

The correction of cyclists pedalling techniques by means of teaching guidelines

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Abstract: The aim of the work – to examine the effect of teaching guidelines on cyclists pedalling techniques and to determine the most significant ones. Material and methods. The experiment involved 10 high qualification pursuit racers. The characteristics of efficient efforts applied by the racers to the bicycle cranks are veraciously connected to the rate of pedalling throughout the whole distance ($r=0,713-0,922$). By changing (through verbal guidelines) the parameters of efficient efforts in a pedalling cycle it is possible to control the speed in certain ways. The research into the interrelation between efficient efforts in the cycle of pedalling and the pedalling rate in the process of modelling an individual pursuit revealed two types of dependence between them. In case of the first type dependence the growth of efficient efforts values within a cycle leads to an increase in speed. In the second situation the increase in efficient efforts values is accompanied by a decrease in the rate of pedalling. The 2-d type dependence is irrational (from the point of efficiency) and requires correction. Conclusions. The intentional use of verbal acts positively affects the movement structure. The effective solution of movement tasks depends on the orientation of the athlete attention towards certain elements of the movement system. One should select those guidelines which are suitable for the specifics of the organization of the movement act system

Key words: cycle sport, movement mental set

Introduction

In the process of mastering a technique (theoretically ideal by structure) and its realization in competitions there could always be spontaneous changes in a movement trajectory. (Hanaki, 2012; Sigrist at al., 2014; Sundström at al., 2013). Likewise, necessary corrections could be made in the process under conditions of a tough sport competition. (Crouch at al., 2014; Lépine at al., 2012; Kolumbet at al., 2017).

Among the simplest and the most popular methods of influence on the athletes on the part of a coach in the process of enhancing their technical mastery one can single out verbal methods. (Diachkov, 1969; Lépine, 2012; Kolumbet at al., 2017). Verbal methods make up the cornerstone of all general methods of instruction and education.

In the process of enhancement of athletes' technical mastery various kinds of mental setting have gained popularity.

In psychology by the term mental set they imply the condition which could be characterized as inclination, orientation, readiness of a person for a certain activity (Puny, 1959). Mental set is a complex personal condition which is expressed by one's preparedness to take certain actions on the grounds of preliminary tuning of sensor and motor processes (Bdgalava, 1966). The ability of a brain to tune in a certain sequence of events in an outer environment is called the law of "the leading reflection of the reality" (Anohin, 1975). Its final form could be found in a so-called mental set of a body.

Movement mental set has an exceptional meaning in improving movement activity of an athlete. Movement mental set is the most important component of controlling technical mastery. Various forms of movement mental set are most actively being realized in a wide spectre of movement activities. Movement mental sets have an essential impact on movement parameters.

The questions of mental set should be analysed as one of the basic aspects of forming and improving a sport skill. The semantic content of movement mental set serves as a determining factor for building up kinematic and dynamic variations of a movement skill. By changing the semantic meaning of an athlete mental set it is possible to change basic parameters of the movement structure and even the variants of technical acts.

The process of forming of mental set is determined by the athlete's previous activity and experience. The formation of mental set does not happen spontaneously. It takes place on the base of specific instruction and training techniques.

The verbal method contains unexploited potential of boosting efficiency of the process of movement techniques enhancement.

In the process of pedalling techniques improvement in cycling among the most popular forms of verbal influence one could differentiate such forms as guidelines and commands.

They are used for the following purposes, namely:

- operative controlling of movement activity;
- setting and specifying tasks which in certain ways direct the thinking process;
- activating control over the movement;
- enrichment and complementing of a semantic structure of a movement act;
- forming involuntary motor image of elements of the system of movement.

Scientific and methodological literature exploits a large number of terms which are equal to the “guidelines” (movement instructions, meaning orientation, information and informative influence, movement assignments, action tasks, movement tasks, movement mental set, tactical set etc.).

In our article, the term “guidelines” is accepted due to the following principles:

- a) our main attention is focused not on the studying of the psychological peculiarities of the mental set, but rather on the pedagogical meaning of guidelines in the process of movement techniques enhancement;
- b) in practice, the term guidelines prevails over any other that determine the notion of verbal influence.

The survey involving leading cycling coaches confirmed the assumption of a high degree of popularity of application of guidelines in the process of pedalling techniques enhancement of highly rated athletes.

However, in spite of the great popularity of this method and convenience of its exploitation there is still few well-grounded methods of its application for the technical enhancement of athletes.

The analysis of literary sources reveals that the effect of various guidelines on the pedalling techniques has not been investigated sufficiently.

The aim is to examine the effect of teaching guidelines on cyclists pedalling techniques and to determine the most significant ones.

Material and methods

The participants. The experiment involved 10 high-qualification pursuit racers.

The organization of research. The research was conducted at the end of a competition period in laboratory conditions using a modified cycle ergometer “*Monark*” and included two stages. At the *first* stage after a standard warming-up it was examined how teaching guidelines affect the efficient efforts of the racers as well as how changing of efficient efforts affects a pedalling rate of each of the athletes, an individual graph of efforts distribution being determined. The *second* stage was focused on finding a possibility of correction of pedalling techniques by means of teaching guidelines in the process of modelling a competition length for an individual race of pursuit.

The instructions were selected in such a way that they should change the mutual dependence of speed and efficient efforts at those distance lengths where distribution of force was irrational.

In order to carry out biomechanical research the complex method was applied (Kolumbet at al., 2017; Monogarov & Bratkovsky, 1979). The research was directed at the dynamics of kinematic and dynamic characteristics of horizontal and vertical components of cyclists’ efforts. The variability of examined movement characteristics was determined (Kolumbet at al., 2017).

Statistical analysis. While processing the experimental data, we determined the average values of the indices and their errors ($X \pm m$), the degree of difference in the means and the significance of differences (t , p), the dispersion value around the mean (σ , CV), and the degree of interrelation between the studied indices (r).

While conducting complex pedagogical, biomechanical and biological examinations with participation of athletes, we adhered to the legislation of Ukraine on health protection, the Helsinki Declaration of 2000, the Directive No. 86/609 of the European Society on the participation of people in biomedical researches.

Results and analysis

All variety of guidelines used in the process of pedalling techniques enhancement could be classified as follows:

1. Guidelines for changing space parameters of pedalling techniques (e.g. at which point it is necessary to make a pedal stroke down, back, up and forward; to enlarge or to reduce the zone of pushing down, pushing back, pulling up and pushing forward).
2. Guidelines for changing time parameters of techniques within a pedalling cycle (to make pedalling strokes down, back, up and forward last shorter).
3. Guidelines for changing dynamic parameters within a pedalling cycle (to increase application of force of a certain zone of a bicycle crank rotating cycle).

In cycling on a track a rigid direct chain transmission is used. Verbal commands which are directed at the change of space, time or dynamic characteristics of pedalling techniques are reflected on dynamic parameters of the movement structure.

Among the characteristics of cyclists movement efforts efficiency there are parameters which reflect the value and dynamics of racer efforts (efforts are directed at the production of a torque in a bicycle rotor shaft). One of the criteria of pedalling technique effectiveness is efficient (tangential) efforts which are directed tangentially towards the pedal axle.

The characteristics of the efficient efforts applied by racers to the bicycle cranks are veraciously connected with a pedalling rate over the whole distance ($r = 0,713-0,922$). By changing the parameters of efficient efforts within one cycle of pedalling by means of verbal guidelines it is possible to control the speed.

A large variety of guidelines were reduced to 14 that are the most important and widely used in the cycling sport practice (table 1).

Table 1. The impact of instructions on efficient efforts in a racers pedaling cycle (n=10)

№	Instructions directed at the change in application of force in a certain zone of a pedalling cycle	The degree of change in efficient efforts compared to the initial level, %	
		\bar{X}	m
1	Right foot down stroke	94,33	0,61
2	Left foot down stroke	88,67	2,05
3	Both feet down stroke	94,67	0,92
4	Right foot up stroke	75,67	1,85
5	Left foot up stroke	73,33	1,23
6	Both feet up stroke	86,00	2,05
7	Down and up strokes of both feet	88,67	0,72
8	Right foot forward stroke	106,00	0,41
9	Left foot forward stroke	108,67	1,13
10	Both feet forward stroke	109,67	0,92
11	Right foot backstroke	105,33	0,21
12	Left foot back stroke	104,88	0,72
13	Both feet back stroke	112,67	1,85
14	Forward and back stroke of both feet	102,00	1,13

Depending on the orientation of guidelines, various changes in efficient efforts in pedalling techniques could be observed. All teaching guidelines used could be subdivided into two groups: those which increase efficient efforts and those decreasing them. The degree of influence of different guidelines for every cyclist varies. At the high level of skills the guidelines directed at the increase in horizontal efforts within a pedalling cycle contribute to the growth of efficient efforts. That is why they are the most efficient. Raising vertical efforts value is not much efficient.

The dynamics of efficiency within a cycle of pedalling is as follows. Its lowest values are observed in so-called "critical zones" of a pedalling cycle. These are forward strokes zones and back stroke zones. The change of values of horizontal efforts in "critical" zones enables to increase the efficiency of pedalling techniques in these zones and in a pedalling cycle on the whole. The guidelines which are directed at the change of horizontal components of efforts are perceived by the experiment participants as the most difficult in comparison with those directed at the vertical components of efforts.

The guidelines directed at the change in horizontal components of efforts have an impact on within-cycle efficiency. Changing vertical components of efforts influences the value of efforts made in the pedalling cycle.

The research into interrelation between efficient efforts in a pedalling cycle and pedalling rate in the process of modelling of individual pursuit race revealed two types of mutual dependence on each other. In the first case the increase in the values of efficient efforts within a cycle results in the speed growth. In the second case the increase in the values of efficient efforts is accompanied by slowing down the pedalling process. The 2-d type dependence is irrational (from the point of efficiency) and thus needs correction.

The guidelines directed at the change of vertical components of efforts in a pedalling cycle (individually for each athlete) enable to change the ratio "speed – efficient efforts" from the 2-d type to the 1-st one. It makes the movement structure more economical while completing a modelled pursuit race.

The application of teaching guidelines has a positive effect on pedalling techniques of cyclists. Individual correcting actions enabled the racers to complete a modelled race of pursuit of the 2-d stage more efficiently compared to the 1-st one. It led to the increase of a pedalling rate at the final length.

Discussion

In scientific research in the field of sport the questions of mental setting were first analysed by S. G. Gellershtein. He experimentally demonstrated the significance of various type of mental setting for the precision and speed of movement. Besides, he demonstrated the influence of the setting on the structure of a movement skill and the dynamic tendencies of this structure.

Later in the psychology of sport, A. C. Puny came up with a notion of setting which referred to the sphere of competition activity (competition mental setting). The author believed that the appearance of setting is the process determined by objective reality conditions. The setting is expressed in a desire of an athlete to achieve the best result possible. The setting becomes the goal of an athlete activity.

For the first time in methodological literature, V. M. Diachkov defined the notion of the “movement setting”. Using the case of athletics jumping events he proved an active role of a movement mental setting in a control over movement and the impact of its content on the nature and structure of technical actions.

It was found out that with the growth of skilfulness a certain movement mental set in the conscience of the athlete is formed in accordance with the nature and structure of the movement. This mental set possesses the function of regulating the efficiently learned movements.

As the movement mental set becomes less precise, the movement skill becomes more unstable and corresponding elements of technical actions may even fall out. It results in the worsening of performance results. The author made a conclusion that the examination of a skill semantic aspect plays a dominant role in understanding its psychological structure and must be carried out in combination with the analysis of a movement composition of athletes’ actions in every particular kind of sport (Diachkov, 1969).

The mental set should be viewed as a “key” to the control over movements. It is possible to differentiate basic approaches to controlling:

- the use of minimal corrections which are made immediately in the process of movement using a feedback mechanism;
- the use of a previously prepared operative action programme which is expressed and implemented in a concrete movement mental set;
- the sequential use of the 1-st and 2-d approaches (Guilaumeatal., 2006; Wangerinatal., 2017).

The analysis of the directed changing of cyclists’ movement structure particular elements demonstrated a possibility to have a control over pedalling techniques. The verbal method (coach guidelines, various mental sets etc.) still has an unused potential for boosting efficiency of the process of movement techniques mastering process.

Techniques improvement requires that it is necessary not to find degrees of divergence between individual and processed model data (Kolumbet at al., 2018).

A necessary condition is finding and processing the means and methods of a targeted effect on the elimination of discrepancies found. Average, mathematical and quality models demand individualization. However, for the coach it is difficult to plan training and to carry out a control over each athlete’s work done (Kolumbet at al., 2017). It appears that it is necessary to divide cyclists into separate groups in accordance with similar individual specifics of their pedalling techniques. It is done in order to conduct the process or technical training with the aid of typical model characteristics of the movement structure.

The efficiency of racers training depends on the scientifically grounded orientation of athletes technical training according to typical attributes of the movement structure. This orientation at preliminary stages must provide for the improvement of those movement structure elements that lag behind while at the final stages it should act similarly in relation to dominant elements of the movement structure (Bini & Rossato, 2014).

The results of the research enable to model an optimal structure of cyclists’ movement activities for the achievement of a projected record result in an individual race of pursuit on a track.

Conclusion

1. The intentional use of verbal acts positively affects the movement structure.
2. The effective solution of movement tasks depends on the orientation of the athlete attention towards certain elements of movement system.
3. One should select those guidelines that are suitable for the specifics of the organization of the movement act system.

Conflict of interest

The authors declare that there is no conflict of interests.

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