of Physical Culture, Sport and Tourism: Materials of the XIII International Science to Practice Conference]. Ufa, RIK UGATU, 75-80.

Borisov, A.B. (2012). *Formirovanie professional'no-prikladnoi fizicheskoi kul'tury kursantov morskikh kolledzhei, obuchaiushchikhsia po napravleniiu «Ekspluatatsiia vodnogo transporta i transportnogo oborudovaniia»: dissertatsiia ... kan.ped. nauk: 13.00.04* [Formation of Professional and Applied Physical Culture among Marine Colleges Cadets Studying in the Field of "Water Transport and Transport Equipment Operation": Dissertation for the Degree of Candidate of Pedagogy: 13.00.04]. Krasnodar, 296.

Dudkina, Iu.I. (2006). *Formirovanie professional'no-prikladnoi fizicheskoi kul'tury studentov muzykal'nykh spetsializatsii v vuze kul'tury i skusstv: dissertatsiia ... kan.ped. nauk: 13.00.04* [Formation of Professional and Applied Physical Culture among Students of Music Specializations at the University of Culture and Arts: Dissertation for the Degree of Candidate of Pedagogy: 13.00.04]. Moscow, 219.

Zhegalova, M.N. (2012). *Tekhnologiia professional'no-prikladnoi fizicheskoi podgotovki studentov, obuchaiushchikhsia po napravleniiu «Pozharnaia bezopasnost'»: dis. ... kand. ped. nauk* [Technology of Professional and Applied Physical Training of Students Studying in the Field of "Fire Safety": Dissertation for the Degree of Candidate of Pedagogy]. Volgograd, 165.

Il'inich, V.I. (1990). O nekotorykh problemnykh voprosakh professional'no-prikladnoi fizicheskoi podgotovki [On Some Problematic Issues of Professional and Applied Physical Training]. In *Teoriia i praktika fizicheskoi kul'tury* [Theory and Practice of Physical Culture], 3, 13-15.

Il'inich, V.I. (2007). O nekotorykh problemnykh voprosakh PFP (voprosy teorii) [On Some Problematic Issues of Professional and Applied Physical Training]. In *Teoriia i praktika fizicheskoi kul'tury* [Theory and Practice of Physical Culture], 3, 53-55.

Martirosova, T.A., Byzov, A.P. (2012). Protsess formirovaniia psikhofizicheskoi gotovnosti PFP studentov leso-tekhnicheskikh vuzov [Process of Formation the Psychophysical Readiness of Professional and Applied Physical Training among Forestry Universities Students]. In *Omskii nauchnyi vestnik* [Omsk Scientific Bulletin], 2, 189-193.

Nemov, R.S. (2003). *Psikhologiia: Slovar'-spravochnik* [Psychology: Dictionary-Reference Book], (2). Moscow, VLADOS – PRESS, (1), 304.

Sergeeva, O.N. (2012). *Formirovanie psikhofizicheskoi gotovnosti k professional'noi deiatel'nosti budushchikh spetsialistov po organizatsii i bezopasnosti dvizheniia sredstvami fizicheskoi kul'tury i sporta v vuze: dis. ... kand. ped. nauk* [Formation of Psychophysical Readiness for Professional Activity of Future Specialists in The Traffic Organization and Safety by Means of Physical Culture and Sports at University: Dissertation for the Degree of Candidate of Pedagogy]. Yoshkar-Ola, 262.