**UDC 378**

# FEATURES OF TEACHING BIOMECHANICS FOR STUDENTS OF THE SPECIALTY PHYSICAL EDUCATION AND SPORTS

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***Abstract.*** *The work is devoted to the use of mathematical modeling methods and computer technology for research and analysis of the motor actions of an athlete. Any motor action can be analyzed from the perspective of dynamic programming, that is, a method of optimizing a step-by-step process in which, going in the analysis from the final, desired result back to the previous stage of movement, you can choose this stage so that the transition from it to the next one is optimal.*

***Key words:*** *biomechanics, mathematical modeling, computer technology, dynamic programming, optimization.*

**Introduction**.

As you know, biomechanics studies the mechanics of the movement of living beings, taking into account their anatomical and physiological features. In the process of development of human society, biomechanics passed through a number of stages and developed in parallel with other natural sciences, in particular, with such exact sciences as mathematics, theoretical and applied mechanics. [1, 2].

**Main text.**

At the present stage of the development of biomechanics, there is a need to create its applied aspects. Applied biomechanics should be based on the ideas of mathematical modeling, which were put forward by O. Fischer. For more than a hundred years of time that have passed since then, most of the obstacles that prevented the introduction of this approach to solving problems of biomechanical analysis have been removed. A mathematical apparatus has developed, which has made it possible, using numerical methods, to solve previously unsolvable problems with any degree of accuracy. Computer technology was developed and improved, on the basis of which computer mathematics systems such as Mathematica, Maple, MathCAD, OpenSim, AnyBody, GaitLab, Xsens, Vicon, Kinovea, Dartfish, Sports Motion, Coach's Eye, Hudl Technique etc. were created. That is, a method of optimizing a step-by-step process, in which, going in the analysis from the final, desired result back to the previous stage of the movement, it is possible to choose this stage in such a way that the transition from it to the next (in this case, the final one) is optimal.

And the use of the method of mathematical modeling in two-dimensional space involves the following main stages of solving the problems:

- determination of the general program of movement, controlling forces and moments of forces necessary for its implementation, general laws of realization of control forces and moments of forces;
- the presence of the main and corrective control movements in the joints, ensuring their creation of the specified forces and moments of forces;

• building a traffic improvement program.

As an object of biomechanical research, it is proposed to consider the mechanism of solving a motor problem. The universal mechanism for solving motor problems is the human musculoskeletal system.

Motor action develops in time, passing from one of its phases to another (naturally, thanks to the time factor, all phases are rigidly ordered) and belongs to the class of processes in which the optimization of the entire process is achieved by optimizing each of its stages. The parameters of the state of the process at the end of each phase are the arguments of the function of the next phase. Thus, there is a logical-temporal structuring of the motor actions.

The anticipatory reflection of this process in human consciousness is called the semantic structure of motor action. The interest of specialists in the search and development of it is constantly stable. This interest can be explained by two aspects.

First of all, the low efficiency of the use of data on the parameters of motor actions obtained and increasingly accumulated with the help of various measurement methods to solve the problem.

Secondly, the difficulties in determining the system connections of the elements of motor action, without the knowledge of which it is impossible to reveal the reasons for the high variability of the technique of its execution and to find ways to individualize the technique.

Tasks, including motor ones, can be elementary, where all the components of an analytical solution are given in conditions, and complex, where it is necessary to perform a number of actions to find the components. At the same time, each action has all the components of the task (its own question and conditions) and a mechanism for solving it. In fact, these are subordinate level tasks that are necessary tasks. In addition, it is important to note that this is not the case. In turn, the formulation of questions of a higher-level problem is a consequence of the need to solve a problem of an even higher order. Thus, the semantic structure of action is in extricable linked with the semantic structure of activity.

The relationship between the levels of the semantic structure of the exercise being studied or mastered can be characterized as follows:
1) the first level of the semantic structure (the introductory one) determines the range of issues of its second level;
2) the second level (the main one) is formed by the tasks to be researched or studied;
3) the third level (additional) is a detailed solution to the problems of the main level.

This can be explained by the example of the semantic structure of the high jump. The target component of the first, second, and third levels corresponds to the goal, the question of the motor task, *and the question of the* method. The conditioning component is the conditions for choosing an exercise, the conditions for the *motor task, and the conditions for the method*. The dividing component is the exercise, the *mechanism for solving the motor problem, the method*. One of the central concepts of the semantic structure of motor action is the mechanism of solving a motor problem.

Within the framework of the problem of increasing the effectiveness of learning

processes and improving the technique of physical exercises, the proposed approach to understanding the semantic structure of motor action allows:

➢ to optimize the process of studying motor actions, using as an object of research their semantic structures, which, acting as a guiding basis for research, are also its product;

➢ to increase the effectiveness of the implementation of one of the main methodological provisions of the principle of sequence, "from the main to the secondary", by developing training programs first for the higher levels of the semantic structure, and then for the subordinates;

➢ build a process of improving technical skills on the basis of determining the limiting mechanisms for solving motor problems and building programs to overcome limiting factors;

➢ expand the ability to identify motor errors, classifying them as incorrectly chosen ways of solving motor problems;

➢ to develop programs for improving and teaching motor actions that allow for more complete implementation of the principle of individualization, since the objects of assimilation in such programs will not be specific methods and techniques, but mechanisms for solving motor problems.

The use of a computer in conducting classes at the university contributes to the rational organization of students' independent work. This problem is very relevant andis related to the choice of optimal ways to apply it to achieve the best possible results with minimal effort and time spent by students and teachers.

Studying the movement of an athlete, studying the program of the place, orientation postures, etc. on a computer is associated with working in specialized environments. It is necessary to have an understanding of working with programs such as ACDSee, Win DVD Creator, Adobe Photoshop, Chaos Crystal, Quick Time Player, Spreadsheets Excel.

Conclusion. In the process of conducting a laboratory workshop on biomechanics, the computer is used as a simulation device and a means of supporting the training session and independent work of students. The study of a real object with the help of its computer model becomes the most important tool of cognition. By supplementing and modifying the model, it is possible to achieve a complete description of the kinematics and dynamics of the physical exercise performed by the athlete. Use of Computer Models It provides clarity in the perception of the material and allows you to overcome the difficulties caused by the complexity of the objects of study.

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