

УДК 796.92

A STRUCTURAL-FUNCTIONAL MODEL OF PHYSICAL TRAINING CONTROL OF SKI-RACERS

A. V. Kucherova

Candidate of Pedagogical Sciences, Associate Professor
Mogilev State A. Kuleshov University

The article substantiates the development of a structural-functional model of physical training control of ski-racers. It reveals a specialized status of the model taking into account an individual level of specific qualities of a ski-racer. The emphasis is placed on creating the components of the physical training system and their interacting, as well as on the essence of this process in athletic training of ski-racers. The article reveals the content component of the model's physical training system in the most orderly and integrated structure of interaction that increases the effectiveness of the training process.

Key words: a model, control, a system, physical training, a structural-functional model, ski-racers.

Introduction

Analyses of scientific and methodological publications show that there exist an insignificant number of works by I. M. Butin (1988) [1]; V. D. Evstratov, P. M. Virolainen, G. B. Chukardin (1988) [2]; V. N. Manzhosov, I. G. Ogoltsov, G. A. Smirnov (1979) [3], V. D. Evstratov, B. I. Sergeev, G. B. Chukardin (1989) [4], in which the issues of physical training of ski-racers are comprehensively considered. They partially take into account the specificity of the process. At the same time, organization of physical training of ski-racers is represented only by its types (general and special) and various techniques of developing physical qualities.

While analyzing the scientific sources, we did not discover in them the structuring of physical training as an independent component in an overall scheme of the training process. There is also a shortage of scientific and methodological publications that substantiate the biological process of adaptation of a skier's body to load components of physical training. It should be noted that some techniques are not relevant and do not meet modern requirements for training ski-racers.

The content of techniques for developing physical qualities is reasoned by subjective empirical criteria, is inadequate in understanding the issues of introducing the latest sports technologies and is often divorced from fundamental sciences. It is problematic for trainers to choose techniques for the development of physical qualities, as they lack clarity of presentation and systematization of methods with the ability to differentiate means of physical training, taking into account characteristics of an individual profile of physical fitness. These circumstances have a rather negative impact on the quality of physical training of athletes in cross-country skiing.

This disorder, the lack of systematized knowledge and the diversity of empirical and analytical information cause the absence of structured physical training of ski-racers as an integral system, which made it possible to identify the following contradictions:

- between the need to improve the quality of the educational and training process and the lack of theoretical and methodological foundations of the essence and content of physical training of ski-racers as an integral system;

© Kucherova A. V., 2024

- between the objective need to use new modern techniques for developing physical qualities of ski-racers and insufficient knowledge of the process of their organization, structuring the order of application and control of the physical training system.

In addition to these contradictions, there are a number of organizational and methodological issues that are open to discussion. Hence, the relevance of the problem of developing a physical training model that allows improving the training process of ski-racers becomes obvious.

Main Body

An analytical study of the works of P.K. Anokhin (1978) [5], V.P. Bepalko (1977) [6], V.V. Guzeev (1999) [7], N.V. Kuzmina (2002) [8], devoted to modeling educational process and educational systems, made it possible to systematize the main components of physical training and compare them in terms of structural and procedural correlation with the components of the educational system.

In our opinion, physical training has similar *structural components* to those of the educational system. The structural components of physical training correspond in content and quantity to the model of the educational system. Thus, at each stage of a multi-year plan in the structure of physical training there are such components as a teacher (a trainer), the content of education (the content of training), a form of education (a training session), a student (an athlete), a goal (a sport result).

From the perspective of the objectives of our research, we logically compared the structural components and arranged them into a system.

A trainer (a subject) as a teacher carrying out guiding activities, in *the form* of a training session, affecting an athlete (a student), introduces *the content* of physical training in the form of exercises with regulated physical load *an athlete (an object)* implements training and cognitive activities, masters and assimilates the content of physical training, this activities form his physical fitness, which is *the goal* of the system.

Данные структурные компоненты процесса физической подготовки характеризуют ее как образовательную систему (рис. 1).

These structural components of the physical training process characterize it as *an educational system* (Fig. 1).

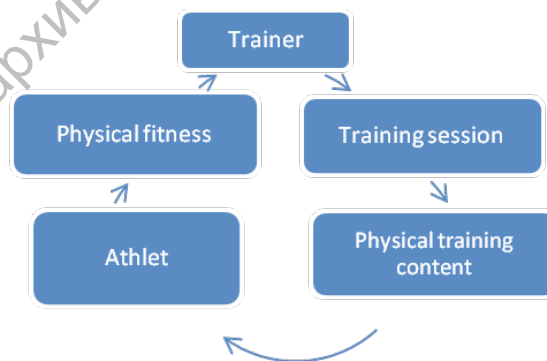


Figure 1 – Physical training as an educational system

In this logical chain, structural components interact between themselves, wherein performing certain independent procedures. These procedures can be called *process components*. The interaction of structural and process components corresponds to the

fact that physical training, which has traditionally been considered as process, has every reason to be classified as a “functional system”.

According to the principle of synergy, the components interaction enhances the functional efficiency of the entire system in the educational and training process of ski-racers. The result of the interaction of these components is the formation of new integrative properties in the system, which are not identical to the properties of the components that form the system itself. Therefore, the physical training system is presented as an integrative structure, including four components: target, content, technological and effective. The model of the physical training system is presented in Figure 2.

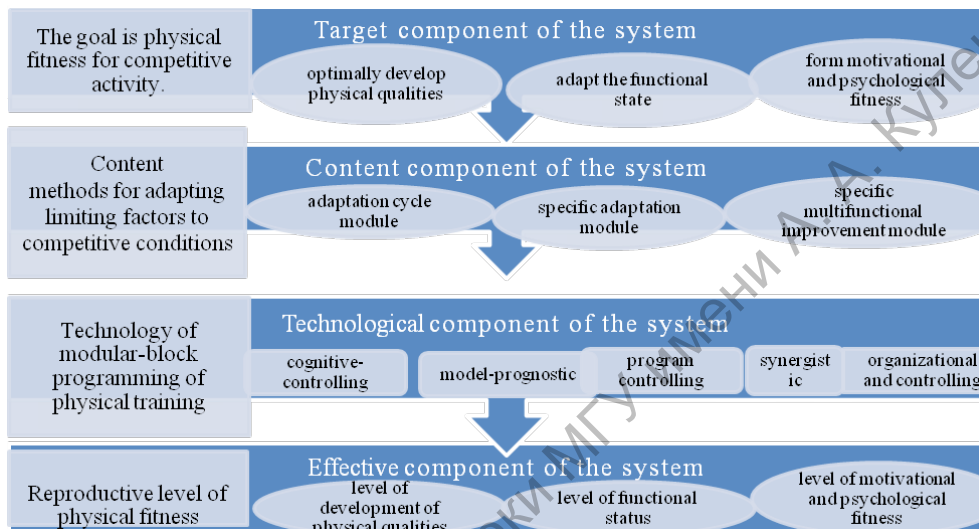


Figure 2 – A model of the physical training system of ski-racers

The target component includes the goal and objectives. The purpose of the system is to optimize creation of the structural components of the athlete’s physical training, the functioning of which purposefully causes changes in the functional state of the skier, promotes the development of individual training and physical fitness for certain competitive activities.

The setting of physical training goals is carried out on the basis of the athlete’s individual fitness, analysis of the experience in competitive activities, taking into account the model characteristics of recent competitions, practice of organizing the training process at previous stages and periods of the athlete’s training. Objectives determine the way to achieve quantitative indicators of the athlete’s physical performance in relation to the development of a certain physical quality, functional readiness, expressed in indicators of the athlete’s functional state, as well as indicators of psychological readiness for the planned training activities.

A comprehensive, cyclical and successive solution to the problems posed in the annual macrocycle is possible with targeted planning of microcycles, mesocycles and periods. At the same time, each of these structural elements has its own specific list of tasks, which is in full connection with the main target orientation in the macrocycle towards the formation of high physical fitness of the athlete.

The content component is represented by methods of adapting the limiting factors of the athlete’s physical training to competitive conditions, which are programmed as

a plan and are realized on condition of its implementation. From a certain group of methods, programs of training exercises and coordinated interaction of all components of the system are formed. The content of the methods consists of load components that logically interact with each other. These include means, quantitative indicators of the load: volume, intensity, intervals and character of rest.

The adaptation cycle module is represented by the organization of means and methods, the primary focus of which is the mobilization and current activity of the morphofunctional systems of the athlete's body in relation to the activation of specific homeostatic reactions caused by a specific load in the previous adaptation cycles of the training process. Yu. V. Verkhoshansky in his studies represents this state of the athlete as a phase of urgent adaptation [9]. And the scientist notes that the appearance of this phase is ensured mainly through the following means: special physical training of optimally large volume and relative intensity, activating the functioning of the motor apparatus, as well as vegetative and energy systems, potentiating their activity [9, p. 43].

The specific adaptation module is represented by means and methods that cause a stress syndrome in the functional systems of the skier's body. The occurrence of the stress syndrome is a very important factor for the process of transition to long-term adaptation of the athlete's body. Yu. V. Verkhoshansky indicates its importance for the entire adaptation system of the body and points out that hormonal changes, occurring in a state of stress, induce adaptive protein synthesis and its supply of amino acids. The stress syndrome potentiates the formation of structural transformations that form the basis of its specific adaptation to a given mode of operation. Metabolites act as biosynthesis inducers, which makes it possible to coordinate the plastic support of a function with its actual activity, as well as the correspondence between the breakdown of obsolete cellular elements and their renewal [9, p. 63].

The specific multifunctional improvement module is the final module of the entire system, which is the result of the work of the previous modules. In his studies Yu.V. Verkhoshansky presents this phase as the completion of the adaptation cycle. The main sign of the onset of this phase is the athlete's manifestation of a higher level of performance. In this regard, in the content of this module we included means and methods that, in addition to the process of improving the adaptation effect, also solve the research problem of identifying the onset of this phase. The corrective element of the system in this module is the quantitative indicators of the athlete's physical, psychological and functional fitness in accordance with the stage of preparation.

The technological component is represented by the technology of modular-block programming, which consists in choosing and implementing, correcting the structural and functional components of the physical training system. The content of technology functions is presented by ways and techniques of interaction between the trainer and the athlete in creating a model of the athlete's individual physical training. A special role in this process is given to the use of information technology means of collecting information for the purpose of self-control and pedagogical control. The rational choice of means and methods of physical training is carried out on the basis of taking into account the specific characteristics of those involved, indicators of the training effects and, in general, the dynamics of the athlete's performance level.

The effective component reflects the final result of the physical training process and is expressed in indicators of the athlete's physical fitness: the optimal level of development

of physical qualities, an increased level of the functional state and motivational and psychological readiness for competitive activities.

The interaction of all components must have a certain control structure, special ordering and hierarchy, which ensures the full functionality of the model. In this regard, we have developed *a structural-functional model of physical training system control*, which is a targeted, dynamically progressing structure containing theoretical, methodological, technological information that predetermines the logic of implementing the physical training system of ski-racers. The model sets the goal and a general scheme for the control over the entire physical training system. This model takes into account the peculiarities of building the training process of ski-racers, harmoniously integrating physical training into the overall educational and training process, and it also allows you to form an individual trajectory of the athlete's physical fitness.

Control implementation involves the systematic passage of three periods: preparatory, competitive and recovery. Each period should be considered as a subsystem, which has its own organization, continuity of tasks and relationship with other periods. Despite the fact that each period has a certain specificity of processes, in general it is aimed at solving the common problems of the entire system.

From the point of view of a system approach, the presented model includes morphological, structural and functional objects that combine functional elements into a single whole - a pedagogical system.

Process components corresponding to the goals and objectives of the athlete's physical training have been identified, and on this basis *a structural-functional model of physical training system control of ski-racers* has been developed. It is presented in Figure 3.

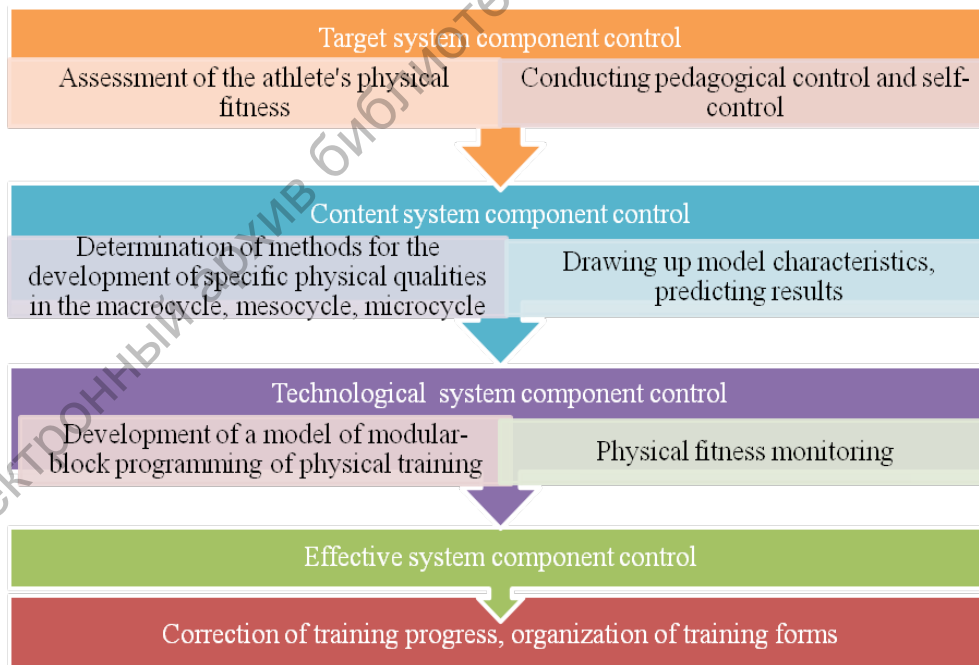


Figure 3 – A structural-functional model of physical training system control

Physical training system control is based on informative data about the athlete's capabilities, which are constantly changing under the influence of load components. The informative data include the following information:

- about the current state of the athlete, his physical condition, motivation, mood to perform the upcoming load;
- about the completed volume of the training load, its intensity, complexity;
- about the dynamics of the functional and psychological state;
- about indicators of the athlete's training and fitness state, the immediate, delayed and cumulative effects.

Physical training system control of ski-racers is a more detailed function carried out by the trainer with the active motivated participation of the athlete, while the object of control is the athlete and his condition.

Conclusion

1 The structural-functional model of physical training system control of ski-racers is represented by a logically ordered structure of components in the form of organizational units and coordination mechanisms, including target settings, content, technology and result of physical training of skiers.

2. The structural-functional model of physical training system control of ski-racers reveals and grounds the hierarchical order of the control over functional connections between the structural components of the system. The model is represented by the following functional components: assessment of the athlete's fitness; conducting pedagogical control and self-control; determination of methods for the development of specific physical qualities of the skier in the macrocycle, mesocycle, microcycle; drawing up model characteristics, predicting results; development of a model of modular-block programming of physical training; physical fitness monitoring; correction of training progress, organization of physical training forms that regulate the interaction of processes in the organizational structural components of the physical training system: target, content, technological and effective.

REFERENCES

1. **Бутин, И. М.** Лыжный спорт : [по спец. № 1910 «Физич. культура»] / И. М. Бутин. – М. : Просвещение, 1988. – 191 с.
2. **Евстратов, В. Д.** Коньковый ход? Но не только / В. Д. Евстратов, П. М. Виролайнен, Г. Б. Чукардин. – М. : Физкультура и спорт, 1988. – 128 с.
3. **Манжосов, В. Н.** Лыжный спорт : учеб. пособие для вузов / В. Н. Манжосов, И. Г. Огольцов, Г. А. Смирнов. – М. : Высш. шк., 1979. – 151 с.
4. Лыжный спорт : учеб. для ин-тов и техн. физич. культуры / под ред. В. Д. Евстратова, Б. И. Сергеева, Г. Б. Чукардина. – М. : Физкультура и спорт, 1989. – 319 с.
5. **Анохин, П. К.** Философские аспекты теории функциональных систем : избр. тр. / П. К. Анохин. – М. : Наука, 1978. – 399 с.
6. **Беспалько, В. П.** Основы теории педагогических систем. Проблемы и методы психолого-педагогического обеспечения технических обучающих систем / В. П. Беспалько. – Воронеж : Изд-во Воронеж. ун-та, 1977. – 304 с. : ил.
7. **Гузев, В. В.** Системные основания интегральной образовательной технологии : автореф. дис. ... д-ра пед. наук : 13.00.01 / В. В. Гузев. – М., 1999. – 17 с.
8. **Кузьмина, Н. В.** Педагогическая система, ее структурные и функциональные компоненты / Н. В. Кузьмина // Методы системного педагогического исследования : учеб. пособие / под ред. Н. В. Кузьминой. – М. : Нар. образование, 2002. – С. 16–18.
9. **Верхошанский, Ю. В.** Основы специальной физической подготовки спортсменов / Ю. В. Верхошанский. – М. : Физкультура и спорт, 1988. – 330 с.

Received by the editor on December 19, 2023.

Contacts: kucherova@msu.by (Kucherova Anzhelika Vladimirovna).

Кучерова А. В. СТРУКТУРНО-ФУНКЦИОНАЛЬНАЯ МОДЕЛЬ УПРАВЛЕНИЯ СИСТЕМОЙ ФИЗИЧЕСКОЙ ПОДГОТОВКИ ЛЫЖНИКОВ-ГОНЩИКОВ

В статье обосновывается разработка структурно-функциональной модели управления системой физической подготовки лыжников-гонщиков. Раскрывается ее специализированный статус, основанный на учете индивидуального уровня развития специфических качеств лыжника-гонщика. Акцентируется аспект построения и взаимодействия компонентов системы физической подготовки и сущности этого процесса в спортивной тренировке лыжников-гонщиков. Раскрывается содержательный компонент новой модели системы физической подготовки в наиболее упорядоченной и комплексной структуре взаимодействия, повышающей эффективность тренировочного процесса.

Ключевые слова: модель, управление, система, физическая подготовка, структурно-функциональная модель, лыжники-гонщики.

Электронный архив библиотеки МГУ имени А. А. Куляшова