

USING INFORMATIONAL TECHNOLOGIES IN THE TRAINING PROCESS OF QUALIFIED ATHLETES

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Abstract

From year to year, the level of athlete's outcomes in different kinds of sports increases to an extremely high level. Taking into account this fact and the rapid development of information technologies in the world, there is an urgent problem of the review of modern computer programs and monitoring systems that can be used in sports, in particular in athletics. The purpose of our work was to analyze modern computer programs and monitoring systems that can be used in the training process of qualified athletes. The task of the work was to determine the peculiarities of the application of information and computer technologies in track and field athletics. The analysis of modern computer programs and monitoring systems in the field of physical culture and sports was carried out, their brief characteristics (Polar – «ProTrainer 5», Dartfish – «Dartfish Connect 5,5», Qualistys video computing complex, Fusion Smartspeed software package, Opto electronic system Opto-Gate (Jump), IMOOV three-dimensional evaluation system, SportKat 650TS simulator of stability and equilibrium, Quintic Biomechanics, Simi – Simi Matchix, Activio Sport monitoring system, Monokra 840E Monoker 840E, Myotest system). As a result of the task accomplished, modern computer technologies have been identified that provide real-time data on the functional state and the level of physical development of athletes, as well as the prevention of injuries and the preservation of health. The presented analysis of computer programs is used to obtain indicators of the level of development of physical qualities and the main characteristics of the technique of performing exercises through the use of a 3D optical-optical image. It has been established that modern research of sports equipment indicators is carried out using video-computer programs that analyze the athlete's movements. Individual computer programs use their capabilities to rehabilitate athletes.

Key words: educational and training process, functionality, computer technology, athletics.

Ярослав Свищ, Ольга Павлось, Руслан Павлось, Алла Хохла, Тетяна Дух. Використання інформаційних технологій у навчально-тренувальному процесі кваліфікованих легкоатлетів. Из року в рік рівень результатів спортсменів у різних видах спорту зростає. Зважаючи на цей факт та стрімкий розвиток інформаційних технологій у сучасному світі, постає актуальна проблема огляду сучасних комп'ютерних програм і системи моніторингу, які можуть бути використані в спорті, зокрема в легкій атлетиці. *Мета нашої роботи* – проаналізувати сучасні комп'ютерні програми та системи моніторингу, які можливо використовувати в навчально-тренувальному процесі кваліфікованих легкоатлетів. *Завдання роботи* – визначити особливості застосування інформаційних та комп'ютерних технологій у легкій атлетиці. У роботі проведено аналіз сучасних комп'ютерних програм і систем моніторингу в галузі фізичної культури й спорту, наведено їхні короткі характеристики (Polar «ProTrainer 5», Dartfish-«Dartfish Connect 5,5», відеокомп'ютерний комплекс «Qualisys», програмний пакет «Fusion Smartspeed», оптико-електронну систему Opto-Gate (Jump), систему тривимірної оцінки IMOOV, тренажер стійкості та рівноваги SportKat 650TS, Quintic – «Quintic Biomechanics», Simi – «Simi Matchix», систему моніторингу Activio Sport, Велоергометри ножні Monark 894E, Monark 828E, система Myotest). У результаті виконання поставленого завдання визначено сучасні комп'ютерні технології, які надають дані в режимі реального часу про функціональний стан і рівень фізичного розвитку спортсменів, а також забезпечують профілактику травматизму та збереження здоров'я. Представлений аналіз комп'ютерних програм, які використовуються для отримання показників рівня розвитку фізичних якостей і основних характеристик техніки виконання вправ із допомогою використання тривимірного світло-оптичного зображення. Установлено, що сучасні дослідження показників спортивної техніки виконуються за допомогою відеокомп'ютерних програм, що аналізують рух спортсмена. Окремі комп'ютерні програми за своїми можливостями використовують у реабілітації спортсменів.

Ключові слова: навчально-тренувальний процес, функціональні можливості, комп'ютерні технології, легка атлетика.

Ярослав Свищ, Ольга Павлось, Руслан Павлось, Алла Хохла, Татьяна Дух. Использование информационных технологий в учебно-тренировочном процессе квалифицированных легкоатлетов. Из года в год уровень результатов спортсменов в различных видах спорта растет. Учитывая этот факт и стремительное развитие

информационных технологий в мире, возникает актуальная проблема обзора современных компьютерных программ и систем мониторинга, которые могут быть использованы в спорте, в частности в легкой атлетике. **Целью нашей работы** был анализ современных компьютерных программ и систем мониторинга, которые возможно использовать в учебно-тренировочном процессе квалифицированных легкоатлетов. **Задачей работы** было определить особенности применения информационных и компьютерных технологий в легкой атлетике. В работе проведен анализ современных компьютерных программ и систем мониторинга в области физической культуры и спорта, приведены их краткие характеристики (Polar – «ProTrainer 5», Dartfish – «Dartfish Connect 5,5», видеокomпьютерный комплекс «Qualisys», программный пакет «Fusion Smartspeed», оптико-электронную систему Opto-Gate (Jump), систему трехмерной оценки IMOOV, тренажер устойчивости и равновесия SportKat 650TS, Quintic – «Quintic Biomechanics», Simi – «Simi Matchix», систему мониторинга Activio Sport, Велоэргометры ножные Monark 894E, Monark 828E, систему Myotest). У результате выполнения поставленной задачи определены современные компьютерные технологии, которые предоставляют данные в режиме реального времени о функциональном состоянии и уровень физического развития спортсменов, а также обеспечивают профилактику травматизма и сохранения здоровья. Представленный анализ компьютерных программ, используется для получения показателей уровня развития физических качеств и основных характеристик техники выполнения упражнений за счет использования трехмерного светло-оптического изображения. Установлено, что современные исследования показателей спортивной техники выполняются с помощью видеокomпьютерных программ, которые анализируют движения спортсмена. Отдельные компьютерные программы по своим возможностям используют в реабилитации спортсменов.

Ключевые слова: учебно-тренировочный процесс, функциональные возможности, компьютерные технологии, легкая атлетика.

The Definition of Scientific Issue and Analysis of Researches. The level of results in a modern sport is high, specifically in the field of athletics. In speed and power types of track and field events the volumes and intensity of competitive and training load that is performed by athletes reaches its maximum permissible limit. The initial level of rationally organized training process depends on the level of theoretical and practical knowledge of specialists that implement the process of realization and optimization of functional body potential and improvement of physical and technical training of athletes.

Fundamental scientific investigations in speed and power types of track and field focus on solving problems related with a permanent improvement in traditional methods of athletes trainings in conjunction with using additional unconventional methods and means, that are directed on expansion of functional organism's reserves and betterment of physical and technical preparation.

Technical preparation of athletes in many ways is determined by the ultimate goal that is reached by corresponding movements. Technique of performing in speed and power types of track and field is related with creation of prerequisites for development of maximum index of power and effective using of body reserves, external forces and inertia.

While studying techniques for mastering complex movements in recent years widely used visual methods that allow an athlete operatively to receive information about kinematical and dynamical movement characteristics and on this basis to correct technique of performing actions and optimize the whole process in general. For instance, there are laboratories equipped with special diagnostic complexes that allow in maximally close to competition conditions to register different biomechanical indexes in order to characterize the effectiveness of technique of an athlete.

The Goal and Tasks of the Article. To analyze modern computer programs and systems of monitoring with a possibility of using in training process of professional athletes.

Presentation of the Main Material and the Substantiation of the Results. These days video analysis of training with a system of movement registration and further computer processing, numeral and graphical demonstration of important elements of technique (parameters of initial reaction, demonstration of efforts, time of overcoming separate areas and a distance in general) are getting more popular in sport. Along with a detailed analysis of technique of performing the exercise there are programs with a possibility to register indexes of functional systems and indexes of work of the organism (cardiovascular system, respiratory system, etc).

In sport, specifically in track and field events, there are used programs focused on solving general tasks or programs with narrow specialization that take into account all the features of training and competitive activity. Basic functionality is represented by products such companies as Polar – «ProTrainer 5», Dartfish – «Dartfish Connect 5,5». Specialized computational programs: video complex Qualisys, software package Fusion Smartspeed, optical electronic system Opto-Gate (Jump), system of three-dimensional evaluation IMOOV, the simulator of stability and balance SpotKat 650TS, Quintic – «Quintic Biomechanics», Simi – «Simi Matchix», the system of monitoring Activio Sport, veloergometers Monark 894E, Monark 828E, Myotest.

Dartfish is a software package for video analysis of tactical and technical actions of an athlete or a team that allow to improve a feedback between a coach and a team, optimize the process of training with a possibility of correction of an athlete's technique.

Software Package Dartfish give an opportunity:

– to divide an integral exercise into parts with its further detailed description, the whole statistical data about separate elements (for instance, in track and field events – relay race).

– to register and process of training results;

– to demonstrate information about training course in on-line mode;

– to print out information that is received through the training course;

– to juxtapose video pictures of a sportsman with some pictures of another one;

– to make a storyboard of sportsman's movements;

– to compare 4 video recordings simultaneously;

– to highlight key moments of technique (picture-in-picture);

– to make a video analysis of tactical and technical actions of athletes;

– to have graphical tools for analysis of technique and tactics of an athlete, etc.

The advantage of the software Dartfish is the availability in use. This technology do not require large financial expenses (a modern video camera and a personal computer are needed), there is an opportunity to carry out all researches in the field (in the stadium, in the arena and in the field). For both a trainer and an athlete the program gives a lot of information about technical preparation immediately during the training process with an opportunity of further correction. During competitions it provides a trainer with indexes about the performance of actions. For instance, in jumping the program shows the quantity of steps during the running start, the length of step in different parts of the run-up, etc. In throwing – different time measurements of rotational movements and the time of the final effort. In running sports it gives an opportunity to analyze the length and the frequency of steps on the different sections and parts of competition distances, in races with hurdles – to analyze the intervals of time between hurdles, the attack and finishing of the hurdle. It is important that this program is used also for forming and preparation of the national team in relay races.

Fusion Smartspeed is a wireless automatic system of the testing of athletes. The system allows automatically identify sportsmen and determine the time of performing exercises.

The software Fusion Smartspeed gives an opportunity:

– to determine the speed capabilities with time fixation for recuperation of athletes;

– to fix automatically the time of overcoming the segments;

– to fix automatically the time of overcoming the distance with the division into segments in any sequence (for example, shuttle run);

• to determine the reaction time for start (with different stimuli);

• to determine the maximum speed;

• to fix the time of overcoming the segments with the given time;

• to fix and to display results in real time;

• to fix the current time, the time of overcoming the segments and the difference in overcoming.

The Fusion Smartspeed software provides an opportunity to evaluate athletes' high-speed capabilities. It is advisable to use this software in the training process and during the competition. However, for working with Fusion, Smartspeed requires additional variety of special equipment.

System of three-dimensional assessment and correction of the asymmetry of the muscle system IMOOV.

This device (simulator) is a mobile platform with eccentric movement, which provides simulation of various kinds of sports, performing power exercises, development of the coordination of movements, intensive balance training and sensory-motor coordination.

It is actively used for injuries of joints, tendons and ligaments. One of the main features of this device is that the athlete can train a separate group of muscles with relatively small energy costs.

This system is effective in the preparation of throwers, jumpers and other difficult coordination sports, it provides an opportunity to improve individual groups of muscles. However, the system of three-dimensional assessment and correction of the asymmetry of the development of the muscular system may be used exclusively in the training process in the laboratory conditions.

The bicycle ergometers for legs Monark 894E, Monark 828E. These kinds of cycling simulators provide the following opportunities:

• a variety of training programs;

• synchronization with a personal computer;

- keeping a «diary» of classes;
- determining the functional state of the athlete (ECG determination, recovery time, heart rate, blood pressure, etc.).

All this gives the possibility of an individual selection of training loads in terms of volume and intensity, taking into account the peculiarities of the athlete's body, the level of his training and health. However, bicycle ergometers are used solely in the training process in laboratory conditions.

Test system for the strength and speed-power capabilities of athletes The Opto-Gate (Jump) is designed to analyze the motion and functional assessment of the athlete's condition.

The Opto-Gate system (Jump) gives an opportunity to:

- assess the general physical condition of the athlete;
- identify disadvantages, posture problems and data-based asymmetry;
- develop and apply rehabilitation programs;
- prevent injuries;
- develop individual recovery programs for an athlete;
- to make fast and affordable comparison of test data conducted at different times;
- to connect the pulse meter to display the ECG during work.

The Opto-Gate (Jump) system is equipped with optical sensors to detect appropriate time and space parameters for walking, running, jumping, throwing. The advantage of this system is in mobility (ease of installation - the installation on the perimeter of pits for jumping, the sector for pushing and throwing, and the treadmill). It is advisable to use this program, both in the training process and during the competitions.

The Myotest system is a mobile complex that allows coaches to determine and analyze the athletes' strength, as well as to determine the optimal load of the training process.

The system allows to determine the following indicators:

- power;
- strength;
- speed;
- jump height;
- contact time with the support;
- stiffness of the leg;
- the dynamics of changes in athlete's performance, depending on the number of repetitions;
- comparison of test results with one or more athletes;
- athlete's race analysis: step length, number of steps per minute, time of contact with the ground, angle of positioning, kickback angle, running asymmetry, etc.

The use of the Myotest system helps to provide the right advice on determining the optimal load for a specific athlete, as well as the ability to compare the results of tests of one or more athletes in the run analysis.

The system for functional analysis of human musculoskeletal system Diers Famus is the system for optical-optical 3D analysis of the spine and posture.

This system is aimed at measuring such indicators of athletes as instability of the body, pelvic displacement, pelvic angle, pelvic rotation, angle of kyphosis, angle of lordosis, angle of scoliosis, vertebral rotation and lateral deflection.

The Diers Famus system is used in laboratory conditions, recommended for trainers at various stages of selection and selection, and in determining the narrow specialization of athletes.

The wireless monitoring system Activio Sport is a wireless heart rate monitoring system in real-time mode.

The advantages of the system are the range of action (+200 m, the update of information per second), battery life (1000 hours), automatic information storage, convenient software, drawing up current reports. It makes possible to determine the functional data of the body of the athlete directly, both in the competitions, and during the training process.

Conclusions. It is established that in order to increase the efficiency of the training process of athletes, trainers increasingly use specialized computer software and monitoring systems such as Polar – “ProTrainer 5”, Dartfish - «Dartfish Connect 5.5», video complex Qualisys, software package Fusion Smartspeed, Opto-Gate (Optical) optoelectronic system (Jump), IMOOV three-dimensional evaluation system, SportKat 650TS simulator, Quintic Biomechanics Simi, Simi Matchix, Activio Sport monitoring system, Monocular bike scanner Monark 894E, Monark 828E, Myotest system, Myotest system. They provide real-time data on the functional status and level of physical development of athletes, as well as provide prevention of injuries and health preservation.

Prospects for Further Research. In future studies it is planned to check the possibilities of using computer technology data in a competitive process.

Sources and Literature

1. Ахметов Р. Ф. Сучасні підходи до вдосконалення спортивної техніки. *Педагогіка, психологія та медико-біологічні проблеми фізичного виховання і спорту*: наук. моногр./за ред. С. С. Єрмакова. Харків : ХДАДМ, 2012. № 04. С. 9–11.
2. Островский М. В. Технологія вдосконалення технічної майстерності металників молота в умовах використання різноманітних систем обтяжень. *Спортивна наука України. Науковий вісник Львівського державного університету фізичної культури*: електронне наук. фах. вид. Львів: ЛДУФК, 2009. № 8. С. 30–46 URL:http://www.sportscience.org.ua/index.php/Arhiv.html?file=tl_files/Arhiv2009/8/OstrovskiyMV.pdf
3. Офіційний сайт компанії Polar, програмний продукт ProTrainer 5. URL:http://www.polar.fi/ru/products/training_softwar_e/polar_protrainer_5#
4. Офіційний сайт компанії Dartfish, програмний продукт Dartfish Connect 5.5. URL:<http://www.dartfish.com/en/freedownload/index.htm>
5. Офіційний сайт компанії Quintic, програмний продукт Quintic Biomechanics. URL:<http://www.quintic.com/downloads/index.htm>
6. Офіційний сайт компанії Simi, програмний продукт Simi Matchix URL:<http://www.simi.com/en/markets/industry/index.html>
7. Платонов В. Н. Система подготовки спортсменов в олимпийском спорте. Общая теория и ее практические приложения. Киев: Олимп. лит., 2004. 808 с.
8. Тестирование – необходимый этап подготовки успешного спортсмена URL:http://www.mordovia-sport.ru/press_center/news/detail.php?element_id=3483
9. Шестаков М. П. Управление технической подготовкой в легкой атлетике на основе компьютерного моделирования. *Наука в олимпийском спорте*. 2005. No 2. С. 187–196.

References

1. Akhmetov, R. F. (2012). Suchasni pidkhody do vdoskonalennia sportyvnoi tekhniky [Modern approaches to sports technique improving]. *Pedahohika, psykholohiia ta medyko-biolohichni problemy fizychnoho vykhovannia i sportu* : nauk. Monohr. Kh. : KhDADM, no. 04, 9–11.
2. Ostrovskiy, M. V. (2009). Tekhnolohiia vdoskonalennia tekhnichnoi maisternosti metalnykiv molota v umovakh vykorystannia riznomanitnykh system obtiazhen [Improvement of technical skill of hammer throwers in conditions of using various systems of additional weights]. *Sportyvna nauka Ukrainy. Naukovyi visnyk Lvivskoho derzhavnoho universytetu fizychnoi kultury*. Elektronne naukove fakhove vydannia : Lviv, LDUFK, no. 8, 30 – 46. [Elektronnyi resurs]. Access mode:http://www.sportscience.org.ua/index.php/Arhiv.html?file=tl_files/Arhiv2009/8/OstrovskiyMV.pdf
3. Ofitsiinyi sait kompanii Polar, prohramnyi produkt ProTrainer 5 [Elektronnyi resurs]. Access mode: http://www.polar.fi/ru/products/training_softwar_e/polar_protrainer_5#
4. Ofitsiinyi sait kompanii Dartfish, prohramnyi produkt Dartfish Connect 5.5 [Elektronnyi resurs]. Access mode: <http://www.dartfish.com/en/freedownload/index.htm>
5. Ofitsiinyi sait kompanii Quintic, prohramnyi produkt Quintic Biomechanics [Elektronnyi resurs]. Access mode:<http://www.quintic.com/downloads/index.htm>
6. Ofitsiinyi sait kompanii Simi, prohramnyi produkt Simi Matchix [Elektronnyi resurs]. Access mode: <http://www.simi.com/en/markets/industry/index.html>
7. Platonov, V. N. (2004). Sistema podhotovki sportsmenov v olimpiiskom sporte. Obshchaia teoriia i ee prakticheskie prilozheniia [The system of training athletes in the Olympic sport. General theory and its practical applications]. Kiev : Olimpiyskaia literatura, 808.
8. Testirovanie – neobkhodimy etap podhotovki uspeshnoho sportsmena [Elektronnyi resurs]. Access mode:http://www.mordovia-sport.ru/press_center/news/detail.php?element_id=3483
9. Shestakov, M. P.(2005). Upravlenie tekhnicheskoi podhotovkoi v lehkoi atletike na osnove kompiuternoho modelirovaniia [Management of technical preparation in track and field on the basis of computer modeling]. *Nauka v olimpiiskom sporte*, no. 2, 187 – 196.

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