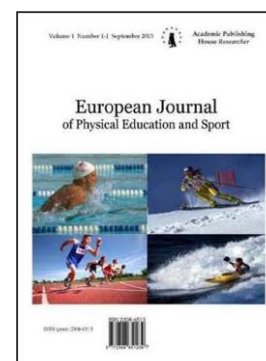


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The Intensification of Speed-Power Ability Control of Basketball Players

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Abstract

Control, as an organic component of the basketball players training, provides management of this process and is a factor of its effectiveness. When the fact that control of basketball players speed-strength abilities requires absolutely precise and effective methods of their diagnostics was taken into account, it was determined the necessity of effective control techniques search for obtaining reliable information on the state of basketball players speed-strength abilities. To solve those problems we used methods of analysis and synthesis, analogy, abstraction, formalization, technical modeling and mathematical statistics. The main idea of the research was to intensify the control process of the basketball players speed and strength abilities. For this purpose, we propose to apply our device to determine the speed-strength abilities level development. Along with the definition the distances time overcoming, other important characteristic of the basketball players speed-strength abilities are calculated with use of the mathematical statistics methods. Modified control method for the speed-strength abilities of basketball players was proposed for the first time. Its use contributes increasing of the control effectiveness of the basketball players speed and strength abilities by operative and effective analysis and interpretation of quantitative testing information.

Keywords: basketball, control, technique, speed-strength abilities, device, effectiveness, statistics, reliability.

1. Introduction

The highest achievements of the sport progress is associated with the justification of the elements of the athletes training system and its orientation on sport results (Colibaba, et al., 1998). The high-class basketball players training is a complex, dynamic pedagogical process based on a deep understanding of the factors that determine its effectiveness under the direct influence of those changes that occur in science (Koryahin, 1998; Simion, et al., 2000). Accordingly, this requires mastering the knowledge of the latest scientific achievements in the training of highly skilled athletes.

The modern level of the basketball development is characterized by a high development level of physical qualities (Koryagin et al., 2016). The leading strategic direction of high qualified basketball players training in modern conditions and an important part of the training process is the control of the level of their physical training (Semashko et al., 1976; Romanenko, 2013). Control, as the organic component of the basketball players training, provides management of the process and is its effective factor (Buceta et al., 2000; Simion et al., 2000).

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It is determined in the theory and methodology of sports, that the effective management of the basketball athletes training is the use of means and methods of integrated control (Romanenko, 2005; Koryahin, et al., 2013). Such control is considered to be one of the most important links in the system of training of high qualified athletes. Its expediency is considered from the position of creating the opportunity for the coach to adjust the training process during the period of athletes training for important sports competitions (Raiola et al., 2016).

The practice of modern sports, numerous scientific studies indicate that at the current stage of basketball players training, there is a need to transform the accumulated knowledge and best practices of scientific achievements in the control implementation. In accordance with the requirements of the time, the global development of technology causes the necessity of significant changes in the organization of control in basketball.

The relevance and timeliness of study of the control techniques in basketball is determined by the fact that the search and introduction of scientific achievements in this process, promotes significant improvement in the quality of control procedures and gained the results. We see the importance of the latest research methods of organizing control in basketball because of the growing demands that modern training process puts forward. The growing level of sports results requires new tools and methods for the perfection and improvement of the training process.

2. Reviews of related literature

The research analysis of this problem shows that it constantly attracts the attention of sports professionals (Bompa, 2002; Colibaba et al., 1998; Makarov, 2013). In the process of training athletes for competition it is important to monitor its various aspects of this process, including such an important factor as their physical training (Semashko et al., 1976). The last may be considered as a component of the multi-year training of basketball players, the aim of which is the creation of optimal conditions for achieving the highest results at the stage of their sports achievements (Simion et al., 2000).

The questions of optimizing the training process of basketball players are considered (Colibaba et al., 1998; Koryahin, 1998; Losin et al., 2011; Poplavsky, 2004; Semashko et al., 1976; Verkhoshanskiy, 1985). Speed-strength training is crucial among the many factors that make possible the achievement of the high sports results. Speed-strength abilities (Afonshin et al., 2016; Matiegka, 1991) are considered to be one of the most important qualities of a basketball player: the effectiveness of game activity of players mostly depends on the speed of simple and complex motor reactions, the speed of movement when performing gaming techniques, the maximum speed of movement. The particular importance in the training process is not only the technique of speed training, including special, but also a technique for determining the level of development of this quality. Taking into consideration the fact that the level of development of speed and strength abilities of basketball players limits the effectiveness of the team's competitive activity as a whole, a significant list of research works are devoted to the problems of qualitative control on the level of the development of these abilities (Koryahin et al., 2013; Romanenko, 2013; Zaporozhanov, 1988). Recently, the relevance of such work has increased because of those high requirements for the level of physical abilities of athletes, which are put forward by modern training process in basketball.

It is established that the control of the level of development of speed-strength abilities is realized by different methods, one of which determines the maximum speed of overcoming the distance (Zaporozhanov, 1988). For a long time, in basketball was used a simple procedure for determining of the level of development of speed – with the help of a stopwatch. The possibility of an error in setting the exercise time, which was recorded by a stopwatch, practically excluded the reliability of the results control. There is also a certain dependence between the subjective assessment of the perception of the specialist that makes this assessment and the observance of the necessary requirements of the provided tests, which are set visually. Consequently, the main disadvantage of this method of control is the accuracy of measurement, which is practically impossible to provide.

The method proposed by I.V. Vsevolodov (1969) became the significant progress in the direction of improvement of the methodology for determining the speed. The method supposed the usage of the registration equipment – a "photo terminal" (Koryahin et al., 2013). Such an invention made it possible to record a number of indicators that fully characterize the level of development of the athlete's speed and their strength abilities.

Speed-strength abilities can be seen in the possibility to perform movement in the shortest possible time in the case of active opposition to this movement (Semashko et al., 1976). With the use of photo finish installation, the speed of the starting acceleration, the maximum running speed over the distance, the starting force, the "explosive" strength of the legs and the whole body are monitored. Thus, you can determine the time of the distance of 20, 30, 40 or 100 m the athlete passes with the maximum speed (Koryahin et al., 2013).

Taking into account the fact that the control of the speed and strength abilities of basketball players requires an absolutely accurate and effective methodology for determining its development, it has been found that it is necessary to search for effective ways of improvement of the objectivity of control techniques and for the obtaining of the reliable information about the state of the speed and strength abilities of basketball players.

3. Methods and organization of the research

The purpose of the research is to develop a technique for controlling the speed and strength abilities of basketball players.

Methods of research: methods of analysis and synthesis, analogy, abstraction, formalization, technical modeling and mathematical statistics were used to solve posed problems.

4. Results and discussion

The main idea of our research is to intensify the controlling process of the speed-strength abilities of basketball players. For this, first of all, we apply the device developed by us to control the level of development of speed-strength abilities. The device consists of starting blocks and three installations. The capacitive motion sensors are placed on the starting blocks and installations, which are able to record and promptly transfer information to the electronic computing device while crossing the distance segments by the athlete, with a resolution of 0.001 s. The practical use of the capacitive motion sensors in our device is access to wide range of advantages. In addition to a small and simple design, they are reliable with a long life. High accuracy of work ensures the indispensability of capacitive sensors in devices in which errors are allowed only in hundredths and even thousandths of a percent (Koryahin et al., 2013).

The developed method of the speed-power abilities control is giving the idea of the capacitive motion sensors that are fixed on the athlete, installed on the starting blocks and along the whole course of the distance. The operating principle of the developed device is in the informative signal that arises between the two sensors in the moment, when the distance was passed by the athlete and allows you to record the start time, the time of overcoming of each distance segment and finish. The signal that was received by the sensors is transmitting to the microcontroller, where it is analysed and by wireless technical means of information (Bluetooth) transferring to the electronic recorder (computer).

The use of the developed portable device for speed-power abilities monitoring provides an effective and prompt access to the reliable data at the level of their development in basketball players. Standardization of the testing procedure ensures the reliability of monitoring information the result of which is determined instantly. The device is compact and has a high sensitivity level. The results of multiple tests are displayed automatically on the monitor in the form of an electronic protocol. Thus, the listed factors of the developed device provide realization of an objective, rational, purposeful operational control of the speed and strength abilities of basketball players. The use of the developed control system for the speed and strength abilities of basketball players provides instant diagnostic of the level of their development, which consists of: the time of information obtaining (usually within 20-60 s), the time of the obtained data review and the results analyzing. The proposed automatic system provides recording of numerous control data and storing it on a disk that available for further processing. Use of the proposed device in time of the basketball players speed-strength abilities control process significantly affects the improvement of the process of their physical training. Presentation of the results in the form of an electronic protocol allows us significantly expand and increase the spectrum of representation, facilitates the search and interpretation of the obtained control results, ensures the safety of information and a convenient view of their structure and dynamics. Thus, operational, flowing, step-by-step control and long-term monitoring are performed with updating the results of processing at a given time interval.

Using the obtained control information that based on the dispositions of the combined (complex) approach, we propose, along with the determination of the time to overcome distances, to calculate other important characteristics with a help of the mathematical statistics methods (Mitropolsky, 1961). This is necessary because of the fact that overcoming short distances of 20, 30, 40, 50, 100 m with maximum speed is considered insufficiently informative indicator of the speed-strength abilities level development of basketball players (Matiegka, 1991; Poplavsky, 2004). We cannot characterize the development level of these abilities without the determination of such specific features as the speed of the starting acceleration (Ks), the maximum running speed at the distance (Vm) and the starting force (F). The exponential nature of the correlation between speed and time in such exercises makes it possible to find a mathematical evaluation of these indicators. So, to calculate the starting acceleration (Kc) we use the exponential formula:

$$K_c = \frac{\lg y_1 - \lg y_2}{t_1 - t_2} \times 2,3$$

where: y1 and y2 – increase in speed, in accordance, from 3 (for example) to 6-8 m and from 6-8 m to 20-30 m, it depends on the length of the selected distance;
t1 and t2 – time to overcome the corresponding distance segments.

To calculate the maximum running speed over a distance (Vm), the following equation is proposed:

$$V_M = \frac{V_t}{1 - e^{-kt}}$$

where: Vt is the speed reached by the time t;
k – is the rate constant that characterize the initial acceleration;
e – is the base of the natural logarithms.

To determine the starting force (F), the following formula is recommended:

$$F = \frac{P}{g} \times K_c \times V_M \times e^{-kt}$$

where: P – weight of the athlete;
g – the acceleration due to gravity.

Received with the use of such mathematical calculations information makes it possible to carry out a differentiated and objective assessment of the speed-strength capabilities of athletes. The processing of a significant array of control results with their restoration and adjustment, as well as their accumulation, takes place in an integrated database. In such a base, replication and interactive analysis of control results are established.

For the first time it is proposed technique for the basketball players speed and strength abilities control, which use portable device that based on modern technologies and computational mathematical statistic methods that ensures the intensification of the test process. Its practical use makes it possible to characterize basketball players speed-strength abilities with far more greater accuracy. Thus, we may see the improvement of the monitoring process effectiveness by operative analysis and interpretation of quantitative testing information.

The introduction of the proposed speed and strength abilities control technique for the process of basketball players' physical training makes it possible to unify and speed up the receiving and processing of control results. Consequently, the effectiveness of management of this process is increased on the basis of prompt correction of individual pedagogical influences.

5. Conclusion

The research material that was presented offers a new qualitative approach to the process of monitoring and assessing the level of basketball players speed-strength abilities development with use of technical control means, as well as additional parameters that characterize the speed-power capabilities. The main indicators of the effective using the developed automated system in the process of basketball players speed and strength abilities control are: convenience in use and compactness of the device, comfortable testing, short testing time, high sensitivity of the device and its multi-functionality. The main methodological result of the work is that the use of the proposed technique for basketball players speed and strength abilities control allows to intensify the testing process during their physical training. That allows you to reasonably draw conclusions about the need for adjustments in the program of classes in accordance with the results.

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