

Assess psychomotor, sensory-perceptual functions in team-sport games

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Abstract

Purpose. Studies demonstrate to investigate the impact of team-sport games on the formation of theoretical knowledge and tactical thinking in freshmen students of Zaporizhzhia National University (ZNU). *Methods.* Overall, 163 freshmen students (57 handball players, 51 football players and 55 basketball players) were enrolled. To assess the influence of training practices in team-sport games on the level of theoretical knowledge and tactical thinking of ZNU students, we conducted and analyzed the dynamics of the relevant indicators. The recorded data was compared at the beginning and end of the study. The levels of theoretical knowledge and tactical thinking of the students involved in basketball, handball and football was assessed using the innovation computer program. *Results.* It was observed that most of the investigated characteristics in all studied groups of students steadily improved during the year. The tactical thinking level of student athletes with excellent value in performance football was 15.69%; in handball – 33.33%; in basketball – 14.55%. The theoretical thinking level of student athletes with excellent value in performance football was 19.61%; in handball – 36.84%; in basketball – 16.36%. *Conclusions.* Handball help expedite the flow of thought processes directed at finding efficient ways of problem-solving and achieving goals on the court, and developing a sense of extrapolating the technical actions that may occur during the game.

Key words: students, basketball, handball, football, computer program

Introduction

In modern team-sport games, in the foreground system perceptual-intellectual, emotional, and volitional processes occur in ever-changing conditions of activity with minimal time to understand and analyze situations, decision-making and implementation, with the active counteraction rivals. Competitive activity requires not only accuracy of perception of objects, rapid response and execution of motor actions, but also the operational mental activity, providing analysis of the situation, the selection and implementation of optimal solutions of a certain number of alternatives [Borgeset al, 2015; Izzo&Varde, 2018; Tyshchenko, 2016]. The complexity of the tactical action in team-sport games determined difficulties in the perception of situations that occur immediately during a game. The implementation of tactics for student athletes are characterized by two levels of operational objectives: sensory-perceptual and prognostic. In the first level, there is a choice among several solutions in response to unexpected situations as they arise, in the second level – the decision comes as a result of the rules that take in the account the actions of the contender and reflexive behavior [Kozina et al, 2017; Menegassi, 2018; Tyshchenko, 2015].

Material And Methods

Participants

163 freshmen students of Zaporizhzhia National University (ZNU) were participated in the experiment (57 handball players, 51 football players and 55 basketball players, all male). All students volunteered to participate in the test. Prior to the testing, the procedures were explained to the students, including the possible risks involved, and an informed consent form was signed. In the end of the experiment, the participants were tested. They were free from any injury or neuromuscular disorder.

Goals, methods and procedures

The purpose of the research – to investigate the impact of team-sport games on the formation of theoretical knowledge and tactical thinking in freshmen students of Zaporizhzhia National University. The subject of the research – the training process in team-sport games. The object of the research – indicators of the level in theoretical knowledge and tactical thinking with the help of an innovative computer program.

To assess the influence of training practices in team-sport games on the level of theoretical knowledge and tactical thinking of ZNU students, we conducted and analyzed the dynamics of the relevant indicators.

The recorded data was compared at the beginning and end of the study. Certain goals of the research, prior to the assignment, were created and had tasks to be followed:

1. To compare and assess the levels of theoretical knowledge and tactical thinking of the students involved in team-sport games.

2. To prove the influence of athletic training in team-sport games on formation of theoretical knowledge and tactical thinking, Pearson's chi squared test should be used to determine significant differences in the distribution of excellent, good, average, and low values in ZNU students.

To achieve the objectives in the following research methods were used:

1. Computer testing the level of theoretical knowledge in team-sport games using a computer program [Tyshchenko, 2015] developed by us (fig. 1).

Testing took place at the 150-point scale and is determined by the value of 4 (excellent – more than 135 points, good – from 82 to 130 points, average – from 41 to 81 points and the low – below 40 points).

2. Computer testing of tactical thinking in team-sport games [Evhen & Valeria, 2017; Tyshchenko, 2015] (fig. 1).

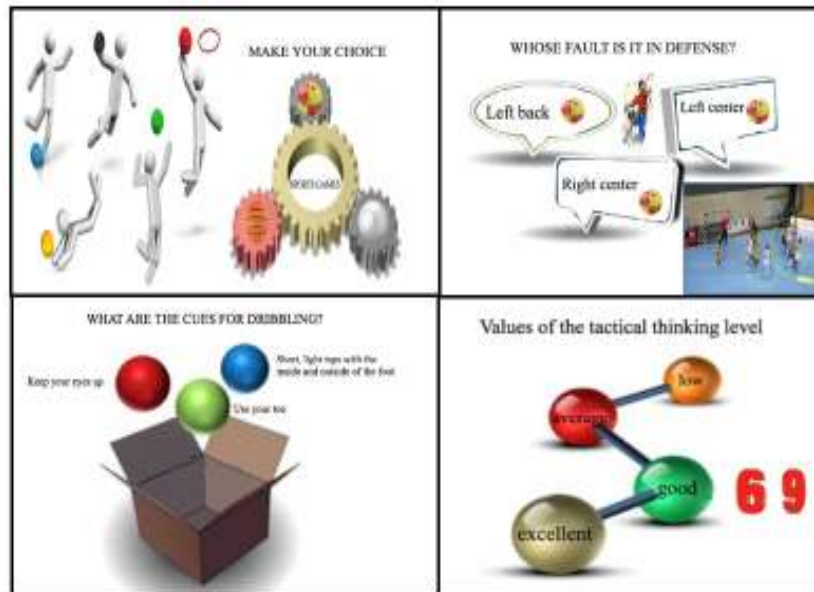


Fig. 1 Diagrammatic representation of computer program

Testing took place on the 100 point scale and defined 4 values (excellent – more than 92 points, good – from 62 to 92 points, the average – from 31 to 61 points and the low – below 30 points).

The levels of theoretical knowledge and tactical thinking of the students involved in basketball, handball and football was assessed using the innovation computer program [Tyshchenko, 2015] that was created at the handball club ZTR (Zaporizhzhia, Ukraine). The main browser screen is a catalog listing the types of team sports (basketball, handball and football) arranged according to categories (theoretical knowledge or tactical thinking). Most needed are represented as icons at the top of the interface.

This program is divided into 2 parts: theoretical and practical. The first block contained questions concerning the foundations of knowledge, general and special physical training, and technical and tactical actions in team-sport games. The second block provided video scenes of contentious issues with selected questions. The participant must answer correctly maximum number of questions from a selection of inquiries. After each block, the program displays achieved value (low, average, good or excellent), depending on the number of correct answers.

Proposed by the authors, the program form of the interpretation of the data can significantly facilitate its analysis of the immediate aftermath in the control testing, and the use of functions provided by the program "Library", is possible to analyze the dynamics.

Statistical analysis

Assessment of quality growth, levels of theoretical knowledge and tactical thinking was performed using nonparametric Pearson's chi square χ^2 . The choice of this criterion is based on the fact that the results of the evaluation method makes it possible not to consider the analyzed statistical distribution as a function and does not imply a preliminary calculation of the distribution parameters. Therefore, its application to sequence criteria which is a level selection, level of theoretical knowledge and tactical thinking, allows to reliably view the results of the pilot study.

Construction of the sample size and the proof of its margin depends on two conditions: selecting a confidence interval allowable error (error margin), and the representation of social facilities for the most important characteristics for the researcher. The level of significance was chosen $\alpha = 0.01$, where the reliable measured values can be obtained without a preliminary assessment of the distribution law. Determination of the minimum sample size was carried out according to the results of studies, M. Grabar, K. Krasnianskii, Shelomovskii V., in which it was proved that when using the criterion χ^2 sample volume should be at least 20-30 variants (elite), otherwise the application of this criterion received data unreliable and ungrounded [Grabar & Krasnianskii, 1977; Shelomovskii, 2005]. The resulting value χ^2 was compared with the table, and was chosen for the degree of freedom and a significance level of [Gorkavii & Jarova, 2004]. It has been known that the accuracy of the results of the experiment depends on the quality measurements of empirical data obtained during the study, as well as the correctness of the theoretical conclusions based on these data. As part of our research for the most objective characteristics of quality measurement and interpretation of empirical data reliability of the information criterion was used.

Indicators of reliability criteria can be defined: the validity of the information – lack of theoretical errors in measurement; representative information – lack of the sampling errors of research; the stability of information – the lack of random measurement errors; correctness and accuracy of information – the lack of systematic measurement errors [Gorlach, 2013].

According to these indicators, the task of the diagnostic phase of experimental work has been formulated as follows: the validity of the information – to determine the evaluation criteria; performance levels of theoretical knowledge and tactical thinking; correctness and accuracy of the information is to define the levels of theoretical knowledge and tactical thinking and justify the statistics; representative information – to determine the required sample size; the stability of information – to determine the timing of the diagnostic slices.

Ethical approval

The research was approved by the Institutional Ethics Committee. The research was conducted in compliance with WMA Declaration of Helsinki – Ethical Principles for Medical Research Involving Human Subjects, 2013.

Informed consent

Informed consent has been obtained from all individuals included in this study.

Results of the research

The design of testing technologies includes blocks like information and educational, operational-activity and criterion-evaluation. The emphasis on the testing of athletes has been made of the fact that the assimilation of knowledge and skills through active search and independent solution to the problem was more durable than traditional training. Formulation of the problem with the help of case studies (videos of controversial points) assists to find intellectual difficulties of handball players on the court and their mental focus.

We obtained the following results in the study of the theoretical knowledge level. In determining the theoretical knowledge of high accuracy of the responses to the job, sometimes it does not coincide with high speed and due to the cumulative effect was improved at the end of the year. Confirming scientific evidence, the presence of gaming experience is necessary for the formation of tactical thinking. Therefore, we paid close attention to the tactical implementation of psychomotor tasks. In that phase, the large role was played by sensorimotor coordination, speed and accuracy of action.

At the beginning of the study, students were tested to determine the initial level of tactical thinking and the theoretical knowledge evidence that there was no statistically significant difference between students' breakout groups were obtained (fig. 2, 3).

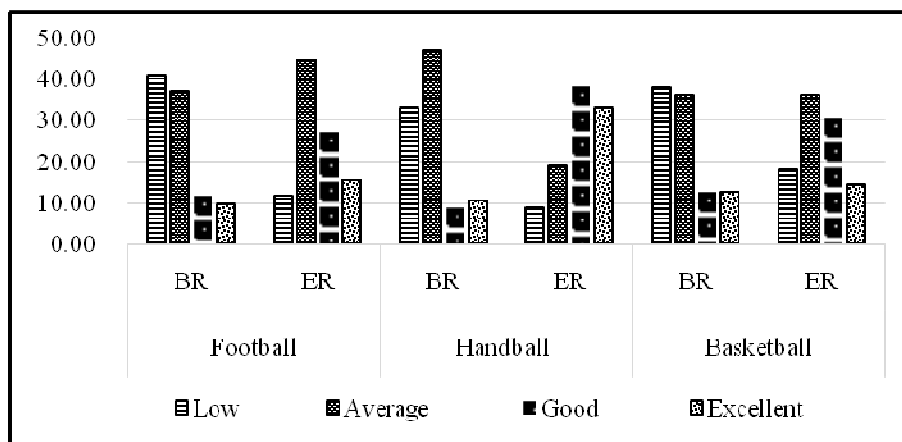


Fig. 2 Dynamics of the level of tactical thinking at the beginning (BR) and end (ER) research, %

The results' analysis of statistical processing of the experimental data showed insufficient formation of theoretical knowledge and tactical thinking. Calculation test showed that the obtained value of Pearson's chi squared Pearson's chi square χ^2 could be seen in the zone of the insignificance, which suggests the equality of conditions in all team-sport games. Thus, for the tactical thinking level among handball and football players Pearson's chi square $\chi^2 = 1.34$ s.u., which is significantly less when compared with tabulated data, equal 7.81 s.u. The same structure has been seen between handball and basketball players Pearson's chi square $\chi^2 = 1.52$ s.u. This made it possible to conclude that with probability ($p=1-0.05=0.95$) made a statement – that students differ insignificantly (fig. 2). Pearson's chi square χ^2 level theoretical knowledge between handball and football players was 0,31 s.u., between handball and basketball players Pearson's chi square $\chi^2 = 0,14$ s.u. (fig. 3).

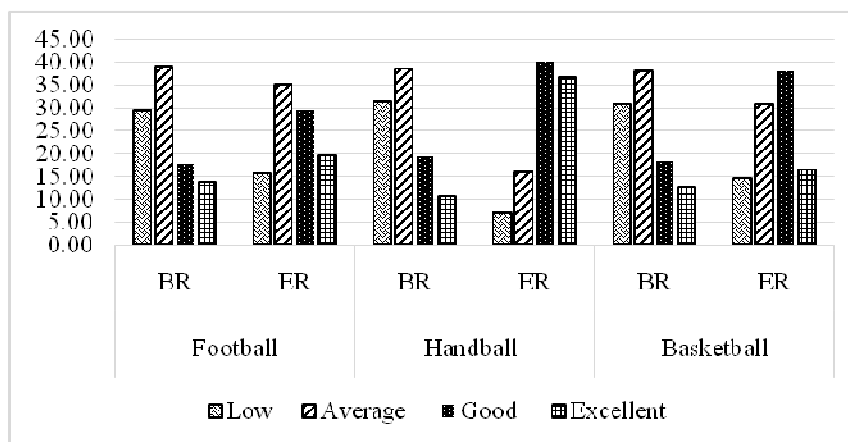


Fig. 3 Dynamics of the level of theoretical knowledge at the beginning (BR) and end (ER) research, %

At the end of the study, the levels of theoretical knowledge and tactical thinking, we obtained information about significant differences in team-sport games. Calculation Pearson's chi square χ^2 showed that the criterion value obtained lies in the zone of significance (Table 1). Pearson's chi square χ^2 tactical thinking level of initial and final data for football players was 12. 61 s.u., handball players – 32.37 s.u., and basketball players – 8.14 s.u. In addition, it was observed significant differences in the final results of tactical thinking level. Pearson's chi square χ^2 between football and handball players was 10.28 s.u., between basketball and handball players was 9.37 s.u.

Table 1

Indicators of the tactical thinking level involved in team-sport games at the end of the study

Values, S	Football		Handball		Basketball	
	factual frequency, f	theoretical frequency, f'	factual frequency, f	theoretical frequency, f'	factual frequency, f	theoretical frequency, f'
<i>Low</i>	6	5.19	5	5.81	10	7.37
<i>Average</i>	23	16.06	11	17.94	20	15.22
<i>Good</i>	14	17	22	19	17	19.15
<i>Excellent</i>	8	12.75	19	14.25	8	13.25
Total	51	51	57	57	55	55

According to the theoretical knowledge level of the initial and final data for football players Pearson's chi square χ^2 was 4.27 s.u., handball players – 26.93 s.u. and basketball players – 7.81 s.u. (Table 2).

We have received positive dynamics of theoretical knowledge and tactical thinking with a help of a computer program that allows us to recommend it as a diagnostic technique in the curriculum for student athletes.

Table 2

Indicators of the level of theoretical knowledge involved in team-sport games at the end of the study

Values, S	Football		Handball		Basketball	
	factual frequency, f	theoretical frequency, f'	factual frequency, f	theoretical frequency, f'	factual frequency, f	theoretical frequency, f'
<i>Low</i>	8	5.67	4	6.33	8	5.89
<i>Average</i>	18	12.75	9	14.25	17	12.76
<i>Good</i>	15	17.94	23	20.05	21	21.6
<i>Excellent</i>	10	14.63	21	16.36	9	14.73
Total	51	51	57	57	55	55

Discussion

The process of sports activity in extreme conditions, competitive activity of the student-athlete directly addresses the specific technical and tactical tasks. It flows inseparable from the proceeds of motor action and direct perception of visual images and effects in conditions of strict time limit, during intense physical stress, against various experiences, and considering the degree of probability of anticipated events [Ferrari et al, 2018]. Directly during the match anticipation of players is not only based on probabilistic forecasting, but also on preventive actions. This special issue is occupied anticipatory reaction, if actions occur in the beginning of the action, or the opponent's movements. Anticipatory reaction as anticipatory reflection of reality is only possible on the basis of the totality of mental processes. In some cases, they are carried out on the basis of the perception of moving objects (the flight of the ball, player movement, etc.), in others – based on memory, thinking and reaction of the players (with interception operations in the protection and etc.) [Tyshchenko et al, 2018].

Many studies focus on psychomotor, sensory-perceptual functions in sports. The agility in sport is correlated with body stability, rapidity and speed [Izzo & Varde, 2018]. For example, it was established that at the stage of in-depth extensive volleyball training is among the leading interest in the sport and cognitive motives [D'Isanto, Altavilla & Raiola, 2017]. Further, it was determined that the tactical thinking of young basketball players was developed only through competition, via operational and spatial thinking [Bazylevsky, 2014]. These results are consistent in our study. In another thesis, it was proved decision-making in sports is influenced by several cognitive processes and that a major factor in the structure efficiency tactical thinking players and individual typological factor which contains parameters of neural and psychodynamic functions [Menegassi et al, 2018]. However, only one study directed to analyze the relationship between aspects psychosomatic variables with protocols and the specific tactical knowledge of the modality [Borges et al, 2015]. These results are consistent with the findings of our studies.

For monitoring the functional training, assessment of mental status and physical performance applied automated methods variation pulsometry, which are implemented as automated medical examination of the complex and carried out by using automated systems, "Kamo". The study expressed features (accentuation) character which is determined by a computer psych diagnostic method, "ACCENT". Control of the functional state of the circulatory system, and the evaluation of the immune status of student athletes – with the help of an automated method of impedance rheography used, "CENTAVR". Control of the functional state of student athletes – in terms of psychomotor and for the fast assessment of the state of the motor and the regulatory functions of student athletes used computer system, "EFECS". The automated system (AS) "REACTION", designed to study individually-typological features of athletes' nervous system (the power of the excitation of the nervous system). Quite often, computer software Rapid Assessment, "SHVSM", of functional level of preparedness has been used for sportsmen. The experience of which turned out to be quite effective when dealing with athletes who specialize in various sports [Malikovetal, 2012]. The number of studies devoted to the monitoring of psycho-physiological fitness and psychological characteristics of the individual handball players. Substantiated functional state of the nervous system in handball players related to the degree of manifestation of individual and typological properties of nervous processes [Yuriyetal, 2016; Evhen& Valeria, 2017].

The application of psychological strategies to improve performance in sports has developed significantly over the past time. Although some researchers despite the correlation between psychological factors and performance, psychological factors alone could not determine the performance of elite soccer players [Abdullahetal, 2016] Relatively high requirements to individual psycho-physiological characteristics make the specificity of team-sport games. Firstly, the motor and psychological complexity of sports activities causes the performer a unique combination of highly developed abilities that are manifested in the mental qualities of perceptual, cognitive and psychomotor areas [Tani et al, 2011]. Secondly, the modern conditions of training and the competitive process require the summation of psychodynamic and personal characteristics that optimize the process of solving operational problems or, at least, contribute to the full realization of an individual approach. Third, athletes' training load on the body depends on many factors the main one is the nervous system [Kozinaetal, 2017]. The same dependence was obtained in our research as well. Therefore, only an analysis and consideration of the complex rather complicated psychophysiological qualities of team sports athletes would allow the effective training of athletes during training process. Our previous studies have attempted to examine the effectiveness of various drugs and psychomotor control methods that will determine the main directions and ways to improve the psycho-physiological features in team-sport games [Tishchenko, 2016; Valeria etal, 2017]. The practical significance of this problem has become a prerequisite for the study. The benefits of testing technologies include the time-saving aspect while also evaluating knowledge. But there are certain disadvantages, such as if the results of people are only by fixing response rates, we do not see the nature of the decision stroke (mental activity can only be probabilistic). In this case, the guarantee of the presence of the subject's knowledge there is no quality. Additionally the test does not eliminate the ability to "guess"; For example, the job test contains only two answers, one of which is "true". In addition to the significant disadvantages of testing can be attributed to the limitations of the materials, which can be reliably tested by this method, no way to verify the degree of independence. Furthermore, to the above, the test does not generate creative or innovative capacity that is constantly used in team-sport games.

Currently, there are four basic tasks of the system in the test form: chain, text, theme and situation. As they note, case studies – is pedagogically processed fragments of specialist activities. They are designed to test the skills of the subjects to act in practice, extreme and other situations. Case studies focused on integrative control competencies, so we relied on a wide range of applications in the training process like the use of innovative light simulators for team-sport games with the requirements of educational psycho-diagnostics (objective approach) when the diagnosis is based on the successful implementation of activity [Valeria & Olexander, 2015]. At the same time, we have developed professionally pedagogical technology is a complete integrated system, pointed at the acquisition of knowledge and the acquisition of professional competencies. In addition, the proposed innovative technology that fully takes into account the specifics of the intellectual capacity and the structure of competitive activity in team-sport games.

The use of computer-based testing of tactical thinking expresses the technological approach to the use of video material. For team-sport games, there is a number of techniques for the diagnosis and control of tactical thinking players: handball, basketball – "Basket-Test" [Bazylevsky, 2014], volleyball players – "Volleyball-Test" [Artemenko&Glazyrin, 2013], rugby players – "Rugby – 13" [Podoliaka&Pasko, 2011]. The innovative technology of computer-based testing is treated as a combination of the method of complex testing, processing, video and theory lessons. In our case it is the optimal integration of the project method, integrated method, search and interactive method, the method of visualization, and relies on evolutionary, competence and formal approaches.

Due to the information received, the coach doesn't get just test data, but has the ability to make corrections in the training plan. Because of this, he not only knows the form in which each player is at the

moment, but also can apply this knowledge to effectively prepare the team for the competition, to unlock the potential of each team member.

For the corresponding psychophysiological reactions, the psychological climate in the team, a high degree of operational thinking players, improving inter-relationship between the athletes, we offer the following methods:

1. Creating links and links on the basis of accounting degree athletes compatibility of mental activity at operative solving tactical problems.
2. Special exercises to improve the speed and accuracy of operational thinking.

Conclusion

1. Based on the presentation of our computer program of theoretical knowledge and tactical thinking in the training process, it was observed increase in the productivity of competitive activity and the formation of students-athletes in professional competencies and knowledge-transformation. The proved data indicate that the use of the innovative computer program as an additional tool to improve theoretical knowledge and tactical thinking student athletes who practice team-sport games is recommended (reference statistics briefly here).

2. Analysis of the results in the study pointed to the increase in student athletes with indicators of excellent and good levels; a simultaneous decrease in the number of students of average and low values. The tactical thinking level of student athletes with excellent value in performance football was 15.69%; in handball – 33.33%; in basketball – 14.55%. The theoretical thinking level of student athletes with excellent value in performance football was 19.61%; in handball – 36.84%; in basketball – 16.36%.

3. Handball help expedite the flow of thought processes directed at finding efficient ways of problem-solving and achieving goals on the court, and developing a sense of extrapolating the technical actions that may occur during the game.

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Conflicts of interest

The authors declared no potential conflicts of interest with respect to the research, authorship and publication of this article.

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