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Quantitative and qualitative indicators of developing anticipation skills in junior wrestling athletes

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Abstract

The present article analyses the possibilities of the usage of anticipation: the study of its mechanisms and processes of development. There is a particular interest in the anticipation issue in sport, where the probabilistic forecast of the situation is crucial for winning. The paper presents the results of testing methods for anticipation skills in junior wrestling. The main objective of the study was to find psycho-physiological and behavioral indicators to quantitatively and qualitatively evaluate the degree of anticipation. The skills formation procedure was based on the reinforcement of the correct choice of behaviour in simulated situations of decision-making using multiple choices technique. Stimuli were videos of simulated situations in wrestling. Simultaneous recording of oculomotor activity and registration of multi-channel electroencephalogram (EEG) was carried out. The results showed the effectiveness of the proposed method. After completing training the number of errors and the decision taking time span reduced. Expert assessment of the main qualifying factors showed a significant increase of the test group. On the psychophysiological level, there is a reduction of oculomotor activity in selecting the right answers, reducing the number of fixations, the number of fixations and saccades reverse on the text of questions and answers.

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Key words: anticipation, sport psychology, junior freestyle wrestling, methods

1. Introduction

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Man's ability to detect or to predict impending future developments and act proactively in time provides a significant competitive advantage, both in everyday life and in the professional field.

For describing the mental processes associated with the prediction of the future, the psychological science generally uses such a term as "anticipation", introduced into psychology by Wundt [1]. In addition, such expressions as "probabilistic forecasting", "predictive ability", "thinking proactively" are often used as a synonym of the term. The phenomena of the prediction of future may include a willingness to act in a certain situation in a certain way [2], [3], [4], [5], [6], [7].

In Russian psychology, the concept of anticipation is interpreted as the ability to act and to take certain decisions to a specific time-space statement in relation to expected future events.

The process of anticipation is a multifunctional mechanism of human mental organization and it has universal significance for all forms of human activity. There are the integral workings of the brain underlying this phenomenon, and their consistency in terms of functioning of mental processes.

Actual problems are both fundamental theoretical studies of anticipation and methodological aspects of its practical application in various spheres of activity. Athletes' probabilistic forecasting is built during their professional development. It takes into account not the frequency of events only, but also the level of formation of functional systems, which are reflected in the specific sport experience. The level of formation and efficiency for specific tasks influences the professional activity of sportsmen: it gives a significant advantage over other less prepared competitors, makes it easier to make the right decision. The main objective of this study was to find psycho-physiological characteristics that allow quantitatively and qualitatively assess the level of skill of anticipation among freestyle wrestlers. The hypothesis of the present study is the assumption that the experience of making the correct choice of behavioral act from the set of possible acts leading to success is underlying the effective prediction of an opponent's behavior.

2. Method

2.1. Participants

The participants were junior athletes, students (young men), had a different experience of employment (years 1-3) and (3-5 years). 24 people in general in the age of 16-17 years old. 8 of were included in the experimental group, 8 people – in a control group and 8 – in a support group (3-5 years' experience).

2.2 *Measures*

Diagnostic training №1. The video sequence of this training consists of 14 colored video clips. During the training the participants' EEG is traced. The number of their correct answers is calculated, the response time is recorded.

The first training stage. This step represents a sequence of training sessions (3-4). The first version of training videos was shown to the participants. Each training session there were video sequences consisted of 18 black-and-white movies. They showed the basic techniques to freestyle struggle. The number of correct answers of the test was recorded. The task of this stage is to teach the test subjects to foresee the developments (to anticipate the behavior of the fighters on the screen).

Diagnostic Training № 2. It is an intermediate training. Its procedure is the same as the first diagnostic training's one. The same 14 colored video clips are presented, the EEG is traced, and the number of correct responses and reaction time are recorded.

The second training stage. This step, like the first one, consists of the series of training sessions. During the each session video sequences were shown, each of them consisted of 18 black and white movies. But this time they differ from the video of the first training stage. The number of correct answers of the test is recorded.

Final Training № 3. Before and after taking a part in the experiment, the athletes of the experimental group were judged by the 3 experts-coaches of wrestling. They evaluate the quality of participants' functional system training. After the experiment the training fights were arranged. The athletes of control and experimental groups fought with the support group sportsmen, who were asked to use 10 basic freestyle-wrestling's grips. During the fight the number of foreseeing actions made by control group and experimental group sportsmen was calculated.

3. Results and discussion

As a result of participation in trainings, all test subjects showed the increase of the number of correct choices in determining possible actions of the rival.

In case of successful training method's assimilation, the process of forming the anticipation skill starts. This is reflected in the number of subjects' correct answers (n=8). On the first control training the average score of correct answers was 7, on the final stage the number of correct answers has increased to 11 points. Statistical analysis by Wilcoxon test also showed significant differences between the first and third final tests.

The analysis of subjects' response time identified three trends:

By the third training the time response increased 1,5-2 times more than at the first one (four athletes);

At the first training there was the slowest reaction time. It increases about 1.5 times to the second training, and reduced (but still above baseline) to the third training (two athletes);

Decrease in reaction time from the first to the third one from 1.5 to 3 times (two athletes).

The following trend is also revealed: the reaction time required for the correct answer is increased 1.5 times from the first control training to the second one, and then it decreases. The reaction time during the second stage was less than during the first one. This can be explained: in the first training athletes are faced with a new situation for them, so they spend a lot of time to choose an answer. In the second control training reaction time is longer. It is possible because of the process of adjusting and optimizing the existing functional system.

The reaction time with the wrong answers as a final was initially longer than in a situation with correct answers. From the first control training to the second one time increases.

According to data obtained as a result of measuring the reaction time it is not possible to make any definite conclusion. Some participants had common trends in the changes of reaction time, needed for choosing an answer. In particular, the reaction time generally increases in the first control training, and reduces at the second. This trend is typical for both of correct and incorrect answers for. This pattern can be interpreted in the following way. On the first and the second meeting in the subject still have formed an adequate response, and at the next stage, he already has an idea of the content of the videos. This knowledge has not yet been systematized, so to select the correct answer the athlete takes more time than in the first case. In the final step of trainings fighters' response time is reduces because of the better systematization of the athletes' experiences.

For a comparative analysis of the results of eye movements (delays, fixations, the number of repeated returns to the area of interest, the number of fixations and attitudes, etc.) for each athlete three experimental situations were chosen:

1. Wrong answer at all three control trainings;
2. Correct answer to all three control trainings;
3. Wrong answer at the first and correct answers at the second and third control trainings.

As a result, we can sort out following specific characteristics for each situation.

In the first situation, if an athlete could not find the right answer for all three trainings, there was not observed a significant change in the character of eye movements while taking a decision. The time spent on reading the answers remains the same, as well as the number of fixations and repeated readings. The time spent by participant to evaluate the fighters decreases.

In the second situation from training to training, the time of the athlete's glance delay on the text and on the correct answer significantly reduces. The time of evaluation the fighters increases, but generally remained lower than in the situation of wrong answers. The number of fixations, repeated visits and the number of views on all areas of interest significantly reduces from the first to the third training.

In the third situation, the athletes made mistake in choosing the answer at the first control training, and then they managed to fix it. They did not spend a lot of time for the answer at the first training, but there was a large number of fixations and repeated the views in the area of the text wrong answer. At the second meeting of the athlete chose correct answer, but the analysis of the situation and the text of the question in this case took much more time. After finding the correct answer there was a decrease of research time, the decrease in the number of fixations and revisits.

Dynamics of changes in eyes motions in all cases is similar to the dynamics of the reaction time. Basing on the discussed in the literature review material about the studies of the phenomenon of anticipation [8], [9], [10] it can be assumed that during the process of athletes' learning starts the process of the formation of functional system, in which the experience gained by the athlete is reflected. A motion of the eye [11], [12] the reaction time and the dynamics of changes of these parameters can be treated as a correlates of establishment and optimization of this system.

During the first training an athlete came across a new unfamiliar situation. A functional system of responding still poorly formed, at this stage he often makes a mistake in choosing a right answer. In the second test he was already in a familiar situation, but his knowledge of the content of the video has not yet been systematized. Therefore, to select the correct response it requires more time than in the first case. At the final meeting time was reduced due to the better systematization of the accumulated experience.

Analysis of the spectral parameters of the EEG showed that in the most cases trainings lead to a substantial reduction of participant's stress tension during the analysis of simulated situations, as evidenced by the increase in the index from the activation from training to training.

The analysis of data obtained from the calculation of the activation index for each test subject, it was possible to reveal the following common trends.

At the stage of "The start of a video - Select answer – the end of a Video" the value of activation index firstly increases and then decreases. So, the activity of the brain is higher during the observing a start and an end of the video. We can assume that at these moments an active analysis of the situation takes place and, consequently, the stress tension increases. At the stage of selecting the answer the tension slightly decreases. That is the pattern traced in all situations: 1) the correct answer in all trainings; 2) The wrong answer in all trainings; 3) The wrong answer in the first – the right in the second and third training.

From the first training to the later ones it was impossible to reveal a common dynamics of changes in activation index's power. In some cases the following trend in changes of activation index at the moment of making decision was shown.

The index value of activation in the situation of "the wrong answer - the right answer" decreased from the first control training to the second one and grew up from the second control training to the third one. In almost all cases, the activation index value on the third training is higher than on the first one. Accordingly, the tension level rises during the second training when athletes choose the correct answer at the first time and decreases on the third training. This correlates with the hypothesis of the study and with the results of analysis of reaction time and the eye movements. The same dynamics took place in a situation where all of the answers were wrong. In a situation where the answers in all three meetings were correct, the index increased by activation of the first meeting of the third, i.e. the origin there were a gradual decrease of stress tension's level. There was a trend to an increase in the value of the activation index at the time making decision from the first training to the second one and reducing it to a third one. Moreover, this trend can be seen in all three possible situations.

According to data obtained as a result of the Loretta analysis, we were able to identify the following dynamics activation of brain structures from the first training to the third one.

In the first meeting the highest activity was observed in the frontal cortex (Frontal Lobe). Gradually, the activity is moved in the occipital cortex and Brodman area 18. It can be assumed that on the second meeting a participant read the possible answers more carefully for avoiding the same mistake. On the last meeting the highest activity was observed in Brodman area 40 and inferior parietal lobe. During the third meeting participant was doing an active critical analysis of complicated professional skills. Overall, these results quite well corresponds with the

currently known data on the brain mechanisms of decision making and with the results obtained with the spectral analysis of the same EEG fragments.

Based on expert assessment of sportsmen, positive data on the formation of anticipation skill was also identified. The evaluation was conducted on the four factors of quality sports training before and after the experiments: the speed of decision-making and quick reflexes and ability to act in unusual situations, the ability to anticipate the opponent's moves and the ability to adequately assess the opponent.

In the experimental group the criterion of Wilcoxon rank showed significant differences (0, 041) in the change of the average numbers for the qualitative assessment factors sports training.

After the expert assessment experimental and control group had training fight with the support group, who were asked to use ten basic freestyle-wrestling grips in every fight. Members of the experimental group evaluated the situation much quicker and used more anticipating moves than athletes of the control group.

4. Conclusion

1. A method of forming and developing the skill of anticipation for the junior freestyle wrestlers was worked out. The effectiveness of the training on this methodology was confirmed by qualitative and quantitative changes in the development of the ability to anticipate the opponent's moves.

2. Systematic training lead to a reduction of the number of mistakes in foreseeing the opponent’s actions and the gradual reduction of reaction time, needed for making a decision and choosing the correct answer.

3. The analysis of participants’ eye movement complex characteristics showed that during the passage of trainings there is a significant reduction of oculomotor activity during the selection of the right answers. The number of fixations, of repeated returns to the area of Interest, the number of fixations and glances, reversing saccades and time of the delay and fixations on the text of the question and answers are reduced.

4. Analysis of the spectral parameters of the most subjects’ EEG showed a gradual decrease in tension during the analysis of simulated situations from the first training to the latest one. This corresponds to the study’s hypothesis and may be one of the anticipation skill development’s correlate.

5. Analysis of EEG data with “Loretta” method showed that in the first meetings of the highest activity is observed in the frontal areas of the brain, and the latest training it gradually moved to the occipital and temporal segments, which are responsible for a critical analysis of complicated professional skills.

6. Expert evaluation in major qualitative factors showed their significant increase in the experimental group. During the training fights athletes of experimental group had more anticipating actions than the control group.

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