ISSN 2708-7581 (Online)
ISSN-L 2708-7573

JLTM Journal of Learning Theory and Methodology

Scientific journal

June 2022
Volume 3
Number 2

JLTM
LLC OVS

ISSN 2708-7581 (Online)
ISSN-L 2708-7573

Journal of Learning Theory and Methodology
Журнал теорії та методології навчання
Abbreviated key-title: J. learn. theory methodol. (Online)

Scientific journal
Науковий журнал

Three issues per year. Established in 2020
Три випуски на рік. Заснований у 2020 році

https://www.ltmjournal.com. E-mail: editor-in-chief@ltmjournal.com

Abstracting and Indexing:

CrossRef; ROAD (Directory of Open Access scholarly Resources); DOAJ (Directory of Open Access Journals); ICI Journals Master List / ICI World of Journals; Google Scholar; Open Ukrainian Citation Index (OUCI); Scilit (A database of scientific & scholarly literature); WorldCat

DOI: https://doi.org/10.17309/jltm.2022.2

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Journal of Learning Theory and Methodology
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June 2022, Vol. 3, Num. 2

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Журнал теорії та методології навчання

ISSN 2708-7581 (Online)
ISSN-L 2708-7573

ORIGINAL SCIENTIFIC ARTICLE

STATISTIC COURSE: CAN IT IMPROVES NUMERIC REASONING ABILITY?

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Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

DOI: 10.17309/jltm.2022.2.01

Abstract

Background. Statistics courses are often one of the courses that must be taught in a college study program. Statistics help students think logically and implement a variety of problem-solving strategies. Statistical learning involves the ability of numerical reasoning to understand data processing and mathematical problems. Will statistics courses be able to improve students' numerical reasoning?

Purpose. This study aims to find out the comparison of students' numerical reasoning skills before and after taking statistics courses.

Materials and methods. A total of 63 students who took statistics courses became a sample. This research uses a quantitative approach. Data collection was conducted over a semester in an online course using a basic proficiency test of numerical reasoning section (α Cronbach = 0.899). The statistical analysis technique used is a Wilcoxon test paired sample.

Results. The results of this study showed an increase in numerical reasoning in students after attending statistics courses ($M = 7.50$; $SD = 1.87$; $p < 0.05$). The results of other related studies were also discussed.

Conclusion. The implication of this study is a statistical course learning model that can be replicated. The increase in numerical ability is also evidence that this ability can be trained with more exposure, the more students will increase their abilities.

Keywords: numerical reasoning, statistics, undergraduate students.

Introduction

Numerical reasoning is a fundamental ability to solve mathematical, number, or numerical problems, basic arithmetic operation, etc. This numerical reasoning can help complete data interpretation, analyze graph and others data, evaluate or critique numerical problems, and draw conclusion from existing data. In addition, this ability also involved in critical thinking, forecasting, and knowing pattern, so that numerical reasoning can be considered as one of the most basic skill (Meirisa et al., 2021; Omonity-Israel & Oluwatoyin-Faith, 2018).

Numerical reasoning has four indicators including mathematical calculation, logically thinking, the ability to solve problems and the ability to sharpness in distinguising numerical patterns and their relationships. Mathematical calculation is the ability to perform basic calculations such as ordinary calculations, logarithm, square roots and others. Logical thinking is an ability that involves logical explanation, cause and effect and systematic. Problem solving is the ability to digest a story and formulate it into a mathematic equation. The sharpness of numerical patterns and their relationships is the ability to analyze the most logical and consistent sequence of numbers or letters that are related to each other (Isworo et al., 2014).

From all the indicators of numerical reasoning it also can be useful for students such as students will be prepared when they can master numerical reasoning by having the ability ko think logically, analitically, systematically, critically and creatively. In general, students who have high numerical easoning abilities will have an organized way of thinking in solving problems, able to filter and manage informations and be able to perform complex mathematical calculation or operation (Juita & Yulhendri, 2019). This is in lane with statements (Indrawati, 2015) which states that the numerical reasoning test can measure person's intellectual abilities, especially the ability to reason in arithmetic and think logically. In addition, there is research (Cahyono et al. 2016) which says that numerical reasoning is a special ability in counting that can help students ability to understand and solve problems that require high-level thinking skills including problem solving abilities.

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Stundents with high numerical reasoning will be better at doing arithmetic, while students with low numerical reasoning will tend to have difficulty in counting. This affects the process of learning activities so that students are found who complain of having difficulty in learning mathematics because in addition to being able to understand concepts, students also have to count with the formulas that already described (Rahmawati et al., 2016). In Zaini's research (2021) mentions the things that cause the low numerical reasoning ability of students including they do not understand basic calculations, are less able to think intuitively in understanding problems, weak ability to use reasoning, can not think logically so that the components in incomprehensible material.

Learning is a system that involves various components that are interrelated and interact with each other, so as to achieve optimal educational outcomes or goals, these components can consist of teaching staff and students (Pane & Darwis Dasopang, 2017). Students who are learning can be interpreted as students who are oriented in learning so that students gain knowledge, develop attitudes and skills. The learning process can include several important components, such as the media used during learning, curriculum, and learning facilities (Firmansyah, 2017).

When studying in higher education, you will often be faced with learning statistics courses, especially when studying these subjects can pose a challenge to students as students who do not have the ability to operate mathematical calculations (Abd Hamid & Sulaiman, 2014). Moreover, the statistics course in universities is one of the subjects that must be taught by almost every study program, so that the learning of this course has a goal, which is students can understand the concepts and procedures of statistics, and be able to apply them when analyzing problems on research that will be carried out by students, especially students who will prepare their final assignments (Afifiah & Wicaksana, 2014).

Statistics courses are material that is studied in mathematics, statistics can be useful to solve daily life problems and can even be used in various scientific fields, such as sociology, economics, health and even in the office sector. This makes statistics a very important and useful science for everyday life. Statistics courses (in this case in the non-statistics department) are not intended to make someone a statistician, but to provide the knowledge needed in research activities in their respective fields (Anggraini & Syahbrudin, 2021).

Statistics learning activities will of course be related to the process of understanding mathematical data processing, moreover the material contained in this course tends to be more calculating, so that good reasoning skills are needed regarding this matter. One of the appropriate reasoning used is mathematical reasoning, this reasoning is related to calculations or numerical (Erviana, 2019). Reasoning has a term as 'reasoning' which can be interpreted as a process of reaching logical conclusions based on relevant facts or sources. Then, mathematics has a term as mathematical which means that something is related to mathematics, such as calculations or numbers (Erviana, 2019).

Numerical reasoning is one of the important skills in dealing with various fields such as mathematics, physics, accounting, chemistry, economics, engineering, banking, business, and other fields that require a mathematical component. The use of good numerical reasoning, proved to be profitable. Someone who has high numerical reasoning will find it easy to use statistical data or data in the form of numbers and be able to use them creatively and accurately. Statistics will help individuals to think logically and clearly, and be able to apply a series of problem solving strategies (Marriott et al., 2017).

Improving the competence of learning statistics related to reasoning which is understanding of concepts, solving a problem and being able to improve communication skills. One of the goals of learning statistics is to solve, reasoning is needed to find the right solution in solving problems related to basic statistics. In solving problems related to statistics, each student has time to try various kinds of reasoning in solving these problems. Most of the material in the basic statistics course is abstract and some questions are in the form of reasoning and application questions so that basic numerical reasoning skills are needed to solve problems related to statistics (Soewandi et al., 2021).

One of the applications of numerical reasoning can be studied in statistics courses. In statistics courses, there are many concepts of calculation, data analysis, mathematical problems, and number operations, so numerical reasoning skills are needed more or less. Will statistics courses be able to improve students numerical reasoning? This study aims to determine the comparison of students numerical reasoning abilities before and after attending statistics lectures.

Materials and methods

Study participants

In this study, participants from the Faculty of Psychology, University of Muhammadiyah Purwokerto, were taking statistics courses. At the beginning of the study, there were 63 students from 2 statistics classes who were the research participants targets. At the first meeting, there were 74 students who had filled out the pre-college numerical test. However, in the second measurement, there were only 63 students who had taken the numerical test until the end of the course, and were able to complete the numerical test completely. In the end, this study only used 63 students who were directly involved in the research process. This study uses a quasi-experimental type of research, quasi-experimental research is the use of methods and procedures to make observations in a study that is structured similar to an experiment, but the conditions and experiences of the participants lack control because the research is limited to random assignments, including comparison or control groups (William & Hita, 2019).

Instrument

In the numerical reasoning test, we can use the speed test, a test that prioritizes speed, with problems consisting of: basic arithmetic, such as addition, subtraction, multiplication, division, number series) and simple mathematics such as percentages, fractions (Psychometric Success, 2013). And of course in this test it is not allowed to use counting tools (Abed, Al-Absi, & Abu Shindi, 2015).

The instrument used in this study was a basic ability test, part of a numerical scale from the Psychology Service Bureau, Universitas Muhammadiyah Purwokerto. The basic ability test on this mathematical scale is usually used to

see numerical reasoning abilities in participants who take psychological tests. This test was developed based on the assumptions of psychologist Louis L. Thurstone (1887–1955) who assumed that intelligence does not consist of only one factor but consists of several mental abilities, one of which is numerical ability that measures mathematical reasoning (Thomas, 1939). In this study, 20 items were taken from the basic ability test scale sections 5 and 6, considering the limited time for lecture meetings. Scoring is done by giving a score of 5 if the answer is correct, and a score of 0 if the answer is wrong. So, the maximum score on this test is 100, while the minimum score is 0.

Validity of the test is carried out with content validity, which is paying attention to the items in the test according to what you want to measure and ensuring that the test items are easy to understand. After the test was successfully carried out, the next step was to perform a reliability test to see the internal consistency using Cronbach Alpha. The results of Cronbach Alpha show a coefficient of 0.899. Based on the results of the alpha coefficient, it can be said that the numerical test used has a good level of reliability (Oluwatayo & Ayodele, 2012; Kaplan & Saccuzo, 2005).

Procedure

This study involved as many as 2 classes of statistics. The instrument is given in the form of a quiz attached to the campus's learning management system (LMS), with the domain onclass.ump.ac.id. LMS is a software that utilizes information technology for learning media or other activities (Gunawan et al., 2021). Each student has their own onclass account. Every assignment, quiz, material will be visible and can be accessed through the account of each student. The advantage of using onclass in learning is that students can systematically access learning materials every week. In addition, the material provided can be synchronous and asynchronous. This study uses both methods. Not every week students take virtual face-to-face lectures. Even students can access learning materials at any time, not limited to lecture meetings. They can also review or re-learn the material that has been given.

Students have sixteen meetings during one semester. Students get quizzes at the 1st and 15th meetings, when they just start lectures and before the end of semester exams. Meanwhile, the 8th and 16th meetings are the midterm and final exams.

During the test, students are asked to log into their own onclass accounts during lecture meeting hours. Then presented questions (quiz) in the form of short answer as many as 20 number questions. The researcher first asked for student approval to fill out the test. For students who are willing to take the test, they are given 30 minutes to answer each of the available questions by writing down the answers in the form of numbers. After students submit their answers, they will see the score they got.

Learning Flow

The learning flow used in the statistics course for one semester in this study includes virtual face-to-face meetings using zoom meetings, learning videos, and quizzes. In general, the pattern made in this lecture are theortical material and also practice questions at each meeting. So, every student has to exercise solving the statistical or numerical problems. Discussion of questions is also always given face-to-face via zoom meetings after quizzes and exams did, so that students know the mistakes they made and how to do it correctly. In addition, there are consistent quizzes and exams conducted after 3 meetings so that students can prepare better by studying material and statistical issues.

Results

The results of participant descriptive analysis are in the table 1.

Table 1. Analysis Description

	Group	N	Average	Median	SD	SE
Pre	male	14	63,9	72,5	25,3	6,76
	female	49	72,2	80,0	15,8	2,25
Post	male	14	76,8	85,0	21,4	5,71
	female	49	76,0	80,0	19,2	2,74

A total of 63 participants (14 men and 49 women) took the pre-test and post-test in this study. In general, table 1 shows that there is an increase in the average, median, and SD in the post-test scores compared to the pre-test scores, both in the male and female groups. Furthermore, the change in pre-test scores in male participants was bigger than female participants. The pre-test score for men had an average of 63.9 with a median of 72.5 then the post-test score increased to an average of 76.8 with a median of 85.0.

Based on the results of the normality test, it produces a (p) value of 0.01. So, it means that the distribution of the data is not normal, so an analysis using a non-parametric test is needed.

Tabel 2. Wilcoxon Test Paired Sample

			Statistic	p	Mean difference	SE difference
Pre	Post	Wilcoxon W	418[a]	0.002	-7.50	1.87
[a]7 pair(s) of values were tied						

Based on the results of the non-parametric Wilcoxon test paired sample in table 2, there is a significance level (p) of 0.002. This value is less than 0.05, so it can be concluded that there is a very significant difference in students numerical reasoning abilities before and after the statistics course is given. In other words, studying statistics can improve students numerical reasoning.

Discussion

Based on the results of the paired sample wilcoxon test, it shows that there is a very significant difference in numerical reasoning ability, before and after the statistics course is given. The Wilcoxon test paired sample test technique is a method of testing data to measure the effectiveness of behavior, which is marked by a difference between before and after certain treatment is given (Widiyanto, 2013). In other words, statistics course is effective in improving students numerical reasoning. These results are in line with Cresswell and Speel-

man's (2020) research conducted on 123 first-year students in Australia. The results of their research indicate that mathematics training can improve mathematical problem solving skills and critical and logical thinking skills.

The results of this study can provide an illustration that the application of statistics courses has a positive impact on students, especially male students. Numerical or statistical reasoning skills are important because they are useful for obtaining, managing, and utilizing information to survive in conditions that are not permanent, volatile, uncertain, and competitive (Somatanaya, 2017). Statistics are needed in daily life. One of the skills students need is the ability to reason and prove, to help solve statistical problems in daily life (Habibatul Izzah & Azizah, 2019). If it is balanced by an innovative and creative learning system, it will improve students numerical reasoning abilities, learning motivation, critical thinking skills, and mathematical interpretation abilities (Mayang, 2021).

The application of online learning has positive sides, such as: students have a lot of time to do assignments, they do not have to come to campus, and lectures can be done anywhere so that students will be more flexible in using their time (Rochima, 2020). Moreover, online learning also makes students have the ability to learn independently and easily understand the material that given (Jamil & Aprilisanda, 2020).

On the other hand, the results of research from Maulana & Iswari (2020) which show that during online learning, students who take statistics courses have emotional and stress disorders, there is even an increase in stress in female students which tends to be higher than male students (Maulana & Iswari, 2020). This is because during online learning students find it difficult to understand the material and assignments given online and lack the opportunity to interact with their teacher or lecturer. This may also be experienced by the participants of this study. Based on the scores obtained by the women's group, the change in their scores was not higher than men. The existence of a stress factor in women during online lectures is very possible. Unfortunately, this study did not look at these factors so that further research can add other variables to enrich the results (Maulana & Iswari, 2020).

Stress when attending online lectures often occurs in students. The difficulties experienced during learning, can not always be solved. Moreover, the lectures given in this study also involve asynchronous so that students can not always ask questions directly when they are confused about learning the material or practicing questions. The ability to deal with stress is also an important asset for students. Saragih & Sari's research (2019) shows that students who have stress coping strategies will be motivated to learn. Meanwhile, students who do not have stress coping strategies when participating in statistics learning tend to have no motivation to learn so they get not really good result (Saragih & Sari, 2019). The limitation of this study is does not involve other variables related to participants internal problems, such as stress levels, stress coping strategies, personality, and motivation. For the next research, it can be suggested that the discussion of the results is more comprehensive. The methodological weakness of this research is that there is no control group, there is no exclusion criteria for students who retake statistics courses.

The advantage of this research is that the research time is relatively long, which is one semester (longitudinal study), so that the changes found can be more meaningful. Longitudinal studies will provide an overview of an increase in ability, from new knowledge obtained through previous knowledge students have at different times, so that later they can be compared (Ijirana et al., 2021). Another advantage is that this research fully utilizes the use of technology in learning (e-learning). This pattern in the learning flow can be said to be effective, because it was found that there was a positive increase in student abilities, so that it could be duplicated in the next statistics lesson.

Conclusion

This study found that there were significant differences in students numerical reasoning abilities before and after attending statistics lectures. In other words, statistics courses are proven to improve students numerical reasoning abilities. The explanation to problems related to numbers, calculations, which are the basis of numerical reasoning abilities, for one semester, can improve students numerical reasoning. The implication of this study is a statistical course learning model that can be replicated. The increase in numerical ability is also evidence that this ability can be trained with more exposure, the more students will increase their abilities.

Conflict of interest

The authors declare that there is no conflict of interest.

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СТАТИСТИЧНИЙ КУРС: ЧИ МОЖЕ ЦЕ ПОКРАЩИТИ ЧИСЛОВУ ЗДІБНІСТЬ?

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Авторський вклад: A – дизайн дослідження; B – збір даних; C – статаналіз; D – підготовка рукопису; E – збір коштів

Реферат. Стаття: 6 с., 2 табл., 32 джерела.

Базова проблематика. Курси статистики часто є одним із курсів, які необхідно викладати в рамках навчальної програми коледжу. Статистика допомагає учням мислити логічно та реалізовувати різноманітні стратегії вирішення проблем. Статистичне навчання передбачає здатність числових міркувань у розумінні обробки даних і математичних проблем. Чи зможуть курси зі статистики покращити числові міркування студентів?

Мета. Дослідження має на меті з'ясувати ефективність курсу статистики у процесі порівняння навичок числового міркування студентів до та після проходження занять.

Матеріали та методи. Загалом у вибірку потрапили 63 студенти, які проходили курси статистики. У цьому дослідженні використовується кількісний підхід. Збір даних проводився протягом семестру в онлайн-курсі з використанням базового тесту на знання розділу числових міркувань (α Кронбах = 0,899). Методом статистичного аналізу, який використовується, є парна вибірка за тестом Вілкоксона.

Результати. Результати даного дослідження показали підвищення чисельного мислення у студентів після відвідування курсів статистики ($M = 7,50$; $SD = 1,87$; $p < 0,05$). Також обговорювалися результати інших суміжних досліджень.

Висновок. Наслідком цього дослідження є статистична модель навчання курсу, яку можна відтворити. Поліпшення числових здібностей також є доказом того, що цю здібність можна розвивати з більшою експозицією, в залежності від її рівня.

Ключові слова: числові міркування, статистика, студенти.

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Cite this article as: Wahidah, F.R., Putra, F.R., & Nugrahaeni, A.F. (2022). Statistic Course: Can it Improves Numeric Reasoning Ability? *Journal of Learning Theory and Methodology, 3*(2), 53-58. https://doi.org/10.17309/jltm.2022.2.01

Received: 4.05.2021. Accepted: 27.05.2022. Published: 30.06.2022

Journal of Learning Theory and Methodology
Журнал теорії та методології навчання

ISSN 2708-7581 (Online)
ISSN-L 2708-7573

ORIGINAL SCIENTIFIC ARTICLE

PATTERN RECOGNITION: FEATURES OF MOTOR FITNESS OF 9-YEAR-OLD SCHOOLCHILDREN

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DOI: 10.17309/jltm.2022.2.02

Abstract

The purpose of the study was to identify the gender-related features of motor fitness of 9-year-old schoolchildren.

Materials and methods. The study involved 83 9-year-old schoolchildren (35 girls, 48 boys). The children and their parents were informed about all the features of the study and gave their consent to participate in the experiment. The study used the following research methods: analysis of scientific and methodological literature, pedagogical observations, testing of motor fitness, probabilistic approach to assessing the learning process, methods of mathematical statistics. In the experiment, the study controlled the level of proficiency in the following exercises: Rope climbing in 2 steps, Rope climbing in 3 steps, One leg swing upward circle.

Results. In the girls and boys, the differences in the level of development of movement coordination between individual parts of the body and vestibular stability are not statistically significant. The 9-year-old boys have a statistically significantly higher level of development of strength, speed strength, speed, endurance, and a higher level of proficiency in gymnastic exercises and rope climbing than the girls. The obtained canonical function explains 100% of the variation of results and is informative for classifying 9-year-old schoolchildren's motor fitness ($r = 0.937$). The analysis of the canonical function indicates its statistical significance ($\lambda = 0.122$; $p = 0.001$).

Conclusions. The canonical discriminant function can be used to classify the gender-related features of motor fitness of 9-year-old schoolchildren. The discriminant analysis revealed the indicators that have the greatest weight in assessing the gender-related features of motor fitness of 9-year-old schoolchildren. They include the level of relative strength of the shoulder flexors, speed strength, agility, and the level of proficiency in the One leg swing upward circle on a low bar.

Keywords: girls, boys, level of proficiency, motor fitness, motor skills, discriminant analysis.

Introduction

The importance of increasing schoolchildren's motor activity is pointed out by Krutsevich, Pengelova, and Trachuk (2019), Krutsevich, and Marchenko (2018a,b). Motor activity is regarded as a condition for physical development and formation of cognitive functions (Junger et al., 2019; Haverkamp et al., 2020; Biddle et al., 2019).

Studies focus on substantiating the amount of motor activity (Bull et al., 2020; Guthold et al., 2020; Love et al., 2019); investigating the effect of physical exercises on human cognitive functions (Quaney et al., 2009; Rodriguez-Ayllon et al., 2019); developing a technique for teaching physical exercises (Khudolii et al., 2020); developing a technique for motor abilities development in schoolchildren (Ivashchenko et al., 2020).

The problem of physical education of schoolchildren was given consideration with reference to their motor fitness (Ivashchenko, 2017), the effect of training loads on the dynamics of strength development (Cieślicka & Ivashchenko, 2017; Ivashchenko & Cieślicka, 2017), the effect of physical training modes on the effectiveness of motor skills formation (Khudolii, Ivashchenko, & Chernenko, 2015; Mugurdinova & Iermakov, 2022; Siedykh et al., 2022) and gender-related features of motor fitness (Iermakov et al., 2020; Khudolii, Golovnin et al., 2020; Petrov et al., 2020). It was found that the positive effect of learning depends on the level of motor skills development, consistent solving of learning tasks, and rational application of methods (Khudolii, 2019; Ivashchenko, 2020; Kharkovshchenko, 2022).

The study of the problem of physical education of schoolchildren remains relevant in view of decrease in motor activity of children and adolescents. The need to improve the pro-

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cess of teaching physical exercises requires further research on gender-related features of motor fitness of schoolchildren.

The purpose of the study was to identify the gender-related features of motor fitness of 9-year-old schoolchildren.

Materials and Methods

Study Participants

The study participants were eighty-three 9-year-old schoolchildren (35 girls and 48 boys). The children and their parents were informed about all the features of the study and gave their consent to participate in the experiment.

Study Organization

The study used the following research methods: analysis of scientific and methodological literature, pedagogical observations, testing of motor fitness, probabilistic approach to assessing the learning process, methods of mathematical statistics.

The study recorded the indicators of height (cm), body weight (kg), and the results in tests No. 3 "Standing long jump, cm", No. 4 "Middle- and long-distance running. 300 m running, s", No. 5 "30 m sprint running from a standing start, s", No. 6 "Seated forward bend, cm", No. 7 "Mixed hang rope pull-ups, times", No. 8 "Shuttle run 4×9 m, s", No. 9 "Combined movements of arms, torso and legs, points", No. 10 "Postural balance test – single leg stance, eyes closed, s", No. 11 "Walking along a straight line after 5 rotations, deviations in cm".

The study recorded the primary schoolchildren's level of proficiency in gymnastic exercises. The coefficient was determined by the formula: p = (m/n)*100, where p is the level of proficiency, m is the number of successfully performed exercises, n is the total number of attempts to perform the exercises. In the experiment, the study controlled the level of proficiency in the following exercises: "Rope climbing in 2 steps", "Rope climbing in 3 steps", "One leg swing upward circle".

Statistical Analysis

The study materials were processed using the IBM SPSS 20 statistical analysis software. Discriminant analysis was performed.

The study protocol was approved by the Ethical Committee of the University. In addition, the children and their parents or legal guardians were fully informed about all the features of the study, and a signed informed consent document was obtained from all the parents.

Results

Table 1 shows the results of testing the 9-year-old schoolchildren's motor fitness.

The results of testing were compared, which made it possible to find out that the difference in height and body mass between the 9-year-old girls and boys was not statistically significant ($p > 0.05$). In test No. 9 "Combined movements of arms, torso and legs, points", the girls and boys show results below average, the difference in fitness is not statistically significant ($p > 0.05$). The difference in the results of the tests for vestibular stability (No. 10 "Postural balance test — single leg stance, eyes closed, s", No. 11 "Walking along a straight line after 5 rotations, deviations in cm") is not statistically significant, the girls and boys show low results. The standard (mean-root-square) deviation value in both the girls and boys indicates that the level of fitness is not homogeneous in the groups.

Compared to the girls, the boys show a 16.33 cm better result in test No. 3 "Standing long jump, cm" ($p = 0.001$), a 13.28 s better result in test No. 4 "300 m running, s" ($p < 0.001$), a 3 time better result in test No. 7 "Mixed hang rope pull-ups, times" ($p < 0.001$), a 0.6 s better result in test No. 8 "Shuttle run 4×9 m, s" ($p = 0.001$). While the 9-year-old girls show statistically significantly better results in test No. 6 "Seated forward bend, cm" (see Table 1).

The 9-year-old boys have a 28.61% higher level of proficiency in the One leg swing upward circle ($p = 0.001$) and an 8.29% higher level of proficiency in the Rope climbing in 2 steps ($p = 0.047$).

Table 1. The results of testing the 9-year-old schoolchildren's motor fitness

No.	Indicator	Girls (n = 35)		Boys (n = 48)		d	t	p
		X	s	X	s			
1.	Height, cm	133.66	4.93	135.88	5.43	-2.22	1.908	0.060
2.	Body mass, kg	34.94	18.94	32.77	5.48	2.17	0.754	0.453
3.	Standing long jump, cm	119.09	13.02	135.42	10.21	-16.33	6.402	0.000
4.	300 m running, s	113.91	16.13	100.63	17.32	13.28	3.552	0.001
5.	30 m running from a standing start, s	6.82	0.32	6.35	0.44	0.47	5.421	0.000
6.	Seated forward bend, cm	8.09	3.02	4.56	3.18	3.53	5.087	0.000
7.	Mixed hang rope pull-ups, times	1.97	1.12	4.79	1.91	-2.82	7.790	0.000
8.	Shuttle run 4×9 m, s	12.84	0.74	12.24	0.67	0.6	3.875	0.000
9.	Combined movements of arms, torso and legs, points	8.11	0.72	8.28	0.9	-0.17	0.903	0.369
10.	Postural balance test — single leg stance, eyes closed, s	18.89	10.76	20.83	11.11	-1.94	0.792	0.431
11.	Walking along a straight line after 5 rotations, deviations in cm	88.8	65.26	81.56	66.06	7.24	0.495	0.622
12.	Rope climbing in 2 steps, proficiency level	24	21.03	32.29	16.4	-8.29	2.018	0.047
13.	Rope climbing in 3 steps, proficiency level	24.57	22.27	32.29	16.4	-7.72	1.820	0.073
14.	One leg swing upward circle, proficiency level	25.14	23.44	53.75	17.09	-28.61	6.435	0.000

The discriminant analysis results which allow to classify the 9-year-old girls and boys by their level of motor skills development, their level of proficiency in rope climbing and gymnastic exercises are set out in Tables 2–5.

The obtained canonical function explains 100% of the variation of results and is informative for classifying 9-year-old schoolchildren's motor fitness (r = 0.937) (see Table 2).

Table 2. The canonical discriminant function. Eigenvalues

Function	Eigenvalues	% of variance explained	Cumulative %	Canonical correlation
1	7.191	100.0	100.0	0.937

Table 3. The canonical discriminant function. Wilks' lambda

Function test	Wilks' lambda	χ-square	degrees of freedom	p
1	0.122	155.622	14	0.000

The analysis of the canonical function indicates its statistical significance (λ = 0.122; p = 0.001) (see Table 3).

The standardized coefficients of the canonical discriminant function which make it possible to determine the percentage contributions of selected variables to the function result are set out in Table 4. The largest contribution to the canonical function is made by variables No. 12 "Rope climbing in 2 steps, proficiency level", No. 13 "Rope climbing in 3 steps, proficiency level", No. 14 "One leg swing upward circle, proficiency level": the larger is the value of these variables, the larger is the value of the function.

The structure coefficients of the canonical discriminant function which are the coefficients of correlation between the variables and the function are set out in Table 4. For instance, the function is most substantially related to the results of test No. 14 "One leg swing upward circle, proficiency level" and tests No. 7 "Mixed hang rope pull-ups, times", No. 3 "Standing long jump, cm", No. 4 "300 m running, s": hence, a substantial difference between the 9-year-old girls and boys is observed in the level of relative strength of the arms, speed strength, agility, and the level of proficiency in gymnastic exercises.

Table 5. The results of classificationa. The function values at the group centroids. 9-year-old schoolchildren

	1 – girls, 2 – boys	Predicted belonging to group		Total	Function values at group centroids
		1.00	2.00		1
Frequency	1.00	35	0	35	-3.102
	2.00	1	47	48	2.262
%	1.00	100.0	.0	100.0	
	2.00	2.1	97.9	100.0	

a. 98.8% of the original grouped data were classified correctly.

The centroid coordinates for two groups are set out in Table 5. They allow to interpret the canonical function with respect to the role in the classification. The centroid for the 9-year-old boys is situated on the positive pole, and the centroid for the 9-year-old girls is situated on the negative pole (see Fig. 1, 2), which indicates a substantial difference in the fitness level of the 9-year-old girls and boys. The results of classification of the groups show that 98.8% of the original grouped observations were classified correctly.

Discussion

The paper assumed that the motor fitness of 9-year-old schoolchildren have gender-related features. It was established that the differences between the girls and boys in the level of development of motor coordination between individual parts of the body and in vestibular stability are not statistically significant. The 9-year-old boys have a statisti-

Table 4. The canonical discriminant function coefficients

No.	Indicator	Canonical discriminant function coefficients		
		standardized function	structure function	unstandardized function
		1	1	1
1	2	3	4	5
1.	Height, cm	0.355	0.037	0.068
2.	Body mass, kg	-0.261	-0.031	-0.020
3.	Standing long jump, cm	0.425	0.265	0.037
4.	300 m running, s	-0.094	-0.147	-0.006
5.	30 m running from a standing start, s	-0.145	-0.225	-0.370
6.	Seated forward bend, cm	-0.479	-0.211	-0.154
7.	Mixed hang rope pull-ups, times	0.486	0.323	0.298
8.	Shuttle run 4×9 m, s	0.037	-0.161	0.053
9.	Combined movements of arms, torso and legs, points	-0.041	0.037	-0.049
10.	Postural balance test – single leg stance, eyes closed, s	0.098	0.033	0.009
11.	Walking along a straight line after 5 rotations, deviations in cm	0.221	-0.021	0.003
12.	Rope climbing in 2 steps, proficiency level	0.926	0.084	0.050
13.	Rope climbing in 3 steps, proficiency level	-30.971	0.075	-0.208
14.	One leg swing upward circle, proficiency level	20.916	0.267	0.146
	(Constant)			-120.593

cally significantly higher level of development of strength, speed strength, speed, endurance, and a higher level of proficiency in gymnastic exercises and rope climbing than the girls (see Table 1). The data obtained supplement the data on the state of motor fitness of children and adolescents (Ivashchenko, Khudolii, Iermakov, Chernenko, & Holovko, 2015; Ivashchenko, Iermakov, Khudolii, Cretu, & Potop, 2017; Khudolii, Ivashchenko, & Beketov, 2015), and indicate that schoolchildren's motor fitness has gender-related features. As in the studies by Ivashchenko, Nosko, Bartik, & Makanin (2020), Iermakov, Ivashchenko, & Khomiakov (2020), non-significant differences in the level of development of motor coordination and statistically significant differences in the level of development of strength, speed strength, speed, endurance, and in the level of proficiency in gymnastic exercises between girls and boys were observed, which indicates a need for dedicated development of motor skills. Such development is possible in teaching physical exercises with the use of programmed materials, as indicated by literature data (Shueva, Ivashchenko, & Jagiello, 2021; Suprun, Ivashchenko, & Cieślicka, 2021; Kharkovshchenko, 2022).

The discriminant analysis made it possible to determine that, in identifying gender-related features of motor fitness of 9-year-old schoolchildren, the classifier is the level of proficiency in gymnastic exercises and rope climbing (see Table 4, column 3). The data set out supplement the data provided by Petrov, Khudolii, and Cieślicka (2020), Shevchenko, Khudolii, and Potop (2020), Ivashchenko, Berezhna, and Cieślicka, (2020) and stating that the formation of motor skills is a priority in the educational process at primary school, the development of "agility" and "motor coordination" ensures the formation of motor skills, and the development of arm strength and vestibular stability is that reserve which allows to improve the effectiveness of the educational process. Furthermore, focusing efforts on the learning process is associated with the formation of cognitive functions such as ability to acquire and recognize information, as indicated by literature data (Junger et al., 2019; Haverkamp et al., 2020; Biddle et al., 2019).

Based on the discriminant analysis, it was found that motor fitness can be controlled based on the regression equation set out in column 5 (Table 4) and the comparison between the result obtained and the function value at group centroids (2.262). The data set out supplement the data on the use of discriminant analysis in physical education of schoolchildren (Mandoli, Sharma, & Joshi, 2021; Siedykh, Ivashchenko, Bartik, & Veremeenko, 2022; Mugurdinova, & Iermakov, 2022).

Thus, the data obtained are of both theoretical and practical importance for organizing the educational process at primary school. They can be used in planning learning activity and controlling its quality in physical education.

Conclusions

The canonical discriminant function can be used to classify the gender-related features of motor fitness of 9-year-old schoolchildren. The discriminant analysis revealed the indicators that have the greatest weight in assessing the gender-related features of motor fitness of 9-year-old schoolchildren. They include the level of relative strength of the shoulder flexors, speed strength, agility, and the level of proficiency in the One leg swing upward circle on a low bar.

Acknowledgement

The study was carried out in accordance with the plan of research work of the Department of Theory and Methodology of Physical Education of H.S. Skovoroda Kharkiv National Pedagogical University.

Conflict of interest

The authors declare no conflict of interest.

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РОЗПІЗНАННЯ ОБРАЗІВ: ОСОБЛИВОСТІ РУХОВОЇ ПІДГОТОВЛЕНОСТІ ШКОЛЯРІВ 9 РОКІВ

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Авторський вклад: A – дизайн дослідження; B – збір даних; C – статаналіз; D – підготовка рукопису; E – збір коштів

Реферат. Стаття: 6 с., 9 табл., 2 рис., 28 джерел.

Мета дослідження – визначити гендерні особливості рухової підготовленості школярів 9 років.

Матеріали і методи. У дослідженні прийняли участь 83 школярі 9 років (дівчаток – 35 чол., хлопчиків – 48 чол.). Діти та їхні батьки були інформовані про всі особливості дослідження і дали згоду на участь в експерименті. У дослідженні використані такі методи дослідження як аналіз наукової та методичної літератури, педагогічні спостереження, тестування рухової підготовленості, ймовірнісний підхід до оцінки процесу навчання, методи математичної статистики. В експерименті контролювався рівень навченості таким вправам: лазіння по канату у 2 прийоми, лазіння по канату у 3 прийоми, підйом переворотом в упор махом однією.

Результати. У дівчаток і хлопчиків у рівні розвитку координації рухів окремими частинами тіла та вестибулярній стійкості розбіжності статистично не достовірні. Хлопчики 9 років мають статистично достовірно вищий рівень розвитку сили, швидкісної сили, бистроти, витривалості та вищий рівень навченості гімнастичних вправ і лазінню по канату ніж дівчатка. Отримана канонічна функція пояснює на 100 % варіацію результатів і є інформативною для класифікації рухової підготовленості школярів 8 років ($r = 0,937$).

Аналіз канонічної функції свідчить про її статистичну значущість ($\lambda = 0,122$; $p = 0,001$).

Висновки. Канонічна дискримінантна функція може бути використана для класифікації гендерних особливостей рухової підготовленості школярів 9 років. У результаті дискримінантного аналізу виявлено показники які мають найбільшу вагу в оцінці гендерних особливостей рухової підготовленості школярів 9 років. До них відносяться рівень відносної сили згиначів плеча, швидкісної сили, прудкості та рівень навченості підйому переворотом в упор махом однією на низькій поперечині.

Ключові слова: дівчатка, хлопчики, рівень навченості, рухова підготовленість, рухові навички, дискримінантний аналіз.

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Cite this article as: Ivashchenko, O., Skochko, Ye., Skrobecki, J., & Wnorowski, K. (2022). Pattern Recognition: Features of Motor Fitness of 9-Year-Old Schoolchildren. *Journal of Learning Theory and Methodology, 3*(2), 59-64. https://doi.org/10.17309/jltm.2022.2.02

Received: 14.01.2022. Accepted: 1.06.2022. Published: 30.06.2022

Journal of Learning Theory and Methodology
Журнал теорії та методології навчання

ISSN 2708-7581 (Online)
ISSN-L 2708-7573

ORIGINAL SCIENTIFIC ARTICLE

INDIVIDUALIZATION OF THE EDUCATIONAL PROCESS OF INCLUSIVE PHYSICAL EDUCATION OF STUDENTS WITH DISABILITIES

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Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

DOI: 10.17309/jltm.2022.2.03

Abstract

Background. The relevance of the study is due to the objective need to increase the effectiveness of PE for students with disabilities during their studies in higher education.

The study purpose was: of the article is to identify the effectiveness of the implementation of classes on inclusive physical education for students with disabilities according to the individual program.

Materials and methods. The experiment was attended by 30 students of Lviv Polytechnic National University with disabilities (with diseases of the nervous system) during a three-year physical education course, with equal numbers of female and male students participating. To determine the effectiveness of the program of physical education for students with disabilities (with diseases of the nervous system), cardiovascular tests have been used.

Results. From the standpoint of the general objectives of the study, the results of the experimental study showed the effectiveness of the individual approach in the choice of correctional and developmental means of inclusive physical education for students with disabilities. After the course, we observe stabilization with a tendency to regression of autonomic disorders, and improvement of peripheral hemodynamics, against the background of reducing the clinical manifestations of diseases of the nervous system in students of the study sample.

Conclusions. It is proved that the main reason for the introduction of an individualized approach to inclusive physical education of students with disabilities is the provision that this process should focus on the individual health of each student and the ability to eliminate existing deviations by physical education, and thus achieve the highest results in such activities. Analysis of research and educational practice gives grounds to conclude that such an approach in physical education, namely taking into account the individual characteristics of a contingent of students with disabilities, identifies new prospects for inclusive physical education of students in higher education in general.

Keywords: inclusive education, students with disabilities, physical education, cardiovascular tests, individual program.

Introduction

In the modern higher school of Ukraine, the institute of an inclusive environment is considered an important component of the educational process, which provides an opportunity to achieve the educational and professional goals of higher education seekers with disabilities. To implement the idea of "education accessible to all", higher education must be a safe and functional environment for students with disabilities (Kedian & West-Burnham, 2017). Recognition of the rights of such students, their interests, needs, assistance in the process of socialization, and choice of professional activity is very important in the development of education (O'Rourke & Houghton, 2006).

The implementation of anti-discrimination aspirations in the issues of educational integration of students with disabilities determines the change of target priorities of education in general. Today, the number of accumulated changes in higher education, especially in the creation of an inclusive environment, has increased significantly and is constantly undergoing purposeful transformation (Baglieri & Bacon, 2020). However, the priority is the need to build a quality educational process for students with disabilities following their real capabilities, based on the peculiarities of their personal development and educational needs (Campos, Ferreira, & Block, 2014; Tant & Watelain, 2016).

The effectiveness of inclusive education is determined not by the chaos of methods, but by systematic work in all areas. There is no doubt that the process of inclusion of students with disabilities is complex and dynamic (Lidor & Hutzler, 2019; Maxwell, Granlund, & Augustine, 2018), lasts throughout the study, and a prominent place in this process is given to physical education (PE) as a factor in realizing their physical development in health.

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An inclusive environment in educational institutions in scientific intelligence is considered a key factor in the socialization of students with disabilities (Kedian, & West-Burnham, 2017; Smith, 2004). There is an active search for ways to organize and operate an inclusive educational environment in higher education (Campos, Ferreira, & Block, 2014), the features of inclusive education, analysis of European-oriented educational inclusion (Goodwin & Watkinson, 2000; Haycock & Smith, 2010) and opportunities for integration of such experiences (Bondar, 2019). The issues of developing new educational practices for students with disabilities are considered (Page, Anderson, & Charteris, 2021; Ruscitti, Thomas, & Bentley, 2017). Some works are designed to find ways to improve the process of inclusive learning (Block & Obrusnikova, 2007; Lidor & Hutzler, 2019).

According to the available ideas, the innovative methodology is based on the principles of student-centeredness, which involves identifying the talents of each individual with developmental problems, and creating conditions for their successful development and self-realization in higher education (Baglieri, Valle, Connor, & Gallagher, 2011).

PE has been identified as one of the leading factors in ensuring the effectiveness of inclusive education, and therefore physical activity with the use of physical exercises is of paramount importance for achieving the goal of this process (Bertills, Granlund, Dahlström, & Augustine, 2018b; Block & Obrusnikova, 2007; Morley, Bailey, Tan, & Cooke, 2005). Scientific sources study the impact of PE classes on the motor and mental spheres of students with disabilities (Briere & Siegle, 2008; Ma, Wang, Li, & Wang, 2020), which is positioned as one of the leading means of ensuring mental performance. Instead, it is proved that one of the main conditions for successful learning of students with disabilities is the implementation of an individual development program (Cavanaugh, 2017; Sönmezoğlu, Tosun, & Yıldız, 2021). It is believed that such programs based on the individualization of correctional and developmental means of PE create an opportunity to fully organize the educational process in higher education (Haycock & Smith, 2010).

However, the study of the organization and implementation of individualization of inclusive PE remains insufficiently studied and requires detailed research. Elaboration of the literature on the research problem allows us to conclude that the key areas of this cooperation are mostly the search for the formation and implementation of best educational practices in higher education to ensure positive results. In addition, only the fragmentation of the development of certain motor and mental functions, and changes in morphofunctional indicators of students with disabilities with various forms of disorders are under the influence of PE.

The study purpose was to identify the effectiveness of the implementation of classes on inclusive PE for students with disabilities in the implementation of the individual program.

Material and methods

Participants

The experiment was attended by 30 students of Lviv Polytechnic National University with disabilities (with diseases of the nervous system) during a three-year PE course, with equal numbers of female and male students participating. The research was conducted in compliance with the WMA Declaration of Helsinki, – Ethical Principles for Medical Research Involving Human Subjects, 2013. The study protocol was approved by the Ethical Committee of Lviv Polytechnic National University.

For the duration of the research, the research groups was formed of the students having a common feature (nosological characteristic), were formed on the principle of cluster analysis, with satisfaction of the requirements regarding the adequacy of the sample size at the probability level $p < 0.05$.

Study organization

For empirical research, a program of PE adapted for students with diseases in the state of the nervous system was used. The decisive difference of such a program from the current is the ratio of PE methods, which were obtained taking into account the recommendations on the effect of physical activity on the body in the presence of violations in the state of the nervous system. The program has been tested during an academic course of PE in university. The research was conducted annually in the defined curriculum terms, following the same order of organization.

To determine the effectiveness of the program of PE for students with disabilities (with diseases of the nervous system), cardiovascular tests have been used (Mathias & Sir Bannister, 2013). Solving the tasks of the study required the use of a research method that would allow relatively small changes in vegetative activity to be recorded using a simple, fast-acting test without any effect on the very activity of the student's body. Using simple objective non-invasive, reliable and accurate diagnostic methods – cardiovascular tests, it was possible to estimate the degree of violation of the pathological process on the autonomic nervous system. Specialists recommend that they be used to assess the process of urgent adaptation of the cardiovascular system to different types of load and to determine the functional state of the nervous system of persons with a wide range of diseases in this system. Interpretation of indicators of cardiovascular tests is based on representations about regulatory influences on the autonomic nervous system, and higher levels of management of physiological functions.

The research uses the following indicators:

1. Determination of the difference between the maximum and minimum values of cardiointerval RR during continuous recording of heart rate for research groups during deep slow breathing (6 for 1 min) and deduction of RR (KR-R = (R-Rmax)/(R-Rmin). that tachycardia in rest and reducing the spread of RR intervals indicate a deterioration of the parasympathetic function of the autonomic nervous system.

2. Assessment of the change in heart rate during ascension with the calculation of the ratio of R-R intervals at the 30^{th} and 15^{th} blows from the onset of ascent (K30:15) (Parati, DiRienzo, & Mancia, 2000).

3. Valsalvi test: the student breathes into the mouthpiece, connected to the pressure gauge, and maintains pressure in the spirometer at 40 mm Hg. Art. within 10-15 seconds. Register the ECG before, during and after the test. Calculate the Valsalvi coefficient (KValsalvi): the ratio of the extended R-R

interval in the first 20 s after the test to the shortened R-R interval during the sampling (Levin, 1966).

4. Orthostatic test, minus the difference for systolic blood pressure (SAT) in the position of lying and at the 3rd minute in standing position (DAT).

5. Isometric test: Student compresses the dynamometer for 30 minutes from the maximum for 3 minutes. Determine the change in diastolic blood pressure (D DAT) to the test and at the 3rd minute. Compression of the dynamometer.

This test characterizes the ability of the peripheral vessels to reduce, that is, the sympathetic function. Thus, the first three tests are aimed at the study of parasympathetic vegetative paths, the next two – on the study of sympathetic paths (Mathias & Sir Bannister, 2013).

Statistical analysis

To characterize the results obtained, the indicators of descriptive statistics were used. The statistical significance of the results was determined using the methods of inductive statistics (Student's t-criterion). All statistical analyzes were performed using SPSS Version 21. Results of descriptive statistics in this study were presented as percentages. The 0.05, 0.01 and 0.001 levels of probability were used to indicate statistical significance.

Results

The experimental study was based on the fact that the leading role of inclusive PE is to prevent poor health of students as a result of adaptation to the university learning process and further appropriate correction of this process by adequate pedagogical tools and methods (Lidor & Hutzler, 2019). Accordingly, an inclusive PE program should meet the individual needs of each student, not be determined by nosology or diagnosis (Goodwin & Watkinson, 2000). At the same time, the implementation of the program is directed in two directions: the formation of motor knowledge, skills, abilities, and socialization (socially acceptable behavior and communication appropriate to the context). Each of these areas is determined individually for specific students with disabilities. Thus, the principle of individualization of PE is realized. The effectiveness of managing the psychophysical condition of students with disabilities takes into account the motor capabilities due to the form of the disease, sexual and age characteristics of morphofunctional maturation, and compliance with the conditions of adaptation.

The key goal of the program is to provide each student with disabilities, despite the existing physical, intellectual, social, emotional, linguistic, and other features, the possibility of inclusion in a common, unified, holistic process of PE, development and socialization to reduce its risks segregation and isolation, with the prospect of full self-realization in the personal and educational life of higher education institutions. This goal setting is a sign of the development of the higher education system of every civilized country in the world.

To ensure the objectivity of the expert opinions on the experimental study, the initial statistical analysis of the obtained primary data of qualitative characteristics of the studied parameters of the students of the studied sample at the beginning of the experiment. In the context of inclusive education, this is extremely important because it makes it possible to find out how different PE programs affect the elimination of existing negative trends in the physical development, and health of students with disabilities by stimulating physical activity, psychophysiological characteristics, functional capabilities, and motor skills.

The experiment involved the constant collection and analysis of data on the formation and implementation of the program related to the implementation of full-fledged physical activity. Believe (Ivashchenko & Khudolii, 2016), that this will contribute to a better understanding of the factors that have a positive or negative impact, the identification of problems, achievements, and best practices in this area, and purposeful planning of this process. We emphasize the need to adapt the content, forms, methods, and technologies of PE for students with disabilities.

It is established that the implementation of the content of PE for students with disabilities provided by experimental research provides a positive effect (at the level of $p < 0.05$) in solving the tasks, as evidenced by the results of the control (Table 1). The results of testing conducted at the beginning of scientific research did not differ significantly, which is statistically confirmed ($p > 0.05$) and indicates the homogeneity of the contingent of the studied sample of students. The majority of the studied students (75.6%) found disorders in the functional state of the nervous system, which manifested themselves in the processes of disintegration between the nervous and humoral channels of regulation, mainly in the form of hyper-sympathetic reactions.

Given that functional disorders of the autonomic systems are not only risk factors for somatic pathology and a predictor of cardiovascular disease, but also factors affecting the physical and mental development of students, such reactions are justified from the standpoint of learning and the presence of functional disorders in the state of health of students. In addition, during the study period, age-related physiological changes in the youth of students of research groups coincide with social changes (Maxwell, Granlund, & Augustine, 2018). Given that the vegetative effect is one of the important factors in ensuring the proper level of adaptation processes and maintaining internal homeostasis, especially in the presence of disorders of the nervous system, studied indicators of autonomic regulation, which generally students at the beginning of the study had no significant differences ($p < 0.05$).

A series of cardiovascular tests were performed to assess the process of urgent adaptation of the cardiovascular system to different types of stress and to determine the functional state of the nervous system (Mathias & Sir Bannister, 2013). The results of these tests before the experiment generally showed a low functional reserve of the autonomic nervous system in the students of the study sample and allowed to determine the directions of possible correction for different types of deviations.

Thus, during the implementation of individual programs of inclusive PE, almost all surveyed students had increased heart rate during cardiovascular tests, these results were significant ($p < 0.05$) in both groups of male and female. Despite lower heart rates in male compared to female, these differences are not significant ($p > 0.05$).

Table 1 Results of cardiovascular tests of students of research groups

Investigated parameters		Period of the experiment									%	Reliability of discrepancies (p)
		at the beginning					after					
		X	S	As	Me	V	X	S	As	Me		
Heart rate beats/min	m	12.18	1.99	0.36	6.11	36.8	14.18	1.99	0.32	0.34	16.41	<0.05
	f	13.75	1.73	0.58	6.44	37.5	15.71	1.73	0.52	6.09	14.26	<0.05
K_{R-R}	m	1.167	0.028	0.70	2.13	37.4	1.236	0.052	0.68	4.98	13.52	<0.05
	f	1.041	0.016	0.46	2.13	36.2	1.187	0.034	0.54	5.88	14.02	<0.05
$K_{30:15}$	m	1.015	0.006	0.53	0.43	34.7	1.192	0.026	0.30	6.43	17.43	<0.05
	f	1.012	0.003	0.54	0.32	34.5	1.177	0.012	0.47	69.3	16.30	<0.05
$K_{Valsalvi}$	m	1.211	0.009	0.34	6.00	39.0	1.413	0.033	0.60	73.2	16.68	<0.05
	f	1.193	0.009	0.22	4.78	40.4	1.388	0.021	0.45	1300	16.34	<0.05
D SAT, mm Hg	m	12.24	1.075	0.62	5.66	36.2	9.96	1.013	0.56	1401	18.46	<0.01
	f	13.06	1.302	0.52	6.66	34.7	10.04	1.882	0.35	38.32	15.48	<0.05
D DAT, mm Hg	m	13.54	0.885	0.20	69.9	34.5	10.66	0.717	0.52	40.92	21.27	<0.01
	f	13.95	0.660	0.79	73.1	37.5	11.04	0.539	0.38	42.43	20.08	<0.01

* Note: hereinafter: $K_{30:15}$– coefficient of change of heart rate; K_{R-R} – coefficient of respiratory test, $K_{Valsalvi}$ – coefficient of Valsalva; m – male; f – female.

The nature of the response to stimulation of the parasympathetic autonomic nervous system by the value of the coefficient of Valsalva, which is within the limits of pathological values ($p < 0.001$), showed the presence of dysfunction of sympathetic and parasympathetic mechanisms of baroreflex reflexes. Indicator K30:15 was in the area of pathological values, indicating the presence of autonomic dystonia, lack of general effects, and low reactivity of the parasympathetic nervous system. In general, these indicators do not have gender and intergroup differences ($p > 0.01$). Nice function according to the results of tests at the limit of limit values.

Studies of autonomic functions, namely the assessment and analysis of the initial autonomic tone, autonomic reactivity, and autonomic status, have shown an imbalance in the nervous system – a phenomenon of systemic autonomic degeneration. And since the results of functional tests are determined by the state of the central nervous system and autonomic endocrine system (Mathias & Sir Bannister, 2013), respectively, the quantitative results of an integrative assessment of cardiovascular reflexes were extremely pathological in the study sample of students.

In general, 70.1% of students had one or another form or two forms of violation of autonomic homeostasis. Given that it has a decisive role in shaping the state of health (Levin, 1966), it is obvious that this factor has decisively led to a low level of somatic health in students in the study sample.

In the course of the study, we note the activation of extracardiac factors under the influence of the implemented program of inclusive PE, which allowed to level pathogenic processes in the nervous system and optimize the processes of sanogenesis.

Discussion

Modern research focuses on the need to significantly improve the quality of research and make drastic changes in the organization of the educational process for students with disabilities in terms of higher education (Bondar, 2019; Goodwin & Watkinson, 2000). This involves searching for and processing information to properly substantiate the principles of inclusive PE of students with disabilities, determining effective conditions for its implementation based on understanding and objective assessment of domestic science and practice and world experience in this field.

We support scientific approaches (Koryahin et al., 2019; Tant & Watelain, 2016; Briere & Siegle, 2008), which require permanent special monitoring and evaluation studies of the effectiveness of inclusive PE for students with disabilities. We believe that without such research it is impossible to assess the impact of PE on their physical development, learning, education, and socialization. Thus, it is possible to ensure the effectiveness of planning and management functions in the course of inclusive PE, which is a factor in its effectiveness (Smith, 2004).

In the process of research, a program of inclusive PE for students with disabilities was developed and implemented, which included a set of measures aimed at individualizing this process. The obtained results can be used as a basis for developing a curriculum for students with disabilities based on the developed strategies, methods, technologies, and techniques of inclusive PE. We believe that through the introduction of such programs in the educational process of higher education, students with disabilities can gain real experience of physical activity, develop new skills and expand their range.

The idea is expanded (Haycock & Smith, 2010; Lidor & Hutzler, 2019), that the implementation of constructive approaches to the development of inclusive PE in higher education will help eliminate the contradiction between the declared equality in our country in receiving educational services and the actual limitation of opportunities for socially vulnerable groups. We are impressed by the opinion (Koryahin et al., 2019), that in higher education institutions PE should primarily provide a high level of interactivity, which necessitates an individual approach to students with disabilities.

In connection with the last, urgent task in the context of increasing the impact of PE classes on the motor and mental spheres of students with disabilities, is to increase their motivation for physical self-improvement, based on awareness of the importance of PE physical, social, and cognitive development as a result of physical training.

We agree (Block, 2007; Morley, Bailey, Tan, & Cooke, 2005), that the implementation of these tasks is possible under the conditions of individualization of the pedagogical process of PE of students with disabilities, aimed at eliminating existing negative trends in their physical development and health using physical culture on the body through stimulating physical activity taking into account the peculiarities of the formation of motor function, mental development with different directions of influence on motor skills and functional capabilities of body systems.

Conclusions

Modern higher education requires the need to change the current paradigm of traditional didactic inclusive PE, focused on the student, his special academic needs, previous experience, and his vision of the future path in the labor market. It was found that a promising way to improve the pedagogical process of PE of students with disabilities is the individualization of the curriculum. The latter should be based on the psychophysiological condition of students with disabilities and their physical and psychological characteristics.

The developed program, taking into account the shortcomings of the current organization and content of PE of students with disabilities determines the directions of its improvement, guided by the principle of individualization, and in the formation of content for disabilities.

The use of inclusive PE for students with disabilities based on individualization of the educational process is experimentally substantiated. Thus, at the end of the formative stage of the experiment recorded significantly better ($p < 0.05$-0.001) functional state of the central nervous system and autonomic and endocrine system of students with disabilities, in groups that implemented an inclusive PE program with individual focus. Thus, the experiment confirmed the feasibility of the measures taken in the organization of the educational process of PE of students with disabilities.

Conflict of interest

The authors state no conflict of interest.

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ІНДИВІДУАЛІЗАЦІЯ НАВЧАЛЬНОГО ПРОЦЕСУ ІНКЛЮЗИВНОГО ФІЗИЧНОГО ВИХОВАННЯ СТУДЕНТІВ З ОСОБЛИВИВМИ ОСВІТНІМИ ПРОБЛЕМАМИ

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Авторський вклад: A – дизайн дослідження; B – збір даних; C – статаналіз; D – підготовка рукопису; E – збір коштів

Реферат. Стаття: 7 с., 1 табл., 26 джерел.

Базова проблематика. Актуальність дослідження обумовлена об'єктивною необхідністю підвищення ефективності фізичного виховання студентів з особливими освітніми потребами у термін їхнього навчання у закладах вищої освіти.

Мета статті – виявити ефективність реалізації занять із інклюзивного фізичного виховання студентів з особливими освітніми потребами згідно індивідуальної програми.

Матеріали та методи. У експерименті взяли участь 30 студентів Національного університету «Львівська політехніка» з особливими освітніми потребами (із захворюваннями нервової системи) протягом трирічного курсу фізичного виховання, у рівній кількості дівчат та хлопців. Для визначення ефективності програми фізичного виховання для студентів з особливими освітніми потребами (із захворюваннями нервової системи) використано кардіоваскулярні тести.

Результати. З позицій загальних завдань дослідження, результати експериментального дослідження засвідчили дієвість реалізації індивідуального підходу у виборі корекційно-розвивальних засобів інклюзивного фізичного виховання студентів з особливими освітніми потребами. Після проведеного курсу занять спостерігаємо стабілізацію з тенденцією до регресування вегетативних порушень, покращення периферичної гемодинаміки, на фоні зменшення клінічних проявів захворювань нервової системи у студентів досліджуваної вибірки.

Висновки. Доведено, що головною підставою впровадження індивідуалізованого підходу у інклюзивне фізичне виховання студентів з особливими освітніми потребами є положення про те, що цей процес повинен орієнтуватися на індивідуальні особливості стану здоров'я кожного студента та можливості усунення наявних відхилень засобами фізичного виховання, а, відтак, досягнення найвищих результатів у такій діяльності. Аналіз досліджень і освітньої практики дає підстави для висновку, що такий підхід у фізичному вихованні, а саме урахування індивідуальних характеристик певного контингенту студентів з особливими освітніми потребами, визначає нові перспективи інклюзивного фізичного виховання студентів закладів вищої освіти в цілому.

Ключові слова: інклюзивна освіта, студенти з особливими освітніми потребами, фізичне виховання, кардіоваскулярні тести, індивідуальна програма.

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Cite this article as: Blavt, O. (2022). Individualization of the Educational Process of Inclusive Physical Education of Students with Disabilities. *Journal of Learning Theory and Methodology, 3*(2), 65-70. https://doi.org/10.17309/jltm.2022.2.03

Received: 22.05.2022. Accepted: 27.06.2022. Published: 30.06.2022

Journal of Learning Theory and Methodology
Журнал теорії та методології навчання

ISSN 2708-7581 (Online)
ISSN-L 2708-7573

ORIGINAL SCIENTIFIC ARTICLE

TECHNOLOGY OF FORMATION OF PSYCHOLOGICAL CLIMATE IN TEAM SPORTS GAMES (ON THE MATERIAL OF VOLLEYBALL)

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DOI: 10.17309/jltm.2022.2.04

Abstract

Purpose of the work – scientifically substantiate the technology of forming the optimal psychological climate in volleyball to increase the effectiveness of competitive activities of athletes.

Material and methods. The experimental studies involved 25 qualified volleyball players - 13 athletes of VC "Orbita-ZNU-RCYSS" (Zaporizhzhya), main group, and 12 athletes of VC "Polissya-SHSM-ZhDU (Zhytomyr), control group. Analysis and generalization of scientific and methodological literature and the Internet; method "Diagnosis of personality for motivation to succeed" (by T. Ehlers); method "Assessment of moral and psychological climate in the team" (according to L. Lutoshkin); method "Assessment of the psychological atmosphere in the team" (according to L. Zhedunova). Analysis and evaluation of competitive performance indicators. Pedagogical experiment. Statistical analysis.

Results. The developed technology of optimization of psychological climate in volleyball contains the corresponding terms of application in a macrocycle of preparation: four consecutive developing complexes of psychological means (exercises, games and trainings). The technology of optimization of the psychological climate in the sports team of qualified volleyball players included specially developed psychological and pedagogical tasks, exercises, situational role-playing games. Interpretation and generalization of experimental research indicators allows us to state that the athletes of VC "Orbita-ZNU-RCYSS" (Zaporizhzhya) in 80% of cases have a tendency to correlate the indicators of optimizing the psychological climate and increase the effectiveness of competitive activities.

Conclusions. The developed technology of optimization of psychological climate in volleyball contains the corresponding terms of application in a macrocycle of preparation: four consecutive developing complexes of psychological means (exercises, games and trainings). The technology of optimization of the psychological climate in the sports team of qualified volleyball players included specially developed psychological and pedagogical tasks, exercises, situational role-playing games. Interpretation and generalization of experimental research indicators allows us to state that the athletes of VC "Orbita-ZNU-RCYSS" (Zaporizhzhya) in 80% of cases have a tendency to correlate the indicators of optimizing the psychological climate and increase the effectiveness of competitive activities.

Keywords: volleyball, formation, technology, optimization, psychological climate.

Introduction

The level of development of modern volleyball is characterized by high competitiveness. At the same time, the classical system of sports training, in practice, is approaching the limit of a certain exhaustion of the system of knowledge about the athletes training, on the one hand, and the maximum physical load on their body, on the other hand (Imas, Borysova, Dutchak, et al., 2018; Oliinyk, Doroshenko, Melnyk, et al., 2021).

At the same time, volleyball players need to demonstrate the highest possible results of competitive activities in highly variable conditions of the game, which requires the manifestation of special psychophysiological and psychological peculiarities of their personality (Salcinovic, Drew, Dijkstra, et al., 2022). So athletes, coaches, managers have to find non-

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traditional approaches to improving the effectiveness of competitive activities (Oliinyk & Voitenko, 2020). Forming of the optimal psychological climate in the sports team is one of the options for such approaches to long-term improvement (Petrovska, Malinovsky, Voronova, et al., 2021).

In the common theory of sports and the system of athletes' training (Platonov, 2017) it is widely spread the thesis that long-term athletes training has certain features that are inherent for the female body. This applies to the development of leading motor skills, structure and content of competitive activities in a particular sport, and so on. This position extends to other aspects of the female athletes' training, such as crucial issues of psychological training and the formation of optimal psychological climate in team sports, in general, and in volleyball, in particular (Drachuk, 2017; Vins & Beliakova, 2021). In addition, relevant today is aspect of applying psychological technologies for the effectiveness of volleyball teams in both competitive and training processes (Afanasieiva, Svitlychna, Bosniuk, et al., 2019).

Achievements of modern sports psychology, particularly the effective use of special means of influencing the female athletes' personality to increase their competitive effectiveness, are obvious and confirmed by studies of authoritative Ukrainian and foreign experts (Vysochina, 2017; McEwan, Ruissen, Eys, et al., 2017; Voronova, Petrovska, Kovalchuk, et al., 2020). This position could be logically extrapolated to the processes of long-term improvement in scientific and methodological works (Ivanii & Serhiienko, 2016; Yamchuk & Almashi, 2017).

The thesis that forming of an optimal psychological climate has a positive effect on the female athletes' competitive effectiveness is axiomatic in modern sport psychology (Vysochina & Bezmylov, 2015; Oliinyk & Doroshenko, 2018). This provision is also important for team sports: the team has a complex multi-level hierarchical structure, which usually includes several coalitions of athletes, the relationship "coach-manager", "coach-athlete", "manager-athlete", "athlete-athlete", etc. In addition, it is necessary to take into account the TOP-level volleyball players presence (or absence) in the team. Their high social status significantly complicates the process of optimizing the psychological climate in the team. The same applies to the personality of coaches or managers with the European or world level experience. In this context, the forming of an optimal psychological climate in the volleyball team is a necessary prerequisite for the successful realization of the game potential of athletes in official competitive activities.

Issues related to determining the specific features of the forming of the optimal psychological climate in volleyball teams of different age (and qualification groups) are also relevant. In adolescence, the influence of family, the authority of coaches, informal communicative leaders in the out-of-team environment is more significant that is proven in some researches (Karaulova, Oliinyk, I., & Oliinyk, M., 2014; Shalar, Strykalenko, & Husar, 2019), which are aimed at investigating the process of creating of the psychological climate in young volleyball players. Similar data were obtained in a study of the influence of parents, coaches and peers on the long-term psychological development of highly qualified and skilled volleyball players (Coutinho, Ribeiro, Mesquita da Silva, et al., 2021).

The study (Goloborodko, Kozina, Polishchuk, et al., 2018) emphasized the positive impact of using a coordination (speed) ladder on the level of technical training and development of psychophysiological functions of 14-16 years old volleyball players. It indicates the presence of a complex relationship: specific psycho-physiological functions improve in the process of developing motor skills, which, in turn, may lead to influence on the processes of optimizing the psychological climate of the team as a whole. The connection between psychophysiological and neurodynamic functions with the technical and tactical training of volleyball players is revealed in the study (Glazyrin & Artemenko, 2013). At the heart of these processes is the investigation of the structure of the relationship between individual psychophysiological indicators of players in modern volleyball, which creates the necessary conditions for further optimization of the psychological climate in the team (Bondar, 2020).

Modern student volleyball is a base and the closest reserve for staffing professional teams. It makes topical issues of forming a psychological climate and its further optimization in the national teams of higher education institutions. Methods of moral and volitional training of volleyball players in higher education institutions are analyzed in detail in the study (Rogal & Vashkevich, 2019). The research is devoted to the problematic issues of determining the level of group cohesion in student sports teams of the Agrarian University (Rybalko, Samokhvalova, & Melyushkina, 2017). The issue of taking into account psychological compatibility as a means of improving the players' interaction in the female volleyball team of the Agricultural University was considered in the study (Samokhvalova, 2018). The main structural components of the creating of the psychological climate of the University's male volleyball team in the preparatory period of the annual training macrocycle were analyzed in the study (Brynzak, Putrov, Omelchuk, et al., 2021).

Associations between the motivational climate, basic psychological needs and the processes of sports orientation and selection of volleyball athletes in competitive practice at various levels are described in the study (Elsborg, Appleton, Wikman, et al., 2022). In particular, the authors show that the higher the level of qualification of volleyball players, the more complex are the relationships in team coalitions and relationships between individual athletes, which greatly complicates the process of optimizing the psychological climate in the team. However, the study (Mosqueda, Lopez-Walle, Gutierrez-García, et al., 2019) highlighted the relationship between the internal factors of autonomous motivation as a mediator between a favorable climate and enjoyment in the training process of volleyball players.

The issues of determining the components in the structure of the general technology of forming the psychological climate in the volleyball team deserve special attention. The study (Teslitskyy, 2017) analyzed in detail the psychological compatibility of players as a prerequisite for effective long-term improvement in volleyball. The research (Lyashenko, Korzh, Podlesnaya, & Rozputnij,2020) is devoted to topical issues of determining the psychological climate, assessing the degree of optimality and its individual components in the volleyball team. The dependence of the success and game effectiveness of volleyball players' training and competitive activities on the individual indicators of the psychological climate in the team was analyzed in the study (Kazakov, 2011).

However, despite the thorough elaboration of topical issues related to the technology of creating a psychological cli-

mate in volleyball, a number of issues that need to be resolved remain unresolved.

Hypothesis. The implementation of science-based technology for forming the optimal psychological climate in volleyball would help to increase the effectiveness of athletes' competitive activities.

The aim is to scientifically substantiate the technology of forming the optimal psychological climate in volleyball to increase the efficiency of competitive activities of athletes.

Material and methods

Participants

The experimental studies involved 25 qualified volleyball female players: main group – 13 female athletes from volleyball club "Orbita-ZNU-ODYUSSH" (Zaporizhzhya), and control group – 12 female athletes from volleyball club "Polissya-SHVSM-ZhDU" (Zhytomyr).

Organization of research

The research was conducted during 2017-2020 at the sports facilities of the Zaporizhzhya Regional Children and Youth Sports School of the Zaporizhzhya Regional Council and the Department of Physical Rehabilitation, Sports Medicine, Physical Education and Health of Zaporizhzhya State Medical University of the Ministry of Health of Ukraine. The technology of psychological climate optimization has been implemented in the annual macro cycle of training of athletes from the main group – VC "Orbita-ZNU-ODYUSSH" (Zaporizhzhya). The obtained results were compared with the performance of athletes form control group – VC "Polissya-SHVSM-ZhDU" (Zhytomyr).

Methods of research

Analysis and generalization of scientific and methodological literature and the Internet resources allowed to summarize and systematize the experience of specialists who studied the problem of forming the technology of optimizing the psychological climate in sports in general and volleyball in particular. Determining the level of individual components of the psychological climate in the main group – VC "Orbita-ZNU-ODYUSS" (Zaporizhzhya): the methodology of motivation for success (by T. Ehlers); methodology "Assessment of moral and psychological climate in the team" (by L. Lutoshkin); methodology "Assessment of the psychological atmosphere in the team" (by L. Zhedunova). The analysis and evaluation of competitive performance indicators was used to determine the relationship with the components of the psychological climate of the team. The pedagogical experiment consisted in the formation of technology for optimizing the psychological climate in the volleyball team and experimental verification of its effectiveness.

Statistical analysis

The obtained indicators were analyzed using methods of mathematical statistics, such as determination of arithmetic mean (X), arithmetic mean error (m), square deviation (S), determination of percentage value (%), correlation coefficient (r) and statistically significant differences (at $p < 0.01$ and $p < 0.05$).

Results

The authors have developed the technology of optimizing the psychological climate in the sports team (based on the materials of qualified volleyball female players) during four consecutive developing complexes of psychological classes and trainings:

- the first complex focused on the personal development of female athletes: the impact on the personal development of female athletes; purposeful formation "self-confidence and their abilities" among volleyball female players; building a set of psychological features and structures aimed at the success of psychological self-regulation;
- the second complex aimed at improving interpersonal interaction in the team at the level of "athlete – athlete": purposeful formation of interpersonal skills, improving relationships and communication in the team, finding common ground to achieve goals, ability to interact and identify problems of sports team and find the best solutions to them;
- the third complex aimed at improving interpersonal interaction in the team at the level of "athlete – coach": improving the relationship between female athletes and coaches; formation of a sense of mutual respect and trust; increasing the level of authority of the coach in the sports team;
- the fourth complex focused on the formation of skills to optimize the psychological climate in the team as a factor that improves the effectiveness of competitive activities: the formation of skills to optimize the psychological climate in the team, creating a positive atmosphere; promoting trusting and sincere relationships; team building and building effective interaction; establishing mutual understanding.

Specially developed psychological and pedagogical tasks, exercises, situational role-playing games were included in the technology of optimization of the psychological climate in the sports team of qualified volleyball female athletes.

Creating the favorable psychological and pedagogical conditions by discussion, training, situational role-playing and creative games was implemented in the process of forming the technology of optimizing the psychological climate in the team.

The structure of the technology of optimization of psychological climate in a sports team has the algorithmic sequence of formation of psychological skills, which consists of three phases:

- phase of orientation, which contributes to the effective implementation of information and motivational functions;
- phase of training, which contributes to the effective mastering of the pedagogical function by obtaining the necessary knowledge, as well as their application in specific conditions of the sports team;
- phase of practical mastery, which is aimed at bringing the acquired knowledge, skills and abilities to automatism in practical activities, including training and competitive activities of athletes.

The experimental studies were aimed at testing the effectiveness of the technology of optimizing the psychological climate in the volleyball team to increase the effectiveness of competitive activities of female athletes.

Motivation of sports activity is a complex hierarchical personal formation, which, at the same time, is determined by the psychophysiological characteristics of the female athlete's personality and the specific situation in the training and competitive activities. Motivation to achieve success is the basis for the development of sportsmanship of volleyball players and, it is one of the leading components of the technology of forming an optimal psychological climate in the team.

The indicators of personal motivation to success in athletes from VC "Orbita-ZNU-ODYUSSH" (Zaporizhzhya) and VC "Polissya-SHVSM-ZhDU" (Zhytomyr) are presented in table 1.

Table 1. The results of the diagnosis of personality for motivation to success in volleyball female players *,%, (n = 25)

Motivation levels	VC "Orbita-ZNU-ODYUSSH" (Zaporizhzhya)		VC "Polissya-SHVSM-ZhDU" (Zhytomyr)	
	n = 13	%	n = 12	%
high	4	30.8	4	33.3
medium	6	46.1	5	41.7
low	3	23.1	3	25

Note. * – according to the Ehlers' methodology.

Female athletes from VC "Orbita-ZNU-ODYUSSH" (Zaporizhzhya) and VC "Polissya-SHVSM-ZhDU" (Zhytomyr) have mostly medium (46.1% and 41.7%, respectively) and high levels of motivation to success (30.8% and 33.3%, respectively) based on the results of the methodology of motivation for success (by T. Ehlers). This shows that the qualified volleyball female players from the Super League (VC "Orbita-ZNU-ODYUSSH", Zaporizhzhya) and the Super League (VC "Polissya-SHVSM-ZhDU", Zhytomyr) of the National Championship do not have statistically significant differences in the motivation to success.

The analysis of the correlation between the results with athletes from the VC "Orbita-ZNU-ODYUSSH" (Zaporizhzhya) by the methodology of motivation for success (by T. Ehlers) in comparison with the effectiveness of their competitive activities is presented in Table 2, namely: indicators of points scored per game; indicators of offensive technical and tactical actions per game; indicators of the effective passing of a ball per game; indicators of effective blockings per game; indicators of effective catching of a ball per game.

80% of the leading technical and tactical actions in the competitive activities of skilled volleyball female players have a high level of correlation with the manifestations of personal motivation to success (by T. Ehlers): the correlation coefficient, r, is in the range from 0.786 to 0.932. The lowest value of the correlation coefficient was recorded in terms of the relationship between motivation to success and offensive technical and tactical actions per game: r = 0.124 according to data analysis presented in Table 2.

Analysis of the correlation between the results by the methodology "Assessment of moral and psychological climate in the team" (by L. Lutoshkin) with the effectiveness of their competitive activities was done (see Table 3).

Table 2. Correlation between the results by the methodology of motivation for success (by T. Ehlers) and the effectiveness of competitive activities of female athletes from VC "Orbita-ZNU-ODYUSSH" (Zaporizhzhya) (n = 13)

Methodology	Indicators	r	t	p
Methodology of motivation for success (by T. Ehlers)	indicators of points scored per game	0.786	2.39	0.01
	indicators of offensive technical and tactical actions per game	0.124		
	indicators of the effective passing of a ball per game	0.809		
	indicators of effective blockings per game	0.932		
	indicators of effective catching of a ball per game	0.728		

Notes: r – correlation coefficient; t – Student's criteria; p – level of significance

80% of leading technical and tactical actions in competitive activity of qualified volleyball female players have a high level of interrelation of manifestations of motivation of the person to success: value of correlation coefficient, r, is in the range from 0.728 to 0.922 according to data analyses from Table 3. The lowest value of the correlation coefficient was also recorded in terms of the relationship between motivation for personal success and offensive technical and tactical actions in competitive activities: r = 0.496.

Table 3. Correlation between the results by the methodology "Assessment of moral and psychological climate in the team" (by L. Lutoshkin) and the effectiveness of competitive activities of female athletes from VC "Orbita-ZNU-ODYUSSH" (Zaporizhzhya) (n = 13)

Methodology	Indicators	r	t	p
"Assessment of moral and psychological climate in the team" (by L. Lutoshkin)	indicators of points scored per game	0.922	2.26	0.01
	indicators of offensive technical and tactical actions per game	0.496		
	indicators of the effective passing of a ball per game	0.907		
	indicators of effective blockings per game	0.876		
	indicators of effective catching of a ball per game	0.728		

Notes: r – correlation coefficient; t – Student's criteria; p – level of significance

In addition, the analysis of the correlation between the results by the methodology "Assessment of the psychological atmosphere in the team" (by L. Zhedunova) with the effectiveness of their competitive activities was implemented (see Table 4).

Table 4. Correlation between the results by the methodology "Assessment of the psychological atmosphere in the team" (by L. Zhedunova) and the effectiveness of competitive activities of female athletes from VC "Orbita-ZNU-ODYUSSH" (Zaporizhzhya) (n = 13)

Methodology	Indicators	r	t	p
"Assessment of the psychological atmosphere in the team" (by L. Zhedunova)	indicators of points scored per game	0.961	2.58	0.01
	indicators of offensive technical and tactical actions per game	0.477		
	indicators of the effective passing of a ball per game	0.965		
	indicators of effective blockings per game	0.956		
	indicators of effective catching of a ball per game	0.860		

Notes: r – correlation coefficient; t – Student's criteria; p – level of significance

The results from Table 4 confirm the existence of this trend. Thus, it could be noted the tendency to reduced indicators of the correlation between motivation for personal success and offensive technical and tactical actions in the competitive activities of volleyball female players done according to the tests 2Methodology of motivation for success" (by T. Ehlers), "Assessment of moral and psychological climate" (by L. Lutoshkin) and "Assessment of the psychological atmosphere in the team" (by L. Zhedunova): r = 0.124, r = 0.496 and r = 0.477, respectively.

The indicators of the number of points scored in the competitive activities of volleyball female players before and after the implementation of technology to optimize the psychological climate in the team is shown in Table 5.

Comparative analysis of the indicators presented in table 5, allows us to state that after the implementing of technology to optimize the psychological climate in the sports team there are the following changes,

VC "Orbita-ZNU-ODYUSSH" (Zaporizhzhya):

- "point guard player" (t = 7.63; p < 0.01): before the experiment – 1.61 + 0.15 points (4.14%), after the experiment – 1.75 + 0.14 points (4.22%);
- "diagonal player" (t = 8.75; p < 0.01): before the experiment – 15.29 + 1.25 points (39.36%), after the experiment – 16.40 + 0.9 points (39.55%);
- "playing out player" (t = 12.11; p < 0.01): before the experiment – 7.66 + 0.68 points (39.4%), after the experiment – 7.86 + 0.58 points (38.56%);
- "central blocking player" (t = 11.29; p < 0.01): before the experiment – 4.43 + 0.23 points (17.1%), after the experiment – 4.88 + 0.22 points (17.67%).
- VC "Polissya-SHVSM-ZhDU" (Zhytomyr):
- "point guard player" (t = 12.61; p < 0.01): before the experiment – 1.20 + 0.10 points (3.39%), after the experiment – 1.36 + 0.09 points (3.5%);
- "diagonal player" (t = 9.7; p < 0.01): before the experiment – 9.4 + 0.9 points (26.52%), after the experiment – 10.50 + 1.32 points (26.92%);
- "playing out player" (t = 8.4; p < 0.01): before the experiment – 12.3 + 1.9 points (34.7%), after the experiment – 13.86 + 1.59 points (35.55%);
- "central blocking player" (t = 9.91; p < 0.01): before the experiment – 6.28 + 0.92 points (35.4%), after the experiment – 6.64 + 0.79 points (34.03%).

The results of comparative analysis show that there are no significant differences, but there is a tendency to increase the number of points scored in the competitive activities of female athletes from VC "Orbita-ZNU-ODYUSSH" (Zaporizhzhya), where the technology of optimizing the team's psychological climate was implemented.

Discussion

The basis for the study is the hypothesis of the possibility to apply the technology of optimizing the psychological climate in the volleyball team to increase the effectiveness of competitive activities. The substantiation of this thesis is carried out on the basis of the scientific literature analysis,

Table 5. Comparative analysis of indicators of the number of points scored in the competitive activities of volleyball female players of different roles, n = 25

Role	Values of indicators					
	Before the experiment			After the experiment		
	ranges, n1 (min – max)	averaged, (X ± m)	S	ranges, n1 (min – max)	averaged, (X ± m)	S
VC "Orbita-ZNU-ODYUSSH" (Zaporizhzhya), n = 13						
point guard player	1.46 – 1.75	1.61 ± 0.15	0.21	1.61 – 1.89	1.75 ± 0.14	0.2
diagonal player	14.04 – 16.54	15.29 ± 1.25	1.77	15.5 – 17.29	16.40 ± 0.9	1.27
playing out player	6.61 – 9.54	7.66 ± 0.68	1.37	6.28 – 9.04	7.86 ± 0.58	1.17
central blocking player	4.14 – 4.89	4.43 ± 0.23	0.41	4.46 – 5.18	4.88 ± 0.22	0.37
VC "Polissya-SHVSM-ZhDU" (Zhytomyr), n = 12						
point guard player	1.1 – 1.3	1.2 ± 0.1	0.14	1.27 – 1.45	1.36 ± 0.09	0.13
diagonal player	8.5 – 10.3	9.4 ± 0.9	1.27	9.18 – 11.82	10.50 ± 1.32	1.87
playing out player	10.4 – 14.2	12.3 ± 1.9	2.69	12.27 – 15.45	13.86 ± 1.59	2.25
central blocking player	4.1 – 8.2	6.28 ± 0.92	1.83	4.55 – 8.18	6.64 ± 0.79	1,58

Notes: min – minimally sufficient; max – maximum; n – number of games; n1 – values of indicators; ± - arithmetic mean; m – the standard error of the mean; S – the standard deviation

the experimental researches, processing and interpretation of their results. The results of experimental research allow to state that the use of technology to optimize the psychological climate in the volleyball team tends to increase the effectiveness of competitive activities, and the hypothesis is true.

The provisions that have positions of scientific novelty are determined in the process of systematizing the data of the scientific literature and the obtained results of experimental research. In particular, for the first time, the technology of optimizing the psychological climate in the volleyball team was developed on the basis of purposeful influence on the personal development of female athletes, improvement interpersonal interaction in the sports team at the level of "athlete – athlete", "coach – athlete", formation of skills to optimize the psychological climate in the team (Vysochina & Bezmylov, 2015; Drachuk, 2017; Oliinyk & Doroshenko, 2018). Also, for the first time, the algorithm of the process of optimizing the psychological climate in a sports team is proposed, which has theoretical and practical levels and the following stages: diagnostic (assessment of individual characteristics of athletes and coaches, interaction and psychological climate), approbation (technology implementation) and control-correctional (summarizing and providing practical recommendations to coaches) (Karaulova, et al.; Lyashenko, et al., 2020). In addition, for the first time, the correlation between indicators of the psychological climate in the volleyball team and indicators of their competitive activities is defined (Oliinyk & Doroshenko, 2018; Samokhvalova, 2018) and complexes of special means (exercises, games, trainings) are developed to optimize the psychological climate in the volleyball team in the training macrocycle (Oliinyk, et al., 2021; Elsborg, et al., 2022).

Data on the use of means and methods to optimize the psychological climate in the volleyball team (Kazakov, 2011) and the need to take into account the type of temperament of female athletes in the competitive activities of qualified volleyball players (Bondar, 2020) is updated.

Data on the positive impact of personal characteristics of volleyball female players on the psychological climate in the sports team and the effectiveness of their competitive activities (Rybalko, et al., 2017; Teslitskyy, 2017), and the importance of a positive psychological climate for successful competitive activities of athletes (Vysochina, 2017; Petrovska, et al., 2021) are confirmed.

The idea of the influence of the coach's personality on the optimization of the psychological climate of the sports team was further developed (Rogal & Vashkevich, 2019; Afanasieiva, et al., 2019; Mosqueda, et al., 2019; Coutinho, et al., 2021).

Prospects for further research in this area are based on the need to identify features and differences in the formation of technology to optimize the psychological climate in female's and male's teams, as well as finding likely influences of formal and informal leaders in the formation of psychological climate.

Conclusions

The developed technology of optimization of psychological climate in volleyball contains the corresponding terms of application in a macrocycle of preparation: four consecutive developing complexes of psychological means (exercises, games and trainings). The technology of optimization of the psychological climate in the sports team of qualified volleyball female players included specially designed psychological and pedagogical tasks, exercises, situational role-playing games. The algorithmic sequence of formation of psychological skills, which consists of three phases: phases of orientation, phases of training, phases of practical mastering, is considered in the structure of the developed technology of optimization of psychological climate in sports team.

Interpretation and generalization of experimental research indicators allows us to state that there is a tendency to correlate the indicators of optimizing the psychological climate and increase the effectiveness of competitive activities in 80% of cases for female athletes from VC "Orbita-ZNU-ODYUSSH" (Zaporizhzhya).

Acknowledgements. The authors are grateful to the administration of the Volleyball Federation of Ukraine (Kyiv) for organizational assistance in conducting experimental research; administration and coachers from volleyball clubs "Orbita-ZNU-ODYUSSH" (Zaporizhzhya) and "Polissya-SHVSM-ZhDU" (Zhytomyr) for practical assistance in conducting experimental research.

Conflict of interest

The authors declare no conflict of interest.

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ТЕХНОЛОГІЯ ФОРМУВАННЯ ПСИХОЛОГІЧНОГО КЛІМАТУ У КОМАНДНИХ СПОРТИВНИХ ІГРАХ (НА МАТЕРІАЛІ ВОЛЕЙБОЛУ)

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Авторський вклад: A – дизайн дослідження; B – збір даних; C – статаналіз; D – підготовка рукопису; E – збір коштів
Реферат. Стаття: 8 с., 5 табл., 32 джерела.

Мета дослідження – науково обґрунтувати технологію формування оптимального психологічного клімату у волейболі для підвищення ефективності змагальної діяльності спортсменок..

Матеріали і методи. В експериментальних дослідженнях брали участь 25 кваліфікованих волейболісток – 13 спортсменок ВК «Орбіта-ЗНУ-ОДЮСШ» (Запоріжжя), основна група, та 12 спортсменок ВК «Полісся-ШВСМ-ЖДУ» (Житомир), контрольна група. Аналіз та узагальнення науково-методичної літератури і мережі «Internet»; методика «Діагностика особистості на мотивацію до успіху» (за T. Ehlers); методика «Оцінка морально-психологічного клімату у колективі» (за Л. Лутошкіним); методика «Оцінка психологічної атмосфери у колективі» (за Л. Жедуновою). Аналіз та оцінка показників ефективності змагальної діяльності. Педагогічний експеримент. Статистичний аналіз.

Результати. Після впровадження розробленої технології оптимізації психологічного клімату у тренувальний процес ВК «Орбіта-ЗНУ-ОДЮСШ» (Запоріжжя), констатуємо наявність тенденції до знижених показників взаємозв'язку мотивації до успіху особистості та атакувальних техніко-тактичних дій у змагальній діяльності волейболісток за тестами Т. Елерс «Діагностика особистості на мотивацію до успіху», Л. Лутошкін «Оцінка морально-психологічного клімату у колективі» та Л. Жедунова «Оцінка психологічної атмосфери у колективі»: r = 0,124, r = 0,496 і r = 0,477 відповідно. За іншими показниками техніко-тактичних дій (набрані очки, подача м'яча, блокування, прийом м'яча) зафіксовано високі значення показників коефіцієнту кореляції.

Висновки. Розроблена технологія оптимізації психологічного клімату у волейболі містить відповідні терміни застосування у макроциклі підготовки: чотири послідовних розвивальних комплекси психологічних засобів (вправ, ігор і тренінгів). До складу технології оптимізації психологічного клімату в спортивній команді кваліфікованих волейболісток увійшли спеціально розроблені психолого-педагогічні завдання, вправи, ситуаційно-рольові ігри. Інтерпретація та узагальнення показників експериментальних досліджень, дозволяє констатувати, що у спортсменок ВК «Орбіта-ЗНУ-ОДЮСШ» (Запоріжжя) у 80% випадків, наявна тенденція до взаємозв'язку показників оптимізації психологічного клімату та підвищення ефективності змагальної діяльності.

Ключові слова: волейбол, формування, технологія, оптимізація, психологічний клімат.

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Cite this article as: Doroshenko, E., Oliinyk, I., Melnyk, M., Oliinyk, M., & Sheviakov, O. (2022). Technology of Formation of Psychological Climate in Team Sports Games (on the Material of Volleyball). *Journal of Learning Theory and Methodology, 3*(2), 71-78. https://doi.org/10.17309/jltm.2022.2.04

Received: 23.05.2022. Accepted: 26.06.2022. Published: 30.06.2022

Journal of Learning Theory and Methodology
Журнал теорії та методології навчання

ISSN 2708-7581 (Online)
ISSN-L 2708-7573

ORIGINAL SCIENTIFIC ARTICLE

FORMATION OF MOTOR SKILLS IN ATHLETES IN BULLET SHOOTING AT THE INITIAL STAGE OF TRAINING

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Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

DOI: 10.17309/jltm.2022.2.05

Abstract

The purpose of the study – to describe the peculiarities of the formation of motor skills in athletes in bullet shooting at the initial stage of training.

Materials and methods. The following research methods were used to solve the tasks: analysis and generalization of scientific and methodological literature, pedagogical observations, processing of results. The analysis of the scientific and methodological literature made it possible to establish that in the technical training of young shooters the available general information is given without specifying the use of tools and methods for learning motor skills. The pedagogical observation was used to study the peculiarities of learning the technique of performing bullet shooting elements, as well as mastering motor skills.

Results. The analysis of educational and training activities allowed to determine that learning to master the technical elements of shooting athletes at the stage of initial training requires the use of modern methods and tools. A number of educational and methodological documents were analyzed: the curriculum for the training of archery for children and youth sports schools, specialized children and youth schools of the Olympic reserve, schools of higher sportsmanship and educational institutions of sports profile; specialized literature on shooter training. In the process of analysis it was determined that the technical training of athletes occupies a significant share of the duration of the training process, and requires the use of an increased arsenal of additional tools for the effective study of shooting techniques.

Conclusions. A detailed analysis of the specialized educational and methodological literature for the training of shooters revealed that in the group of initial training technical training is characterized by studying the basics of elements of shooting techniques, namely: racks for shooting, aiming, breathing, finger pressure on the trigger. Mastering these basics of the elements of shooting technique directly depends on quality and well-formed motor skills, which in the future will allow the athlete to achieve a high sports result.

Keywords: bullet shooting, motor skill, technical training.

Introduction

Technical training of athletes in bullet shooting at the stage of initial training should be based on the formation of motor skills. It is appropriate to describe the features of sports training of young shooters in bullet shooting, taking into account the physiological basis of its formation, as well as the system of educational and training process. From the very beginning, technical training is one of the main priorities and reserves for improving efficiency and should be built in a way that takes into account trends in research (Lopatiev, Vlasov, & Trach, 2013; Pavlyuk, Pityn, Pavlyuk, Chopyk, Antoniuk, & Soltyk, 2020; Lopatiev, & Demichkovskyi, 2021).

The specialists proposed the basics of the method of formation of motor skills, and also made an attempt to interpret them in accordance with modern requirements of the sports industry (Vovkanych & Berhtraum, 2013; Kalynichenko & Lopatiev, 2012; Kalynichenko, 2009).

Technical training is one of the key in bullet shooting, because in the future it creates a foundation for successful performances in competitions of various levels and achieve the maximum possible individual result. Taking into account the peculiarities of the initial training of athletes and the formation of motor skills, it is important at this stage to choose effective tools and methods for the training process. It is proposed to use the basics of a systematic approach in the pedagogical process, as it allows to identify certain parts of the system "shooter – weapon – target" for further training

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and improvement (Vlasov et al., 2016; Lopatiev et al., 2017; Pyanylo et al., 2020; Pyanylo et al., 2021).

The available scientific and methodological literature does not take into account the modern nature and approaches to the training of young shooters through the formation of motor skills, which are the basis of sports techniques. There are no methodological recommendations for technical training of athletes in shooting at the beginning of a sports career, which creates a mismatch between the use of tools and methods for effective training of shooters, quality formation of motor skills and scientific explanation of basic psycho-physiological mechanisms of their use (Kalynichenko & Lopatiev, 2012; Mon-López & Tejero-González, 2019; Mon-López et al., 2021; Park et al., 2019).

On the issue of training young athletes in shot put at the stage of initial training, it is emphasized that the study and mastering of sports techniques and its elements will be the foundation for further sports training (Volkov, Kuksa, Dronov, Starinskyi, Bohino, & Petrosiuk, 2009; Gładyszewski & Gładyszewska, 2012).

At present, no clear methods and steps for technical training are offered in the training of novice athletes in shot put. The main purpose of technical training at the initial stage is to master the technical elements, that is, such motor skills that will further contribute to its effective use to achieve high sports results. In order to suggest specific steps for mastering the technical elements, it is necessary to analyze the shooting technique, characterize and identify the key elements, as well as describe the physiological mechanism of motor skills formation.

The purpose of the study – to describe the peculiarities of the formation of motor skills in athletes in bullet shooting at the initial stage of training.

Materials and methods

Research participants

The study involved athletes in the bullet shooting group of primary training (male and female). It is assumed that on the basis of performance analysis it is possible to determine the level of technical readiness and informative indicators of readiness of novice shooters, that is, motor skills.

Research organization

The following research methods were used to solve the tasks: analysis and generalization of scientific and methodological literature, pedagogical observations, processing of results. The analysis of scientific and methodological literature made it possible to establish that in the technical training of young shooters available general information is given without specifying the use of tools and methods for learning motor skills. Pedagogical observation was used to study the peculiarities of learning the technique of performing bullet shooting elements, as well as mastering motor skills.

Testing procedure

Video recording of rifle shooting training by novice athletes was carried out. The results were used to identify the main mistakes that athletes made during their performance.

Equipment: video camera, analysis chart.

Results

In the specialized educational and methodical literature it is emphasized that the content of technical training of athletes in bullet shooting at the stage of initial training is: mastering the elements of shooting technique (racks for shooting, aiming, breathing, finger pressure on the trigger).

Under the technique of shooting we will understand a set of rational motor actions of the shooter, aimed at achieving a high sports result in a particular type of shooting.

The analysis of scientific and methodological documentation revealed that the curriculum of long-term training program for shooters for children and youth sports schools, specialized children and youth schools of the Olympic reserve, schools of higher sportsmanship and educational institutions of sports profile indicated: technical training at different stages of long-term training is within – the stage of initial training – 42.2% (first year), 54.9% (second year); previous basic training – 56.1% (first year), 52.4% (fourth year); specialized basic training – 53.4% (first year), 54.6% (third year); preparation for higher achievements – 57.9%

Table 1. Curriculum of long-term training, hours (Volkov, Kuksa, Dronov, Starinskyi, Bohino, & Petrosiuk, 2009)

Type of training	Group									
	Initial training		Pre-basic training				Specialized basic training			Preparation for higher achievements
	Year of study									
	1-й	2-й	1-й	2-й	3-й	4-й	1-й	2-й	3-й	All term
Theoretical training	20	20	20	24	24	28	38	38	34	34
General physical training	80	90	110	130	154	162	166	168	170	174
Special physical training	36	48	92	120	140	160	190	192	194	196
Technical training	136	202	310	334	444	482	590	652	704	852
Participation in competitions, drawing up standards	4	8	20	36	56	72	100	120	150	180
Instructing and judging practice	–	–	–	–	10	16	20	24	36	36
Total:	276	368	552	644	828	920	1104	1194	1288	1472

of the total amount (Table 1). Thus, it is possible to indicate that the technical training of the shooter is an important factor in successful performance in competitions, appropriately selected tools and methods at the initial stage of training will contribute to achieving high sports results in the future.

Hereinafter, we use the following terminology.

Under the movement we will understand any movement in the body, as well as changes in its state.

Change – the transformation of something into something qualitatively different, change is characterized by the direction, speed and duration. Change is also understood as the transition from one place to another (spatial movements).

Mechanical movements are changes in the position of a body (material point) over time relative to other bodies.

Biokinematics is a branch of biomechanics that studies the motion of living bodies and biological systems. In general, kinematics is a branch of mechanics that studies the external laws of motion of a material point.

Dynamics is the doctrine of the motion of bodies under the influence of forces. The task of dynamics – to determine the movement of the body by the specified forces that affect it and vice versa – to determine the forces that cause its movement by the specified direction of movement of the body. Dynamics as a branch of mechanics studies the mechanical causes of motion.

Biodynamics – a branch of dynamics that studies the action of forces that provide movement to the human body.

Motor action is a manifestation of human motor activity, which is aware of it and is aimed at solving any specific motor task.

Motor actions consist of innate (based on unconditional) and acquired during life (based on conditioned reflexes). The innate motor actions play a secondary role, remaining in the form of tendon, protective and vestibular reflexes throughout human life. Complex motor actions are formed in the process of life as a result of learning and are based on the formation of complex conditioned reflexes. The physiological mechanism for the formation of new, individually acquired types of motor activity are temporary connections, that are formed on the principle of conditioned reflexes. The ability to develop new motor skills, that is, the ability to train, is largely due to hereditary factors, and is different in different people, the rate of formation of new motor skills changes with age.

Motor action is the smallest structural unit of ball shooting technique (technique, motor action, motor skill, temporal connections). This division provides an opportunity to effectively analyze and select tools and methods for teaching shooting techniques to young shooters at the initial stage of training, which in turn will help to improve the effectiveness of the process of sports training at the beginning of a sports career.

In shooting we are interested in the result, so it is logical to study the material and information system "shooter – the result", in which the material component of the system is replaced by an information component in shooting sports.

In systemology study the dynamic system consisting of three subsystem elements: "object – interaction – environment", where the object – stable in time and limited in space formation, perceived as a whole – an element of the system; interaction -continuous process of interconnected with causal relationships transformation of the parameters of the object and the environment; environment – an arbitrary set of objects that may affect the studied object (Fig. 1). The material system "shooter – weapon – target" was identified to determine the influence of external and internal factors on the functioning of this system, which later allowed to divide the execution of the shot into phases: "aiming", "execution of the shot – active shot", "shot adjustment" (Demichkovskyi, 2019; Lopatiev, & Demichkovskyi, 2021).

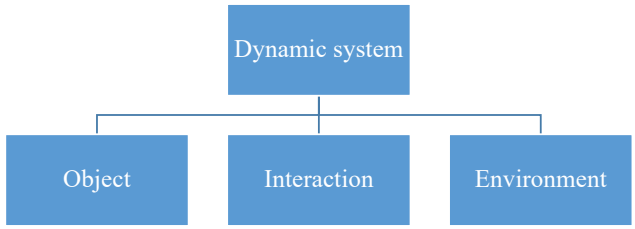

Fig. 1. The dynamic system of "object – interaction – environment" (Demichkovskyi, Lopatiev, & Pianylo, 2021)

Using this principle to build a system, we propose to create a system "shooter – weapon – result" to further establish the relationship between the result and the phases of the shot.

The feature of the information system "shooter – result" is the analysis of the element "result" (see Table 2) and establishing a connection between the elements of the system. The result of the shooting characterizes the level of training of the athlete, the analysis of which will improve the selection of tools and methods for training.

A feature of systems analysis is the use of two types of methods: qualitative and formal.

In shooting sports for analysis often use:

- discriminant analysis – a type of multidimensional analysis designed to solve problems of image recognition. Used to decide which variables share (i.e. discriminate) certain data sets (so-called groups);
- regression analysis is needed to solve problems in which stochastic dependencies (stochastic cause-and-effect relationships) are given by functions with one or more variables that are defined as independent. Regression analysis is a method of mathematical statistics that allows to determine the degree of separate and combined influence of the factors being studied on the performance trait and to quantify this influence using different criteria;
- correlation analysis is used to determine the relationship between two or more stochastic variables that exist between them.

Table 2 is directly related to the effectiveness of mastering the motor skills of shooters in ball shooting, because it provides an opportunity to analyze the result of the performance, that is the level of mastery of technical training.

Discussion

The attempt to describe the peculiarities of the formation of motor skills in athletes in shot put at the stage of initial training was made in the paper.

Considering technical training as a process of formation of motor skills, a number of authors drew attention and defined it as follows: technical training is a process of mastering

Table 2. Analysis of air rifle shooting

Steps of analysis	Description	Organizational and methodological guidelines
The first – the analysis of the result	Investigate the outcome of the competitive exercise in general.	—
The second – the analysis of series	The analysis of each series provides information about the course of fatigue during the shooting. In each series, it is manifested by a decrease in performance, for example, the first series – 97 points; second series – 96 points; third series – 98 points; fourth series – 96 points; fifth series – 98 points; sixth series – 96 points. The results of the series differ from the maximum of 100 points	Analyzing the result of the series within the exercise, we can attest that fatigue is manifested in the athlete in the lowest results in the series
The third – a shot analysis	Each shot of the competitive activity is studied in each series and analyzed from 1-10, 11-20, 21-30, 31-40, 41-50, 51-60 so that you can observe the location of each shot according to the center of the target, for example : T.L. (top left); T.R. (top right); D.L. (down left); D.R. (down right). Most attention is paid to those series with the lowest result to determine at what point fatigue affected the athlete and reflected in the result. Determine the percentage ratio between the total number of shots in the exercise and determined, according to their location relative to the center of the target	Demonstrates in which direction in accordance with the center of the target is the deviation of the shots, the presence of which is a consequence of the lack of appropriate technical and tactical adjustments during the exercise, as well as the impact of fatigue on the athlete. The results are important for practical work, because they allow to make appropriate changes in the implementation of the exercise
The fourth – the generalization of the obtained results	Distribute all the shots according to the execution from the first to the last, make a table, build a visual schedule of execution, on which it is possible to clearly see how each shot and exercise in general took place. The schedule will allow you to see the picture of performance, will show the coach the level of preparedness of the athlete	The analysis should be carried out individually for each athlete to determine ways to improve the training of each athlete and choose the right tools and methods to perform tasks

the technique of shooting and improving technical skills (Vynohradskyi & Demichkovskyi, 2021, 2022). This statement is best related to the initial preparation stage, because in the following stages the statement is supplemented by additional information load, and is interpreted as follows: technical training is the improvement of sports equipment by changing the dynamic and kinematic parameters of the structure of movements during the shot taking into account the individual characteristics of the athlete, compliance with modern conditions of competitive activities and morpho-functional capabilities of the athlete during the shot during competitive exercises, ensuring the resistance of technology to the action of disruptive factors (Lopatiev & Demichkovskyi, 2021).

An important role in the formation of motor skills belongs to the coordination of movements. Such qualities of movement as smoothness, accuracy and necessary force are realized by physiological mechanisms of an athlete's organism by regulation of temporal, speed and spatial characteristics of movement.

The hypothesis put forward by Kalynichenko and Lopatiev (2012) that in the final phase of the shot it is necessary to use control mechanisms such as "aimless movement" and avoid control mechanisms "target movements" requires theoretical confirmation of the formation of motor skills in shooting as a basis for performing an accurate shot from a physiological point of view. Attention is drawn to the fact that the concept of purposeful change, pedagogical means of controlling the motor actions of athletes in the final phase of the shot is possible, and opens encouraging prospects for improving the efficiency and intensification of shooters training using modern methods of analysis of technical readiness of shooters (for example, table 2). Due to this, not only the methodology can change, but also the specific technology of forming the given systems of movements of athletes in shooting sports in the process of learning and training.

Conclusions

The paper describes the mechanism of formation of motor skills of young athletes in bullet shooting at the stage of initial preparation. Emphasis is placed on the importance of using modern methods and means of technical training, which directly affect the formation of motor skills, that is create a quality basis for the formation of temporary connections and effective mastery of shooting techniques. A detailed analysis of the specialized educational and methodological literature for the training of shooters revealed that in the group of initial training technical training is characterized by studying the basics of elements of shooting techniques, namely: racks for shooting, aiming, breathing, finger pressure on the trigger. Mastering these basics of the elements of shooting technique directly depends on high-quality and well-formed motor skills, which in the future will allow the athlete to achieve high sports results.

Conflict of interest

The authors declare no conflict of interest.

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ФОРМУВАННЯ РУХОВИХ НАВИЧОК У СПОРТСМЕНІВ В СТРІЛЬБІ КУЛЬОВІЙ НА ЕТАПІ ПОЧАТКОВОЇ ПІДГОТОВКИ

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Авторський вклад: A – дизайн дослідження; B – збір даних; C – статаналіз; D – підготовка рукопису; E – збір коштів

Реферат. Стаття: 6 с., 2 табл., 19 джерела.

Мета дослідження – описати особливості формування рухових навичок у спортсменів зі стрільби кульової на етапі початкової підготовки.

Матеріали та методи. Для вирішення поставлених завдань було використано наступні методи дослідження: аналіз та узагальнення науково-методичної літератури, педагогічні спостереження, обробка результатів. Аналіз науково-методичної літератури дав змогу встановити, що в технічній підготовці юних стрільців наявна загальна інформація подана без конкре-

тизації використання засобів та методів для формування рухових навичок. Педагогічне спостереження використано для вивчення особливостей навчання техніки виконання елементів стрільби кульової, а також оволодіння рухових навичок.

Результати. Аналіз навчально-тренувальної діяльності дозволив визначити, що навчання технічних елементів стрільби спортсменів на етапі початкової підготовки потребує використання сучасних методів та засобів. Було проаналізовано ряд навчально-методичних документів: навчальна програма з підготовки стрільців з кульової стрільби для дитячо-юнацьких спортивних шкіл, спеціалізованих дитячо-юнацьких шкіл олімпійського резерву, шкіл вищої спортивної майстерності та навчальних закладів спортивного профілю; спеціалізована література з підготовки стрільців. У процесі аналізу визначено, що технічна підготовка спортсменів займає вагому частку тривалості навчально-тренувального процесу, і вимагає застосування збільшеного арсеналу додаткових засобів для ефективного навчання техніки стрільби.

Висновки. Детальний аналіз спеціалізованої навчально-методичної літератури для підготовки стрільців дозволив встановити, що в групі початкової підготовки технічна підготовка характеризується вивченням основ елементів техніки стрільби а саме: стійки для стрільби, прицілювання, дихання, натискання пальцем на спусковий гачок. Саме оволодіння цих основних елементів техніки стрільби напряму залежить від якісних та правильно сформованих рухових навичок, що в майбутньому дозволятиме спортсменові досягнути високого спортивного результату.

Ключові слова: стрільба кульова, рухова навичка, технічна підготовка.

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Cite this article as: Lopatiev, A., & Demichkovskyi, A. (2022). Formation of Motor Skills in Athletes in Bullet Shooting at the Initial Stage of Training. *Journal of Learning Theory and Methodology, 3*(2), 79-84. https://doi.org/10.17309/jltm.2022.2.05

Received: 26.05.2022. Accepted: 29.06.2022. Published: 30.06.2022

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ISSN 2708-7581 (Online)
ISSN-L 2708-7573

JLTM

Journal of Learning Theory and Methodology

Scientific journal

February 2022
Volume 3
Number 2

Відповідальний за випуск О. М. Худолій
Комп'ютерна верстка М. О. Худолій
Коректор Є. Б. Бланк

Засновник і видавець — ТОВ «ОВС».
Адреса редакції: https://www.ltmjournal.com.Тел.: (067) 578-40-08. E-mail: editor-in-chief@ltmjournal.com

Підписано до друку 28.06.2022. Формат 60×84 1/8. Електронне видання. Гарнітура Таймс. PDF формат.
Ум. друк. арк. 6,989. Обл.-вид. арк.7,25. Вид. № 01-2022. Зам. № 56. Тираж 300 прим. Ціна договірна.

ТОВ «ОВС» Україна, 61003 Харків, пл. Конституції, 18, к. 11.
Свідоцтво Держкомінформу України Серія ДК № 331 від 08.02.2001 р.
Друкарня ТзОВ «Цифра прінт». 61166, м. Харків, вул. Культури, 20-В