



SCIENTIFIC RESEARCH OF THE SCO COUNTRIES: SYNERGY AND INTEGRATION

上合组织国家的科学研究：协同和一体化

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这些会议文结合了会议的材料 – 研究论文和科学工作者的论文报告。它考察了职业化人格的技术和社会学问题。一些文章涉及人格职业化研究问题的理论和方法论方法和原则。

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集体决策过程的统一和优化
**UNIFICATION AND OPTIMIZATION OF COLLECTIVE
DECISION-MAKING PROCESSES**

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注解。 提出了统一和优化集体决策过程的原始方法, 这使我们能够快速评估已出现的问题可能造成的损害程度, 计算实施集体解决威胁安全的复杂问题的资源成本 的状态, 并根据各种准则做出最优解的最优选择。

关键词: 集体决策, 统一优化, 损害评估, 最优选择。

***Annotation.** The original methods of unification and optimization of collective decision-making processes are proposed, which allow us to quickly assess the amount of possible damage from the problem that has arisen, calculate the cost of resources for implementing collective solutions to complex problems that threaten the security of the state, and make the optimal choice of the best solution according to various criteria.*

***Keywords:** collective decisions, unification and optimization, damage assessment, optimal choice.*

Formulation of the problem. As you know, in the process of management activity, many different problems of varying degrees of significance constantly arise: in the field of economics, technology, ecology, sociology, security threats to the population, etc. And for each of these problems, the management body (MB) of the appropriate level of executive state power must respond and make a decision to promptly (or not very quickly) eliminate the problem and its consequences. Moreover, the decision by the governing body should, as a rule, be made as a result of collective discussion, since even a responsible professional, trying to maintain his competence, will be able to read only an insignificant fraction of periodicals in any of the basic areas of knowledge. What social and economic losses for the population of the country leads to the adoption of erroneous decisions by the educational institution, is shown in [1].

Therefore, naturally, the question arises: is it possible, at least not to the full extent, to unify and optimize the processes of collective decision-making by man-

agement bodies of different levels in order to increase efficiency in eliminating emerging problems and minimize the cost of labor and financial resources for management activities.

What problems have to be solved by the governing bodies of the executive state power? It seems to us that all decisions made by the educational institution can be divided into two groups: 1) decisions that are repeated to eliminate problems of the same type and 2) decisions to eliminate unexpectedly arising extraordinary problems of varying degrees of significance, complexity, danger to a managed object - for example, for the population administrative-territorial entity (ATE).

In the article, based on the methods previously developed by the author, a guide is proposed for unifying and optimizing the processes of making collective decisions by governing bodies of different levels (by the criterion of minimizing the time, labor and financial resources spent on making a collective decision to eliminate the problem that has arisen and minimize damage from its possible consequences).

1. Unification of collective decision-making processes to eliminate recurring problems of the same type. Although it is quite obvious that the unification of decision-making processes to eliminate recurring problems of the same type is economically beneficial, since it helps to reduce the time, labor and financial resources for the operation of the MB (see, for example, [2], but first you need to find such processes that can be unified. To resolve such a problematic situation, it is proposed to periodically compare (perhaps, according to the protocols of meetings of the teams of advisers in the MB) the decisions made by the OS in the largest (in terms of population) ATE over the past 1-2 years. Solutions that are similar in content and direction may become candidates for unification.

[**Note.** An analysis of the structure of the MB and the composition of operations of business processes of the same purpose in different ATEs of the same country showed the feasibility of developing (or rather, “pushed” to the development) a software product for a comparative assessment of the composition of operations of business processes of one purpose [3])

2. How to optimize collective decision-making processes on unique, unexpected problems

[**Previous note.** It is assumed that a database of professional experts in various fields of knowledge (uniform for all executive government bodies of various levels) has been created (for example, according to the method [1]) and is maintained up to date.

2.1. Express assessment of possible damage to the population of the ATE if the problem is not promptly resolved. For a rapid assessment of the magnitude of possible damage from a problem that has arisen, it is advisable to use the repeatedly proven method of step-by-step refinement by experts of the values of

indicators with an assessment of distribution characteristics [4-6] - the SOC-ADC method. Here we present the process of implementing this method in relation to the assessment of damage from a problem. Let's assume that five specialists-experts participate in the examination (this number of specialists is quite enough to explain the process of applying the method). Each expert indicates three values of damage (minimum, most probable and maximum - see Table 1).

Table 1
Experts' answers about the amount of possible damage from the problem that has arisen. Step 1.

Step number	The value of the possible damage from the threat (c.u.)	Experts' answers about the amount of possible damage				
		Э1	Э2	Э3	Э4	Э5
1	Minimum	50	25	45	55	35
	Most likely	91	45	52	59	45
	Maximum	105	60	95	90	55

Using the data presented in table. 1, and after performing simulation modeling, we will obtain the statistical characteristics of the distribution of damage values from the problem that has arisen (see Table 2).

Table 2
Statistical characteristics of the distribution of damage values from the problem that has arisen (results of simulation modeling after Step 1)

Parameter	Statistical characteristics of the distribution of damage values from the problem that has arisen (after Step 1)					
	Э1	Э2	Э3	Э4	Э5	$\sum_{j=1}^5 j \cdot \epsilon_j$
Number of iterations	1000	1000	1000	1000	1000	1000
Average	81.98	43.3	64.3	67.9	44.9	60.4
Dispersion	132.4	50.5	122.2	63.5	15.7	15.8
standard deviation	11.5	7.1	11.0	7.9	3.9	3.9
The coefficient of variation	0.14	0.16	0.17	0.12	0.09	0.06
Asymmetry	-0.46	-0.07	0.47	0.46	0.06	-0.06
Excess	-0.47	-0.59	-0.7	-0.7	-0.6	-0.12
Minimum	51.2	25.6	45.4	55.3	35.9	48.9
Maximum	103.8	59.4	93.8	89.2	54.4	72.1
modal spacing	84.7-89.5	44.-47.	50-54	58-61	44-46	59-62

After reviewing the simulation results presented in Table. 2, some of the experts changed their opinion at Step 2 regarding the amount of possible damage from the threat that has arisen - see Table. 3.

Table 3

Experts' answers about the amount of possible damage from the problem that has arisen. Step 2.

Step number	The value of the possible damage from the threat (c.u.)	Experts' answers about the amount of possible damage				
		Э1	Э2	Э3	Э4	Э5
2	Minimum	50	65	45	55	55
	Most likely	90	105	52	59	60
	Maximum	105	115	95	90	95

*cost values indicates in bold type that have changed after the next step

Using simulation modeling and information about the opinion of experts at Step 2, we will evaluate the statistical characteristics of the distribution of damage values from the problem that has arisen (see Table 4).

Table 4

Statistical characteristics of the distribution of damage values from the problem that has arisen (results of simulation modeling after Step 2)

Statistical characteristics of the distribution of damage values from the problem that has arisen (results of simulation modeling after Step 2), $\sum_{j \in C} \xi_j$							
Average	Dispersion	Mean-square deviation	Coefficient variations	Asymmetry	Excess	min	max
75.7	20.4	4.5	0.06	-0.2	-0.11	61.5	86.7

After studying the obtained new results of simulation modeling (presented in Table 4), two experts changed their answers - see Table. 5.

Table 5

Experts' answers about the amount of possible damage from the problem that has arisen. Step 3.

Step number	The value of the possible damage from the threat (c.u.)	Experts' answers about the amount of possible damage				
		Э1	Э2	Э3	Э4	Э5
3	Minimum	50	65	45	55	55
	Most likely	90	105	50	60	60
	Maximum	105	115	95	90	95

*bold type indicates cost values that have changed after the next step

Statistical characteristics of the distribution of values of possible damage from the problem that has arisen, obtained from the results of simulation after all **three** steps of the expert survey, are presented in Table 6.

Table 6

Statistical characteristics of the distribution of damage values from the problem that has arisen (results of simulation modeling, $\sum \mathfrak{J}j, j \in 5$). Steps 1-3

Statistical characteristics of the distribution of damage values from the problem that has arisen (results of simulation modeling, $\sum \mathfrak{J}j, j \in 5$)			
Parameter	STEP 1	STEP 2	STEP 3
Variable	$\mathfrak{J}^{(01)}$	$\mathfrak{J}^{(02)}$	$\mathfrak{J}^{(03)}$
Number of iterations	1000	1000	1000
Average	60.4	75.7	75.6
Dispersion	15.8	20.4	20.2
Mean-square deviation	3.97	4.5	4.5
The coefficient of variation, $K^{(01-03)}_{var}$	0.066	0.06	0.059
Asymmetry	-0.06	-0.2	0.03
Excess	-0.12	-0.11	-0.2
Minimum	48.9	61.5	61.7
Maximum	72.1	86.7	90.5
Modal spacing	59-62	75-78	72-75

As follows from the data in Table 6, the examination to assess the amount of damage from the problem that has arisen can be completed, because value is $|K^{(02)}_{var} - K^{(03)}_{var}| * 100 / K^{(02)}_{var} = 1,7\% < 5\%$.

The benefits of SOC-ADC are described in detail in [7]. Here, we will only pay attention to the fact that when using the SOC-ADC method, it is possible to determine how *the answers of the expert group participants are interconnected*, what is the degree of this relationship, and what factors influence the existence of such a relationship (does the level of education, place of work, specialty, length of service affect work, features of the object of analysis, etc.).

Comparative evaluation of the applied usefulness of the method. In many cases, it is simply impossible to do without the use of an expert procedure according to the SOC-ADC method. Indeed, in many different situations, for example, when assessing damage from hacking the protection of a software product, computer network, and other objects [8]. Therefore, it is desirable to know how *reliable the results* of applying the method will be.

To assess the consumer quality of the method (*the degree of its applied utility*), we carried out experimental studies during contractual work on orders from a number of large enterprises. Thus, when developing information systems «ASU-remont» for the electric locomotive plant NELP (Novocherkassk c.) and the plant «Atommash» (Volgodonsk c.), the time spent on processes and operations to repair equipment was estimated and *by timing* (explicitly and implicitly), and *by interviewing repairmen* with more than one year of work experience.

A similar approach was also used in assessing the time spent on performing *other processes and operations* on orders from the Voskhod and Hydroagregat plants (Nizhny Novgorod Oblast), Plant No. 412 (Rostov-on-Don), etc., as well as in several tax inspections.

It turned out (*completely unexpected for many of us*) that statistically significant (with a probability of 0.9-0.95) in terms of interdecile ranges, both samples (both obtained as a result of explicit and implicit time measurements, and expertly (according to the SOC-ADC method) belong to the same general collections (!).

2.2. Formation of a subset of ways to solve the problem.

To select a limited subset of the most promising ways to solve the arisen «very unusual» problem, it is advisable to use the method «Isolation of the required subset of objects from a set of large power», described in [9]. Therefore, we recall only a few first steps.

Step 1. Using a table or generator of random numbers from a database containing information about experts, potential participants in the examination are selected to identify and then arrange possible solutions to the problem that has arisen.

Step 2. The selected experts are invited to take part in the search for ways to solve a specific problem of interest to the organizers of the expert survey.

Step 3. Experts who agreed to participate in the survey are assigned identifiers (also using a random number generator). Let's suppose that there were 100 people who agreed to participate in the examination.

[**Note 1.** It is desirable that not only the participants, but also the organizers of the examination, do not know who specifically participates in the surveys, who justified their decision and how, and how groupings of survey participants arise]

Step 4. Each participant in the expert survey is informed of the need to list possible ways to solve a particular problem and rank (order) them according to their degree of usefulness and effectiveness.

[**Note 2.** The need to perform not only the selection of possible solutions to the problem, but also their ranking, forces most experts to be more careful in choosing a subset of the desired solutions]

Step 5. For each expert, no more than 15-16 are left in the lists of selected and ordered solutions.

[**Note 3.** Experts whose lists include such solutions that were chosen by no more than 10-15 percent of those participating in the examination are asked to explain the reasons for choosing these particular methods, and all experts are familiarized with the explanations, suggesting, if desired, to change their ranking].

The difference in the composition of the lists of solutions selected by the participants of the expert survey can be clearly shown in the graphs built on the matrices G_0 and H_0 . The degree of interconnection of experts in terms of the composition of their chosen solutions can be assessed by analyzing the matrix $G = \{g_{ik}\}$.

Performing the transposition of the original matrix, it is possible to estimate the informational weight of the selected solutions by calculating the matrix $(P_0 + P_0^2)$. Analysis of the matrix $(P_0 + P_0^2)$ allows you to determine which of the solution methods, according to the participants in the expert survey, has the **highest** information weight (rank).

Next, a subset of the desired methods for solving the problem is formed and the group of solutions is ranked, for example, by the cost of resources for implementation using the method of stepwise refinement of the ranking of objects - the PURO method [10], the advantages of which are described in [7].

If it turns out that the problem that has arisen poses a serious threat to the security of the state and / or requires significant financial and other resources for its solution, then for a more accurate assessment of the resource intensity of the process of implementing its solution, the method “Process-statistical accounting of resource costs” should be used (see [11, 12]), by first performing a step-by-step representation of the processes of implementing competing options for collective solutions, followed by a comparative analysis of the results.

Conclusion. The article proposes original methods for unifying and optimizing the processes of making collective decisions, which make it possible to quickly assess the amount of possible damage from a problem that has arisen, calculate the cost of resources for the implementation of collective solutions to complex problems that threaten the security of the state, and make the optimal choice of the best solution according to various criteria.

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自适应教学技术建模

MODELING OF ADAPTIVE PEDAGOGICAL TECHNOLOGIES

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抽象的。随着教育技术信息化在培训合格专家领域的作用越来越大，有必要使它们适应用户的要求。

目前最需要的是面向个人的声明式智能学习系统。它们旨在支持教育活动，并基于教学方法，组织适应性自动化学习以及准备和吸收参与者的教学知识

自适应教学技术在声明式智能学习系统中应用最广泛。在创建培训课程时，它们可以轻松形成学科领域的模型，作为其适应学生个人需求的基础。ear ms 的适应性允许通过减少所提供的理论信息量和测试任务的数量来优化时间，而不会降低训练质量。因此，自适应教学技术建模的任务似乎是相关的。在此基础上，根据学生的知识水平动态调整培训课程的结构和内容。自适应教学技术与传统的自动学习教学方法非常一致，并允许为电子教育资源的每个用户形成参考轨迹。

关键词：信息化发展、教育、自适应系统、教学内容、用户参考轨迹。

Abstract. *With the increasing role of informatization of educational technologies in the field of training qualified specialists, there is a necessity to adapt them to user requests.*

Individually oriented intelligent learning systems of the declarative type are currently the most in demand. They designed to support educational activities and based on pedagogical methods both in the organization of adaptive automated learning and in the preparation and assimilation of didactic knowledge of a particular discipline.

Adaptive pedagogical technologies are most widely used among declarative intelligent learning systems. They provide ease of forming a model of the subject area when creating a training course as the basis for its adaptation to the

individual needs of students. Adaptability allows optimizing the learning process in terms of time by reducing the amount of theoretical information presented and the number of test tasks without losing the quality of training. Therefore, the task of modeling adaptive pedagogical technologies seems to be relevant. Based on them, dynamic adaptation of the structure and content of the training course to the level of knowledge of the student carried out. Adaptive pedagogical technologies are in good agreement with traditional pedagogical methods of automated learning and allow the formation of reference trajectories for each user of electronic educational resources.

Keywords: informatization development, education, adaptive systems, didactic content, user reference trajectories.

Introduction

A characteristic trend of the current stage of development of informatization in the field of education is the adaptation of modern pedagogical information and communication technologies (ICT) to individual capabilities and user requests. Adaptive systems usually understood as systems that contain the possibility of modifying the algorithms of their functioning in response to user actions or changes in the characteristics of the external environment [3]. The necessity and possibility of a unified approach to the formalization of the structure of didactic content and the decomposition of the filling of adaptive pedagogical technologies (APT) with information objects (IO) substantiated by us in previous works. For this, we used the methods of mathematical modeling of the APT, which made it possible to describe the structure of didactic content, form an individual user profile (IUP) and determine the conditions for its interaction with the system. This article presents some approaches to modeling adaptive pedagogical technologies.

Main part

The model of the structure of the didactic content of the APT represented as a set:

$$\bar{\Omega} = (\bar{S}, <, \rightarrow) \quad (1),$$

where $\bar{S} = (L, \bar{A}, \bar{V}, \mu)$ - static model of the structure of didactic content, which providing the possibility of searching and navigating;

L – a finite set of IOs that form the didactic content of the APT;

$\bar{A} = \{a_1, \dots, a_M\}$ – many characteristics of IO;

\bar{M} – quantity of characteristics,

$\mu : \bar{A} \rightarrow \bar{V}$ a mapping that associates each characteristic a_i with the set of its allowable values $V_i \in \bar{V} = \{V_1, \dots, V_{\bar{M}}\}$.

Thus, each IO as part of the didactic content of the APT presented as a set of ordered pairs having the form:

$$\{(a_1, v_1), (a_2, v_2), \dots, (a_M, v_M)\} \quad (2).$$

This approach makes it possible to implement indirect control of user actions by adjusting search results and selecting didactic content (DQ) taking into account its individual abilities.

The reference trajectory model and the adaptive trajectory model used to reflect the interaction of the user with the APT.

The first model has the form

$$TR^{on} = (\Omega, B^S, F, \lambda_S, \rho) \quad (3)$$

where $\Omega = (S, <, \rightarrow)$, $S = (L, A, V, \mu)$.

TR is a collection of a subset of IO DQ didactic content and the ratio \rightarrow .

We believe that $l_i \rightarrow l_j$, if IO l_i was presented to the user before the IO l_j , $\forall l_i, l_j \in DQ \subseteq L$. Wherein $l_i \rightarrow l_j \Rightarrow l_i \rightarrow l_j, \forall l_i, l_j \in DQ$. The converse is false.

Construction of the reference trajectory of the user u (TR^{on}) based on the selection of user clusters with similar values of the characteristics of the IUP. Function ρ determines the measure of similarity of the IUP based on subjective parameters B^S . Since the meaning of the characteristics and the scale of measurement of their values can vary, then, for example, the Gower coefficient proposed as a measure of similarity [6]. It allows the simultaneous use of features measured in different scales (quantitative, ordinal and nominal):

$$\rho = \rho(B^S(u), B^S(v)) = \left[\sum_{i=1}^{N_S} G_i^{uv} \times f_i^u \right] : \sum_{i=1}^{N_S} f_i^u, v \in U \quad (4)$$

where G_i^{uv} – difference in feature values (method of calculation is determined by the type of measurement scale),

f_i^u – feature weighting factor, set by the user $u \in U$, U – the set of all system users.

Specific user u assigned to the cluster, which denoted by $C^u \in U$.

The reference trajectory of the user's access $u \in U$ ($TR^{on}(u)$) o the IO selected from the set $\{TR(v)\}$, where $v \in C^u$, subject to the constraints B_R^S , on the assumption that:

$$TR^{on}(u) = TR(v) : \Xi(B^S(v), BO(v)) \rightarrow \min, \forall v \in C^u \quad (5)$$

The model of the adaptive trajectory of IO presentation to the user determined by the set $TR = (\Omega, B, F, \lambda_S, \beta, \phi)$. At the same time, the subjective and objective parameters of the model are the characteristics of the IUP. The similarity measure of the IUP given by the function:

$$\phi = \phi(B(u), B(v)), \text{ } \partial \in B = B^S \cup B^O \quad (6)$$

Characteristic values B^O and function ϕ change after the user passes the next IO. Change of values B^S initiated by the user. This model makes it possible to adapt the presentation of DQ didactic content to the user in accordance with the dynamically changing characteristics of his IUP.

Let us present the proposed model of the functioning of the APT.

Since the process of changing the APT parameters described in terms of the transition of the system from one state to another depending on the flow of input data, we can use the automaton approach to develop a model of its functioning. In this case, the APT functioning model will be represented by a set in the form of an adaptive control automaton (CA) and a control object (APT directly) [3].

The CA structure has the form:

$$YA = (D, Y, Z, y_0, \zeta, \delta) \quad (7)$$

where $D = D_X \times D_E$ – a set of input actions, consisting of a component D_E , generated by the external environment, and a component of the control object D_X ;

Y – set of control states;

$y_0 \in Y$ – initial state (in which the user forms a request for didactic content);

Z и $\zeta : D \times Y \rightarrow Z$ – set and function of output actions, respectively;

$\delta : D \times Y \times B_R^S \rightarrow Y$ – transition function that, unlike the standard ones, depends not only on the current state of y and input actions that determine the user's preferences B^D , but also on the given constraints B_R^S .

Thus, for any state of y defined a set of states, the transition rules to which determined by the observance/violation of restrictions when passing previous states.

Set $Wi = \bigcup_{j=1}^{N_y} Wij, \forall i = N_p + 1 \dots N_s$, we have

$$\forall y \in Y \exists y_1 \supset y_2 \supset \dots \supset y_{N_y} : wi \in Wij, \forall i = N_p + 1 \dots N_s \Rightarrow \quad (8)$$

Transition to $y_j, j = 1, \dots, N_y$.

The function δ given as a sequence of transitions shown below:

1 - Input, 2 - Conformity assessment, 3 - Correction, 4 - Clustering, 5 - Trajectory presentation, 6 - Information object (IO) presentation as part of didactic content, 7 - Exit (+), 8 - Exit (-).

Presentation of the model of didactic content as a set of IOs of two types, their characteristics, as well as the explicit setting of links between them, allows further implementation of indirect control of user actions by adjusting the search results and selecting didactic content, taking into account his individual abilities.

The elements of the set of input actions D_E determine the user's actions (d_1 , d_2 – setting and changing the values of subjective characteristics, respectively, d_3 – forced completion of the interaction). The values of the elements of the set D_X determined based on the parameters of the adaptive trajectory model

$$TR = (\Omega, B, F, \lambda S, \beta, \phi)$$

($x_1 - B^S$ correspond B^O , $x_2 - C^u$ determined, x_3 – requirements for IO done, x_4 – TR ended, $x_5 - B_R^S$ observed).

A feature of this model is the presence of two accepting states: the control automaton goes to state (7) if the user achieves the set goals, taking into account the given restrictions, to state (8) - otherwise.

The proposed set of mathematical models allows the possibility of complex adaptation. Since the parameters of the models and the relationships between them are not rigidly fixed, they may vary depending on the type of APT and the tasks solved on its basis [1, 3, and 5].

Let us specify the developed models.

In this case, the characteristics of the IO and the individual user profile (IUP) interpreted as level of complexity a_1 / level of training b_1 ; object type a_2 / b_2 , time a_3 / b_3 . The values a_1, a_2, a_3 determined by the developer of the didactic content, the values b_1, b_2, b_3 – set by the user when generating a request for didactic content (b_1 and b_2 define preferences, b_3 is a restriction). As a function of the correspondence between the parameters a_1 and b_1 authors used the logistic function of G. Rasch [6]:

$$l_S(a_i, b_i) = e^{(a_i - b_i)} / (1 + e^{(a_i - b_i)}) \tag{9}$$

which allows to determine the probability of meeting the requirements for IO in terms of complexity a_i by a user with a level of training b_i .

Let us define the following objective characteristics of the IPP:

- 1) b_4 - time spent interacting with an object;
- 2) $b_5 \in \{-1, 0, 1\}$ - object status (issued / being processed / completed);
- 3) $b_6 \in \{0, 1\}$ - result (object requirements done / not done by the user), $b_6 = 1 \Rightarrow b_5 = 1$ [2, 4].

For an aggregating IO l^* values of objective characteristics are calculated: if $\tilde{L} = \{l \in L : d(l^*, l) = 1\}$, then

$$b_4(l^*) = \sum_{l \in \tilde{L}} b_4(l) \quad \forall l \in Q \setminus \tilde{L} \tag{10}$$

$$b_5(l^*) = \{1, \forall l \in Q \setminus \tilde{L} \Rightarrow b_5(l) = 1; 0 \exists l \in Q \setminus \tilde{L} \Rightarrow b_5(l) = 0\} \tag{11}$$

$$b_6(l^*) = \{1, \forall l \in Q \setminus \tilde{L} \Rightarrow b_6(l) = 1; 0 \exists l \in Q \setminus \tilde{L} \Rightarrow b_6(l) = 0\} \tag{12}$$

For aggregating IOs, the level of user training also determined $b_7 = \chi(b_5, b_6)$, its value can be calculated on the basis of modified methods of latent structural analysis, taking into account the possibility of presenting users with a different number of different IOs.

Similarity measures in the reference and adaptive trajectory models have the form:

$$\rho = \rho(B^S(u), B^S(v)) = [\sum_{i=1}^{N_S} G_i^{uv} \times f_i^u / \sum_{i=1}^{N_S} f_i^u], v \in U; \tag{13}$$

$$G_i^{uv} = 1 - (\frac{b_1^u - b_1^v}{\sup W_1 - \inf W_1}), i = 1, 3, \quad G_2^{uv} = \{1, b_2^u = b_2^v = 1; 0, b_2^u = 0, \text{ or } b_2^v = 0\} \tag{14}$$

$$\varphi = \varphi(B(u), B(v)) = \rho(B^S(u), B^S(v)) + \frac{1}{(\sup W_1 - \inf W_1)^2} \times \sum (b_7(u) - b_7(v))^2 \quad \forall l \in Q_{uv} \tag{15}$$

where $Q_{uv} = Q(u) \cap Q(v)$.

The developed APT is a web-oriented software package designed for learning in an electronic information environment and solving the following main tasks:

- a) storage and editing of information about the IO that form the didactic content of the APT, and the links between them;
- b) providing the user tools to set the values of characteristics that determine his preferences and restrictions on interaction with the APT;
- c) providing the user with didactic content corresponding to the characteristics of his IUP;
- d) storage and processing of the values of the user's objective characteristics;
- д) implementation of clustering algorithms and adaptive dynamic generation of IO sequences.

In the development of methods for mathematical modeling of didactic content, authors proposed an approach to formalize its structure, based on the IEEE LOM standard, which extended by specifying nesting and precedence relations on the set of IOs.

This made it possible to take into account the hierarchical nature of didactic content, as well as possible dependencies between IOs, which impose restrictions about their presentation, including for objects belonging to different branches of the hierarchy.

Conclusion

The proposed approach to modeling APT, due to the large variability of model parameters and relationships between them, can be used to develop the adaptive functionality of various types of information systems (in particular, search information systems with hierarchically structured didactic content). We can use them in the design of the educational process based on intelligent adaptive semantic and cognitive models.

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走向循环经济模型：企业背景下循环 R 策略的分类

**TOWARDS A CIRCULAR ECONOMY MODEL: CLASSIFICATION
OF CIRCULAR R-STRATEGIES IN THE CONTEXT OF
ENTERPRISES**

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抽象的。向循环经济模式转型和实施循环 R 战略的企业并不总是评估其对实现目标的有效性和影响（有时是有限的）。该研究的目的是从材料（产品）在重复使用过程中保持价值的角度，回顾主要的 10R 策略及其分类，以便更全面了解各种循环 R 策略的可能性及其影响关于企业实施循环解决方案。研究对象是循环经济模型的R策略。研究的主题是从产品的生产和使用生命周期的角度（R-战略“高水平”和R-战略“低水平”）的角度研究R-战略的特征及其分类。

关键词：循环经济，可持续增长，价值守恒，废物最小化，生命周期。

JEL分类：F62、F64、Q25、Q32、Q5。

Abstract. *Enterprises in the transition to a circular economy model and implementing circular R-strategies do not always evaluate their effectiveness and impact (sometimes limited) on achieving their goals. The purpose of the study is to review the main 10R strategies and their classification from the standpoint of preserving the value of materials (products) during their repeated use in order to have a more complete picture of the possibilities of various circular R strategies and their impact on the implementation of circular solutions by enterprises. The object of the study is the R-strategies of the circular economy model. The subject of the study is the characteristics of R-strategies and their classification from the point of view of the life cycle of production and use of the product (R-strategy “high level” and R-strategy “low level”).*

Keywords: *circular economy, sustainable growth, value conservation, waste minimization, life cycle.*

JEL classification: *F62, F64, Q25, Q32, Q5.*

The Circular Economy Model (CEM) is gaining increasing attention in academia, government and business, providing solutions to achieve sustainable economic growth while reducing the use of primary resources, paying equal attention to environmental and social issues. In addition, the CEM aims to minimize waste and extend the useful life of products and materials without losing value (Yerznkyan, Fontana, 2021). It also shows that the adoption of a systematic approach to the transition to the CEM is an important condition for achieving sustainable development goals and solving environmental problems. It is emphasized that the opportunities provided by the reuse of water, being an important element of the circular economy (CE), are still not fully exploited, which is due, among other things, to political, administrative, institutional, information, financial, infrastructure and innovation gaps (Yerznkyan, Fontana, 2021).

It is important to underline that the CEM cover all links and levels (Valko, 2018), so the transition of enterprises to the CEM is a hot topic on today's agenda. In turn, enterprises must manage their transition processes; evaluate the benefits of circular solutions for your business in terms of efficiency, cost savings, access to new markets, incl. due to the weighted choice of R-strategies.

Initially, circular economy (CE) was associated with 3R strategies: reduce, reuse, recycle (Yerznkyan, Fontana, 2022). Currently, in the literature one can find a description of a large number of various (re-) strategies that are associated with CE: return, restoration, reconstruction, reproduction, replacement, correction, modernization, failure, reassembly, reprocessing, re-maintenance, processing, redesign, redistribution, repurposing, rethinking, resale, repair, restoration, downsizing, etc. And yet, in most cases, 10Rs are among the main strategies of CEM (Reike et al., 2018), which will be discussed below.

The lack of a single generally accepted classification of R-strategies can be explained by the following:

- the complexity of the CE concept itself, which has not yet been fully formed;
- the field of CE is not a well-defined academic discipline with paradigmatic features; the concept developed in symbiosis with the development of political strategies, and the political disciplinary vocabulary was also invested in the “R-definitions”;
- scholars, politicians, governments of various countries, international organizations continue to use domestic or national terminology (for example, in the EU, the 3R is “reuse, recycle, recover”, in the Russian Federation, as in the UN, and the OECD – “reduce, recycle use, processing);

CEM is relevant at various scales (macro-, meso- and micro-levels), and the subject of its study can be material flows, waste, production and use of products, design (redesign) of products, etc.

The generally accepted definitions and understanding of the key concepts in relation to the IES is critical, especially when professional terminology is used by stakeholders with different basic paradigms, which can lead to a different vision of similar problems and ways to solve them, and as a result hinder the development of the CE concept and the exchange of experience.

Although the principles of CE seem to be universal for business, the effectiveness of R-strategies in each specific case may be different, taking into account the strategic objectives of the enterprise development, limited opportunities for access to resources (including financial, technological, information), the availability of relevant skills for managers and employees. To get a complete picture of R-strategies and better understand the potential effect of their implementation, it is possible to classify R-strategies in terms of the life cycle of production and use of the product, with an emphasis on maintaining the value of materials (products) during their repeated use.

Despite the fact that in practice the most common R-strategy is still “recycling” (with a low level of preservation of the value of materials and products), experts call for an emphasis on R-strategies that ensure the preservation of value as close as possible to their original state, i.e. a higher level of value retention over several product life cycles (for example, “reuse”, “recovery”, etc.).

The considered 10R strategies, which have received the greatest recognition in the scientific literature, can be conditionally divided into: “high level” strategies (providing a high level of preservation of the value of materials close to the original state and having a short recovery cycle) and “low level” (in which products lose their original function, have a low level of material retention and a long recovery cycle). “High-level” R-strategies are most effective in preserving the economic value of products and materials while reducing environmental impact. “Low-level” R-strategies are preferable to landfills, but they degrade the material value of materials, can have a negative impact on the environment, require more energy than “high-level” R-strategies.

“High-level” R-strategies include: (1) refusal to use (refuse); (2) reduce; (3) rethinking; (4) reuse; (5) repair; (6) recovery (refurbish); (7) reconstruction (re-manufacture).

“Low” level R-strategies include: (8) repurpose; (9) recycling; (10) recovery (withdrawal).

The first three R-strategies (1,2,3) aim to minimize the use of materials in both the design and manufacture of products; the next four (4,5,6,7) extend the life of the product and reduce the use of primary resources. The last three R-strategies

(8,9,10) aim to recover materials at the end of the product's life, but lead to lower material quality levels and have reduced circular potential.

Let's take a closer look at each of the R-strategies.

1. Refuse refers to the direct rejection of a particular material in order to prevent its potential waste. If a company forgoes something that does not play a critical role in its production process and does not have a decisive impact on the quality of the product produced, then such a decision can prevent future waste. An example would be the elimination of plastic packaging. "Refusal" can also be seen in terms of consumer preferences (for example, the decision not to buy a product in favor of extending the life of an already purchased one), which also prevents the generation of waste.

2. Reduce is to reduce the amount of material used in the manufacture of a product in order to reduce costs and minimize environmental impact. On the part of the consumer, this strategy can be implemented through the functions "use less often", "use longer", "share". At what enterprises can be guided by the same messages (for example, replace the purchase of equipment or machinery with their leasing or rent). And yet, in most cases, "downsizing" is associated with the use of less material per unit of production, as well as the use of recycled or used materials instead of buying new ones (Jayal et al., 2010).

3. Rethinking refers to rethinking existing methods and systems, which may include manufacturing processes themselves, to make them more efficient while reducing waste; the use of innovative materials in the production of products, which will allow in the future to reuse products and their components and thus reduce the consumption of primary resources, etc.

4. Reuse means using products and their components more than once before they are thrown away and become waste. From the manufacturer's point of view, "reuse" may reflect the production activities of the enterprise itself (for example, repurposing used furniture in order to (re)sell it; setting up online platforms for the sale of used clothing, which extends not only the life cycle of these products, but and reduces the need to produce a new one). An enterprise can "reuse" certain materials, equipment in its own production, including packaging, containers, etc. From the consumer's point of view, "reuse" usually involves the purchase of used goods, incl. for the purpose of collecting.

5. Repair of items that do not work properly, but can be repaired, involves restoring the original properties of the product and its components, which extends their life cycle, potentially saving resources on the production and purchase of new ones. Repair may be accompanied by a change of owner and without a change of owner; can be performed by various entities (customer himself, invited specialist, specialized centers; enterprises can send recalled products to their repair centers or to third-party repair centers); repairs can be planned, as part of main-

tenance, and specialized. A common problem with repairs is cost, availability of skilled labor and parts.

6. Refurbish the product to its original state. This is usually done by replacing individual elements that do not work correctly, are worn out or obsolete with new ones. In fact, “refurbishment” performs the same function as “repair”, but with the difference that the product after restoration is perceived as new or even of improved quality. The use of this strategy is justified when the overall structure of a multicomponent product remains intact, while its components are subject to replacement, which leads to a “renewal” of the product (Greibenkin, Vegner-Kozlova, 2020). The result of “restoration” should be the achievement of a certain quality, incl. by using more advanced components. In general, “remanufacturing” is less expensive than producing a new product, making it cost effective and reducing the environmental impact by consuming less resources.

7. Remanufacture is the return to a product that has reached the end of its service life stage, its characteristics by replacing failed elements. This strategy combines “repair” and “reuse” as multiple failed products can be rebuilt into a single working product. During the “reconstruction”, a multi-component product is disassembled, its parts are tested, repaired (or replaced) both at the expense of maintained components and new ones (Lieder, Rashid, 2015).

The last two R-strategies are similar to each other, so some authors combine them (Mitra, 2007) or use them as synonyms (Defee et al., 2009).

8. Repurposing means using an existing product that has reached the end of its life cycle, adapting it into a new one with different functions from the original product. So, used clothes can be repurposed into bedding and interior items, etc. However, not all products and their components can be repurposed. It is not always possible to maintain the appropriate quality of the material or there may not be a market for repurposed products, so this strategy is referred to as “low-level” R-strategies.

9. Recycling means the decomposition of materials (eg metal, glass, plastic, etc.) into smaller substances in order to use them later to produce a new material. Recycled materials do not retain their original structure and can be reused anywhere, which is why they are sometimes referred to as “recycled materials”. So, in production, recycled materials can partially (or completely) replace primary resources. Recycling refers to the “low-level” R-strategies due to the fact that this process is more complex than other circular R-strategies, energy-intensive and labor-intensive, it implies that the raw material for processing is sorted, and the processing enterprise has technological capacities. At the same time, materials after processing may have limited demand, incl. due to quality degradation. “Recycling” is justified, for example, in a situation where it is necessary to reduce the extraction of primary resources (for example, ores) due to a threat to the environ-

ment. In this case, the slight loss in quality that is characteristic of recycled metals makes them competitive with primary resources. “Recycling” can also be characteristic of ecosystem enterprises, when the production waste of some enterprises can, after appropriate processing, serve as resources for others: we are talking about the so-called “primary processing”, in which by-products and waste are not mixed, in contrast to “secondary processing” where used products are mixed with other waste (Stahel, 2010).

10. Recovery is the removal of individual materials from used products for their further use in the production of new materials and products, incl. using R-strategies (for example, extracting gold from mobile phones to make jewelry). As a result of recovery, the seized material restores its value, because. can serve as a resource for the production of new products, rather than being turned into waste. Companies that use extracted materials as a resource benefit incl. by reducing the costs associated with the acquisition of primary resources, which in most cases are more expensive than the withdrawn counterparts. In addition, “recovery” contributes to the protection of the environment from pollution associated with mining and the production of primary products from scratch. At the same time, “recovery” refers to a “low-level” R-strategy, since does not allow to save the material value of the product, and the result of its application provides an intermediate, not a final product.

The practical implementation of the CEM shows that by far the most widespread are “low-level” R-strategies, which are traditional waste management activities. At the same time, scientists dealing with CE issues note that these strategies are less desirable, incl. due to the fact that the use of “low-level” R-strategies often leads to a deterioration in the material value of products and materials themselves, is accompanied by a long recovery cycle, can have a negative impact on the environment, requires more energy than “high-level” R-strategies “. However, it must be taken into account that the materials obtained as a result of the application of “low-level” R-strategies can serve as an “input resource” for the implementation of “high-level” R-strategies. In addition, the use of such strategies is justified when “high-level” R-strategies cannot be planned for various reasons.

The considered 10R strategies relate to the life cycle of production and use of products. It seems important in the future to supplement the hierarchy of R-strategies of the CE from the standpoint of the product design life cycle. It is at the design stage of the product that, incl. preventive measures, extending its life and components, which contributes to the implementation of R-strategies - in fact, it is a “waste design”, which is critical for a successful transition from the linear model to the CEM (Xing et al., 2003).

Findings of the study: The transition to the CEM is implemented through R-strategies and in order to achieve greater efficiency, the CEM should cover all

levels and sectors of the economy, and the choice of R-strategies should be balanced in order to obtain a greater positive impact. This approach is also justified for enterprises that need to evaluate the benefits of circular solutions for their business. Thus, by prioritizing “high-level” R strategies such as “reject” and “rethink” businesses can avoid generating waste and reduce their dependence on unsustainable materials; “reuse” and “repair” will extend the life of products and equipment; “recovery” and “reconstruction” - can give new life to products and materials that would otherwise turn into waste and lose their value (including when applying the R-strategy of a “lower level”).

Novelty of the proposed approach: The study proposes a classification of 10R-strategies of the CEM related to the life cycle of production and use of products into: R-strategies of “high level” (providing a high level of conservation of the value of materials and having a short recovery cycle) and “low level” (in where products lose their original function, have poor material retention and long recovery cycles). The first are closely related to the production and provision of alternative or upgraded products to the consumer; these strategies are mainly implemented by business entities (but in some cases they can be implemented on the consumer side). The implementation of the R-strategy of the 2nd group often leads to a decrease in cyclicity, including the loss of quality and value of the product and material and are sold exclusively by business entities.

The proposed classification of R-strategies allows you to better navigate the strategies of digital economy and evaluate the potential effect of the implementation of various R-strategies. At the same time, it should be taken into account that, in practice, when moving to the CEM, it is not always possible to clearly separate R-strategies, just as it was shown in the study, a combination of several R-strategies may be required.

In conclusion, I would like to highlight the following three theses addressed to three stakeholders – government and policymakers, business representatives and academia:

1. Government and policy makers need to play a key role in the transition to CEM; set targets to achieve circularity at all levels; contribute to the creation of mechanisms for the implementation of “high-level” R-strategies with a short recovery cycle, which in turn will ensure a high level of preservation of the value of materials in the economy.
2. Business representatives, in order to get a greater positive impact when moving to CEM, should carefully assess the benefits of R-strategies and circular decisions for their business in terms of efficiency, cost savings, access to new markets, and shape business development around feasible R-strategies. The presented classification of R-strategies can contribute to a better understanding of CE on the part of business, its role in the process of transition to CEM on an economy scale.

3. The proposed classification of CEM R strategies is a step towards a systematic understanding of CE among academic disciplines and between stakeholders. It seems important that in the study of circularity, researchers move towards a consensus in the conceptualization of the IESZ, terminology and definitions. The contribution of the scientific community to the development and evaluation of the effectiveness of R-strategies has not yet been fully realized. Mixed research methods and collaborative work between scientists, governments and businesses are of paramount importance for a better understanding of the CEM and for putting the principles of circularity into practice.

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在建立和发展新兴市场国家区域一体化组织领域的国家经济政策的科学论证原则

**SCIENTIFICALLY-BASED PRINCIPLES OF GOVERNMENT
ECONOMIC POLICY IN THE FIELD OF SETTING UP
AND DEVELOPMENT OF THE REGIONAL INTERSTATE
INTEGRATION ASSOCIATIONS OF COUNTRIES WITH
EMERGING MARKETS**

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抽象的。文章证实了新兴市场国家政府一体化经济政策的科学原则。作者一贯揭示一致性原则、复杂性原则、完整性原则、合理性原则的内容。这些原则的理论支持的实际意义在于，通过协调目标、目标、阶段和手段，为建立和发展区域一体化国家间协会建立联合经济政策奠定了统一基础。它的实施。

关键词：原则、政府经济政策、一体化政策、一体化协会、新兴市场国家、上海合作组织。

***Abstract.** The article has substantiated the scientifically-based principles of the government integration economic policy of countries with emerging markets. The author has consistently revealed the content of the principle of consistency, the principle of complexity, the principle of integrity, the principle of rationality. The practical significance of the theoretical substantiation of these principles consists in the formation of a united foundation for a joint economic policy for setting up and the development of the regional integration interstate associations as a result of the coordination of goals, objectives, stages and instruments of its implementation.*

***Keywords:** principles, government economic policy, integration policy, integration associations, countries with emerging markets, Shanghai Cooperation Organization.*

Introduction

The prospective economic policy of countries with emerging markets in the field of creation and development of regional interstate integration associations should be formed on the basis of scientifically substantiated principles. The need

for their application stems from their provisions of the activity concept as a theoretical and methodological justification for the modern integration policy of countries with developing markets, including those with the promising participation of Russia and China.

The implementation of the principles in the course of implementing the joint economic policy of states in the field of institutionalization of integration relations is aimed at solving the most important tasks facing each stage of the creation and development of integration economic associations of countries with emerging markets. These are, first of all, the tasks of deepening the economic cooperation of the business community within integration associations (integration “from below”), creating a solid economic and legal basis for obtaining integration benefits and leveling interstate contradictions during the period of exacerbation of crisis phenomena, internal and external economic instability (integration “from above”). (“)[1].

In a theoretical aspect, the content of the principles of the state economic policy pursued by the states-participants of integration associations is rightly associated by researchers with the depth of policy (Depth of Integration), the width of policy (Width of Integration), the form and intensity of implementation of regional economic integration[2].

The fundamental provisions on what an integrated economic space should be like and how the norms and rules of the integration activities of states are put into practice, it is advisable to consider through the prism of scientifically based principles that affect the mechanism for regulating the processes of creation and development of integration associations of countries with emerging markets in the modern economy: consistency, complexity, integrity, rationality. These principles are the cornerstone of the foundation of the state economic policy for the creation and development of integration associations of countries with emerging markets with the participation of China and Russia.

Materials and methods

In the economic scientific literature, the problem of the formation of an integration economic policy has been given quite a lot of attention. First of all, these studies were related to the analysis of the genesis and current state of the European integration process, which actively began after the Second World War. In the works of J. Mead, J. Wiener, R. Lipsey, V. Roepke, B. Balassa and other representatives of Western thought, the stages of the formation of the European Economic Union, the main principles of economic integration policy and the effectiveness of their implementation were analyzed. The Soviet school focused on the essential aspects of international integration and the integration economic policy of the socialist states, and is represented by good studies by O.T. Bogomolova, M.M. Maksimova, N.P. Shmeleva, Yu.V. Shishkova, Yu.S. Shiryaev and

other economists. After the 90s of the last century in Russian economic science, theoretical and methodological justifications for the growth of the influence of international integration relations on state economic policy are given in the works of E.F. Avdokushina, M.M. Maksimova, A.V. Kholopova, Yu.V. Shishkova, N.G. Shchegoleva, as well as in the works of L.B. Vardomsky, S.G. Luzyanina, E.D. Platonova, O. E. Ryazanova and other researchers.

Despite the study in the Russian and foreign economic literature of certain aspects of integration economic interstate relations, the fundamental foundations of the state economic policy in the field of creating and developing integration associations of countries with emerging markets, including those with the participation of China and Russia, have not yet been formulated.

The methodological basis of the study was theoretical research methods (scientific abstraction, analysis and synthesis, conceptualization, comparison, generalization, grouping), as well as systemic and logical-genetic approaches that provide a holistic view of the development of economic structures

Results and discussion

Based on the principle of consistency, we highlight the following provisions when considering this type of state economic policy of countries with emerging markets:

- Firstly, the state integration economic policy of countries with developing countries is a systemic formation, consisting of two subsystems:

1) development, which consists in the scientific substantiation of strategies, goals, objectives, priorities, stages of economic integration, as well as the desired qualitative and quantitative characteristics of the common integrated economic space and integration institutions;

2) implementation is a system of measures and tools of direct and indirect, formal and informal influence on entities operating in national economies to achieve all the elements provided for by the “development” subsystem, including the system of goals and objectives facing integration associations of countries with emerging markets.

The expediency of separating these subsystems is confirmed by the integration practice of countries, in particular, the EAEU. It was in the process of implementing the policy of creating and developing this regional interstate integration association that the participating countries encountered the action of internal and external negative factors that required the creation of mechanisms to counteract these factors and neutralize them.

- Secondly, from the standpoint of the principle of consistency, this type of state economic policy must be considered as an element of a higher order system - the general economic policy of the nation state striving for economic integration, at the mega-, macro-, meso-, micro levels. In this regard, not only consistency

with the integration and general economic policy of the state is important, but also consistency and conjugation with other elements of state policy (national security policy, foreign policy, state legal policy, social, industrial, informational, structural, etc.).

In this regard, an urgent and difficult task for countries with emerging markets striving for economic integration is both the formation of a unified economic policy for the creation and development of an integration economic association, and the development of mechanisms for its coordination with domestic state policy, as well as contingency with the integration efforts of other countries. with emerging markets. Indeed, within the framework of a single national-state economic system, the national state, exercising economic sovereignty, independently establishes a system of national rules for regulating economic life, taking into account its international treaties and obligations. The creation of an integration economic association leads to the emergence at a certain stage of its development of a common economic space with varying degrees of integration (preferential zones, free trade zones, customs union, common market, monetary and economic union) and the transfer of a certain part of economic sovereignty to a common regulator. This requires harmonization and coordination of the state policy of all participating countries on the basis of a legal system that includes both the institutions of mutual agreements, reflected in the statutory documents of the integration economic association, and the institutions of international law.

This system of institutions of the integration association ensures the implementation of a coordinated economic policy by each member country and the integration association as a whole, as a subject of international law, by highlighting economic relations. These relations are objects, firstly, of the exclusive competence of the integration association, secondly, separate competences, and thirdly, additional competences of the participating countries. In this regard, one cannot but agree with the researchers that “Integration contributes to the development of the practice of interstate agreements, the formation of coordinating institutions and mechanisms, the creation of structures and bodies of a new type, the development of an agreed system of international norms for regulating economic relations, the use of unified economic levers and instruments” [3].

Consistency should be the principle of developing the state integration economic policy of the member countries of the Shanghai Cooperation Organization (SCO), as a promising regional integration interstate economic association of countries with emerging markets with the participation of China and Russia. At present, the SCO operates in its initial form - in the form of a pro-integration economic association with the official status of an intergovernmental international organization.

At the beginning of the creation of this intergovernmental organization of countries with emerging markets, the foundations of a systematic approach to the

development and implementation of the state policy of the SCO member countries were laid. Taking into account the different levels of socio-economic development and the diversity of domestic and foreign national economic policies pursued by the SCO member countries, as well as the current level of interconnection of their economies, it is necessary to point out that at present only certain elements of the system of economic integration cooperation have been formed. Their development in the future may lead to a deeper coordination of national economic policies and the formation of joint unified approaches to the state integration economic policy in the most significant (priority) areas for the SCO member countries.

The Department for Economic and Humanitarian Affairs of the SCO Secretariat has been established within the organizational structure of the SCO. This Department is, in our opinion, a prototype of a new type of coordinating supranational center that influences relations in the integrated economic space of the SCO family countries.

At present, the Department for Economic and Humanitarian Affairs of the SCO Secretariat, within the limits of its powers, coordinates trade, economic and investment cooperation between the SCO member states. At the same time, the activities of this Department are coordinated with other SCO institutions and are regulated by the SCO bodies. This testifies to the understanding by the ruling elites of the SCO member states of the systemic nature of formal institutions that perform agreed economic functions within the framework of the SCO.

In addition to formal institutions, in the subsystem “implementation” of the economic policy of creating and developing regional interstate integration associations of countries with emerging markets, informal institutions that make up the “Shanghai spirit” play a significant role. It is the “Shanghai spirit” that unites the SCO member countries in their desire to create an equal system of integration cooperation of a new type, which is based on informal institutions such as trust, respect for the diversity of cultures, joint development, justice, equality and mutually beneficial cooperation[4].

The coordinating and regulating effects of the system of state national structures and supranational centers should provide an integrated approach to creating a favorable business and investment environment for all economic agents from the countries participating in the economic integration association, providing additional economic benefits from integration. In addition, the principle of the complexity of the state economic policy for the creation and development of integration associations of countries with emerging markets implies a comprehensive consideration of the influence of external and internal factors on the activities of these states for integration convergence and cooperation. This means that states need to build a system for neutralizing and counteracting negative factors that create risks for economic entities striving for economic integration.

The principle of the integrity of the economic policy of states with emerging markets in relation to the creation and development of integration economic associations requires:

- firstly, to consider the emerging integration economic space of countries with emerging markets in the unity of its interacting parts - national-state systems;
- secondly, to take into account the fact that an object striving for integrity - an integration economic space - manifests new properties (emergence), new relationships and interdependencies;
- thirdly, the emerging integration space of countries with emerging markets has its own characteristics and specifics, which allows it to be distinguished as a special object in the international economic space.

The rationality principle of the economic policy of countries with emerging markets can be traced in the trends in the creation and accelerated development of regional interstate integration associations that unite countries with emerging markets that have approximately the same level of development and are interested in economic cooperation (CIS, SCO, BRIC, APEC, EAEU, ECOWAS, GCC and etc.).

Currently, tough and aggressive economic competition is clearly manifested, which can be characterized as an economic war of a number of Western countries and their leader - the United States - with countries with developing economies that pursue a nationally oriented economic policy and do not accept the dictates of the aggregated West [5]. Under these conditions, the economic integration policy of the SCO member countries should be based on the principle of rationality in order to create a common integration good.

The concept of «integration benefit» is not yet widely used in characterizing the benefits of economic integration. But it can be seen as a kind of public good that explains additional economic and other benefits from the process of interstate integration of countries with emerging markets. At the same time, researchers introduce a more specific concept - “international public good”, which “reflects both the inability to ensure sustainable development and the welfare of national economies (aggregate welfare), within the framework of the market alone, and the increasing internationalization of market and non-market contacts, using which are associated with hopes for facilitating searches when they are carried out jointly, as well as with the failures of international markets” [6].

In developing the content side of the principle of rationality of the economic policy of countries with emerging markets, we point out that it underlies the countries' free choice of formal and informal procedures. They are guided by these procedures when making coordinated decisions on integration activities covering all areas of integration activities (trade, finance, investment, logistics, communications, etc.).

Conclusion

Thus, the practical significance of the theoretical substantiation of science-based principles lies in the creation of a single foundation for the formation of integration associations, as well as the implementation by all countries with developing markets, striving for economic integration, of a systemic policy of harmonizing the goals, objectives, stages and tools for its implementation.

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月球种族: 事态, 地球人的前景。 政治和经济因素

**THE LUNAR RACE: THE STATE OF AFFAIRS, THE PROSPECTS
OF EARTHLINGS. POLITICAL AND ECONOMIC FACTORS**

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抽象的。 作者描述了与月球和月球项目相关的事态, 指出了地球殖民者进入太阳系和深空的文明任务, 表达了他们对成功找到最佳资源的进一步选择的预测估计, 科学、近地空间发展人才储备和星际基础设施储备建设。

关键词: 太空、苏联、俄罗斯、火星、月球、美国宇航局、美国、中国、太空人、殖民者、人工智能、大数据、工业 4.0、第七机器人-人形订单、NBICS、Roscosmos State Corporation。

Abstract. *The authors describe the state of affairs in relation to the Moon and lunar projects, name the tasks of civilization for breakthroughs of earthly colonists into the solar system and deep space, express their predictive estimates of further options for success in finding the optimum of resources, science, personnel reserves for the development of near-Earth space and on building interplanetary infrastructure reserves.*

Keywords: *space, USSR, Russia, Mars, Moon, NASA, USA, China, taikonauts, colonists, AI, Big Data, Industry 4.0, 7th robot-humanoid order, NBICS, Roscosmos State Corporation.*

In its activities, modern science determines the development of the Earth from the standpoint of the state of affairs of further scientific and technological search: either it will occur within the framework of a deeper exploration of outer space on the basis of existing technologies, materials and growing geopolitical challenges, as well as the use and processing of existing resources on Earth (ore, concentrates, slags, sludge, scrap metal, recycling of waste and containers, etc.), or the key scientific competencies of the upcoming scientific and technological revolution should be the systemic backlog of states for the collective creation and debugging of space infrastructure that allows for exploration, production and organization delivery of the necessary resources of cosmic origin (from planets, stars, asteroids, comets and other space bodies) to the world economy of earthlings. At the same time, the answer to this dilemma facing humanity in the form of tasks and challenges will never be unambiguous and will have a constantly changing component of practical choice (development of technologies, spacecraft, reduction in the cost of delivery logistics and more efficient extraction of a valuable component from space materials/soils/substances of an alien origin). [1] And the logical link in this process will be the scientific and industrial cooperation of states, which must avoid the growth of the space and nuclear race, build a system of priorities for more rational service of the interests of mankind, whose appetites are growing and require accelerated post-COVID satisfaction. And this means that the production and cooperation chains of the world's transnational corporations (WTCs) working to meet the needs of rich customers of the "golden billion" should be focused on finding better mechanisms for analyzing existing sources of mineral raw materials and transuranium elements. And then the division and diversification of each stage of building programs for the search, extraction and delivery of each such valuable component or ordinary raw material will become the property of the general infrastructure of the solar system first, and then its evolutionary changes of further movement to the planets of deep space. This will become possible only through the creation of a network of space stations (for example, Lunar and Martian, for a start), united by target values and tasks to be solved to move passenger flows and extracted materials between extraterrestrial objects and the Earth, using the synergy of joint developments and investments, triggering multiplier effects of scale and generating cyclicity for increasingly diversified operations of groundbreaking space age business processes. Therefore, the speedy evolution and demilitarization of space programs on the agenda of scientifically developed states and their joint participation in interplanetary manned expeditions (IPEs) should become the dominant and only possible solutions to existential threats, so famously dispersed by states in the process of changing the paradigm of the sole hegemony of the Anglo-Saxons to the multiculturalism of polycentric world community of states equal in their sovereignty. And therefore, each of them perfectly understands the

cosmic tasks of their potential involvement in the interstellar heights of the cosmic economy of tomorrow - no one is rich enough to bear the burden of all the costs of extracting planetary resources alone and create not creative worlds, but rapidly evolving worlds that are far from behavioral. economics of Daniel Kahneman and Richard Thaler, which makes the irrational fantasies of mankind the main meaning of their virtualized life [2].

The exact number of galaxies (very dense globular clusters of hundreds of thousands of stars held together by gravity) estimated from scientific studies in the universe is between 200 and 500 billion (according to spectroscopy), each of which is an autonomous object, isolated by the vast depths of space. Our Milky Way galaxy, Via Lactae, is an organized structure and looks like a disk in which our system is located. At the same time, the Milky Way galaxy belongs to large spiral galaxies with a bar - a structure that attaches spiral arms to the nucleus.

The main tasks for the development of space resources in our galaxy are considered to be the creation of local industries by the transferred terrestrial colonists on the Moon and Mars. Since, with the beginning of the ADF, the Americans do not want to solve the problems of developing the Moon and Mars with us and closed with the West and its satellites as part of their Artemis program, and even the ISS ceases to be a point of our potential space cooperation, the authors, taking into account the long-established scientific and production ties with India and China will focus on the lunar successes of our partners in the BRICS and SCO, historically determined in space cooperation on the basis of Soviet science [3].

Initially, after the breakthrough of the unique Soviet space assault that we announced, the first part of which can be considered the flight of our first satellite on October 3, 1957, we should have focused more on countering the United States and their potential spacecraft (SC), which really began to create their own lunar race, spurred on by a galaxy of German scientists from Nazi Germany, in particular, Wernher von Braun. At the same time, it should be noted that our lead designer M.K. Tikhonravov, the earliest colleague and like-minded person of S.P. Korolev from the legendary 9th department of OKB-1, already then called the next step in the study of the Universe the coming era of spacecraft (SC) control systems (rockets and rocket and space complexes). This work was carried out at the head of the national academician N.A. Pilyugin and was based on the backlog of universal developments created by his team in the field of creating cruise and ballistic missiles, spacecraft and long-term orbital stations with their main inspirer V.N. Chelome. The works of the latter were supervised by his colleagues M.K. Yangel and V.M. Myasishchev, leading the competition for the right to lead the direction of long-range and high-altitude cruise-ballistic missiles. Later, their ideas were also embodied in the Soviet reusable orbital ship Buran, designed with the participation of G.E. Lozino-Lozinsky. It is also necessary to recall K.D. Bushuev, who

became the designer of spacecraft for the study of near-Earth space and the planets of the solar system, as well as M.F. Reshetnev, as one of the leaders in space engineering, who was closely involved in the issues of launching communication satellites and information and satellite systems into orbit. At the same time, such universal specialists as V.P. Glushko, and launch vehicles - Yu.A. Koloskov [4].

After absorbing the information about numerous Soviet scientific backlogs that became available after the collapse of the USSR, and enriched by our ideas and accumulated results about the space race, NASA employees, who are mainly followers of the school of Wernher von Braun, proceeded to more pinpoint breakthroughs, among which the most significant to date for mankind was the new era of November 5, 2018, when the American spacecraft Voyager 2 plunged into interstellar matter, leaving the solar system, which it had acquired since August 1977, having explored all 4 giants - Jupiter, Saturn, Uranus and Neptune. Truly, this event characterized the accomplished dream of earthlings who dreamed of heading to other galaxies of the Milky Way and beyond. At the same time, people can already promptly and purposefully resolve issues of mutual destruction, which we are seeing today in the ADF being held by Russia in Ukraine, build intrigues of a sanctions and destructive nature, ruining global space cooperation, undermining the previously planned symbiosis of scientific concepts of the involvement of all existing national space agencies in the race extraterrestrial priorities, destroying not only humanoid and humanistic values, but also frightening the silent starry sky above us with the imperative of our own “exclusivity” and intransigence with the laws of existence and development of the Universe itself.

The disunity of approaches to issues of space leadership leads to discrete variants of consequences and to national autarchies that distort the course of the scientific and technological revolution itself at the level of grinding the truly global tasks of mankind, solved by research centers of the governments of various states in special secrecy regimes and in a trend with increasing militarization of all existing environments, including air and cyberspace and vacuum itself.

Today, scientists already accurately indicate that all fossil and valuable components can be enough for humanity with current methods of production for a maximum of 500 years. Such scarce and heavily used resources include fresh water, metals and gases.

Spacecraft (SC) launched in the Solar System can solve problems in astrobiology and telemedicine, astrophysics and mechanics, monitoring of ecology and current local conflicts (ERS), nature-like technologies and materials science of «tomorrow», which already today solves the main issues: and in the race of deployed global arms, and in the processes of life support, and in the ability to survive for humanity in hostile environments.

At the beginning of the 21st century, China and India joined in conducting lunar research using artificial lunar satellites. In October 2007, China’s first lunar

satellite, Chang'e-1, was launched, which orbited the moon for 16 months and successfully landed on the moon in March 2009, collecting data for the first heat map of the moon.

In October 2008, the first Indian lunar probe «Chandrayaan-1» (Chandrayaan 1) was launched, which worked in the orbit of the Moon for 312 days until August 29, 2009, making 3.4 thousand orbits around it and transmitting thousands of photographs of the surface and data to Earth about the chemical composition of the moon, the approximate form of its soil, surface features. He established that huge blocks of ice lie at a depth in the northern polar craters of the Moon. Only according to the results of his mission, the amount of water buried in the soil of the north pole of the moon was estimated at least 600 million tons, while the places of ice occurrence in other parts of the Earth's satellite can be specified in other mountain ranges of the lunar relief [5] .

At the end of June 2009, on an American Atlas 5 launch vehicle equipped with Russian third-stage engines, the LRO («Lunar Reconnaissance Orbital Probe») and LCROSS («Lunar Crater Observation and Exploration Probe») spacecraft were launched into space, which confirmed that that in the lunar polar regions there is ice that can be used by the first colonists and ensure their self-sufficient work and survival as a unique self-organizing structure ..

On October 1, 2010, the Chinese Chang'e-2 lunar sounding satellite was launched, one of the main tasks of which was to collect the necessary information for the successful landing of spacecraft on the lunar surface, analysis of the relief and lunar wind near the surface. After graduating from the program for collecting and sending high-resolution images of the lunar surface, on December 13, 2012, Chang'e-2 flew past the asteroid Tautatis, photographed it and flew into outer space.

In September 2013, the next American apparatus LADEE (Lunar Atmosphere and Dust Environment Explorer) was launched to the Moon, which on November 20 entered a low lunar orbit - from 12 to 60 kilometers above the surface of the Earth's satellite, and began to carry out the main scientific program to study the rarefied atmosphere Moon.

From 2013-2016 After launching to the Moon, China used its Yutu (Jade Hare) lunar rover. He was on board the Chang'e-3 lander, which landed on the Earth's satellite in the Rainbow Bay crater on December 14, 2013. Lunokhod carried out the study of the lunar surface for 31 months. He was also the first to organize photographs of the geological layers of the Moon, giving their visual descriptive characteristics.

In 2019, China launched the next phase of its lunar program - the first landing on the far side of the Moon in the history of the Earth. To this end, in May 2018, a unique communication satellite «Queqiao» (Magpie Bridge) was launched, ca-

pable of maintaining communication between the Chang'e-4 apparatus, the first mission on the far side of the Moon, and the mission control center in Beijing. Launched on December 7, 2018, the Chang'e-4 apparatus, consisting of a stationary lunar station and a lunar rover («Jade Hare-2»), landed on the bottom of the Karman crater on January 3, 2019, located in the subpolar southern latitudes of the far side of the Moon. The landing platform and the Yutu-2 lunar rover have successfully worked in uncharted territory for several months and continue to study the moon. Yutu-2 discovered two types of rocks in the lunar mantle on the far side of the Moon, which had not been considered by scientists before as a possible structure.

On November 24, 2020, the implementation of the third stage of the lunar program began in China, the Chang'e-5 return vehicle was launched, on December 1 it landed in a given area on the visible side of the Moon. He also collected lunar soil samples and is soon considering the possibility of their transfer to Earth. [6]

The Chinese lunar sounding program in the future provides for the delivery of lunar soil by another second Chang'e-6 apparatus. The Chang'e-7 mission involves a general exploration of the South Pole of the Moon, including a comprehensive sounding of the lunar relief. «Chang'e-8», in addition to scientific research, must conduct key tests of a number of technologies on the lunar surface. As part of the fourth phase of its lunar program, China plans to build a prototype lunar research station, which will consist of several probes in lunar orbit and on the surface of the moon, and will be able to conduct scientific and technological research on a natural satellite of the Earth, as well as testing technologies for the development and use of lunar resources. The basis of the Chinese orbital space station will be the base module «Tianhe», as well as two experimental modules «Wentian» and «Mengtian». It is planned to complete the construction of the station around 2022, for this a total of 12 missions will be completed.

In 2019, India sent the Chandrayaan-2 spacecraft to the Earth's satellite, which entered the Moon's orbit on August 20. The Indian descent module «Vikram» with a small six-wheeled rover «Pragyan» was supposed to make a controlled descent to the surface of the Moon, but on September 7 it made a hard landing and communication with it was lost and now the Indians are waiting for new lunar records from Chandrayan-3.

In April 2023, NASA management created a model of underwater soil, a lunar regalite, based on the hydraulic astronaut training laboratory, which Americans can explore in the created model of the Earth's satellite at the bottom of the pool, which already imitates the potential landing site for astronauts in «Artemis 3» on the Moon. A similar Hydrolaboratory in the training complex of the Yu.A. Gagarin, the same is actively used by our cosmonauts to prepare for stellar missions, and the Russian film «Challenge», the first terrestrial film shot in outer

space, makes our race attractive and relevant again - we were able to do something earlier and better than others, even in difficult conditions of confrontation with the West [2;4].

At the same time, the head of NASA, Jim Bridenstine, told world agencies that the United States, together with the American military-industrial complex and European colleagues in the space workshop, are already working on creating airlock design standards that will allow the Russian Orel manned spacecraft to dock with the American lunar orbital station Lunar Orbital Platform-Gateway, if the mind and tasks of mankind will defeat the bloodthirstiness and intransigence of NATO in the ADF in Ukraine.

In October 2020, NASA announced the conclusion of agreements for the joint implementation of the Artemis2 lunar program with Canada, Japan, the United Arab Emirates, the United Kingdom, Australia, Italy and Luxembourg, the European Space Agency is engaged in the fragmentation of scientific and materials science reserves for all participants [4; 5].

According to the NASA schedule, the first unmanned flight under the Artemis program took place in 2021. In 2023, the United States plans to fly around the Moon on the Orion spacecraft with a crew, the mission duration is 10 days. In 2024, a month-long flight of Orion is planned with the landing of two astronauts on the Moon, with their stay on the surface for seven days, but after the explosion in April 2023 of Elon Musk's heavy launch vehicle, so far these plans seem extremely unlikely [3; 6].

In Russia, since the end of 2018, "Roscosmos" State Corporation, together with the Russian Academy of Sciences, has been jointly developing R&D of a long-term Russian program for the exploration and exploration of the Moon for the period up to 2040, where Russian cosmonauts and Chinese taikonauts through participation in the future ROS (Russian Orbital Station) will build secure and complementary solutions through AI and Big Data systems for successful expansion in near-Earth projects. The same ideology is successfully used in the Russian cooperation of NBICS scientific schools with India, and especially with China. To do this, Russia has already launched Luna-25 to find potential sites on the Moon for a lunar base. The heavy landing station Luna 28 (after Luna 26 and Luna 27 (will choose the final site for our Moon base, which will launch in 2024 and 2025)) will take samples of lunar soil and bring it to Earth, helping " Luna 29" correctly lunar heavy lunar rover. There is a dispute about the last "Moons" and the dates can be postponed for obvious reasons due to the ADF and the sanctions opposition of the "Roscosmos" State Corporation, but the vector for cooperation in space and for the joint movement of Russia and China to the Moon will continue.

The landing of the first Russian cosmonaut on the moon should take place in 2030 according to the plan of the "Roscosmos" State Corporation.

Russia is currently developing a super-heavy rocket, and the Eagle spacecraft is being actively created for a flight to the moon. In addition, in 2020, the Energia Rocket and Space Corporation, which leads the cooperation to create a super-heavy class rocket for flights to the Moon, patented a flight scheme to the Earth's satellite, which makes it possible to abandon the creation and use of a super-heavy rocket. The planned flight provides for the delivery of the crew to the International Space Station or another near-Earth station on a "Soyuz" rocket inside the "Soyuz MS" spacecraft, where they transfer to a lunar takeoff and landing reusable spacecraft, on which they go to the Moon, and then return to the station on it. For such a flight, an additional three "Angara-A5V" rockets under development will be required to deliver tanker ships to the station, to the Moon and circumlunar orbit, from which fuel will be pumped into a reusable take-off and landing vehicle. The crew must fly to Earth from the station on the "Soyuz-MS" spacecraft.

These plans could be accelerated and cheaper in cooperation with friendly countries, which is what Yu.I. Borisov. Each country, dreaming of its place in the progression of the Strugatsky brothers, should come closer and closer to understanding the ideas of humanism and philanthropy, because even the lunar and Martian bases built in the future will not solve the problems of our civilization, which is slipping into civil strife and proxy wars, spending even without moreover, scarce resources, but most importantly, those striving to find harmony somewhere out there, not realizing that everyone was born on time and agreeing with their neighbor remains a super task. "A man does not need space... a man needs a man" - Solaris understood this and extended his hand to us, the choice of answer is up to all of us...

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论知识产权发生时刻的理论与立法认定问题
**ON THE ISSUE OF DETERMINING THE MOMENT OF
EMERGENCE OF INTELLECTUAL RIGHTS IN THEORY AND
LEGISLATION**

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抽象的。在文章中,作者指出,对于知识产权的实施和保护,其法律性质和发生时刻的确定性是必要的。作者论证其他知识产权为债权。考虑与受创意和注册系统保护的智力活动(RIA)结果相关的知识产权出现的时刻。他指出,立法应该表明,从RIA创建的那一刻起,整个必要的知识产权集就从最初的主题中产生,而不仅仅是艺术第3段中指出的那样。俄罗斯联邦民法典第1228条:“专有权来自作者”。无论RIA是否注册,RIA的作者权都会产生。

关键词:权利起源时刻;知识产权;专有权;其他知识产权;署名权。

Abstract. *In the article, the author notes that for the implementation and protection of intellectual property rights, certainty in their legal nature and the moment of occurrence is necessary. The author substantiates that other intellectual rights are rights of obligation. Considers the moment of the emergence of intellectual rights in relation to the result of intellectual activity (RIA) protected by the creative and registration system. He notes that the legislation should indicate that the entire necessary set of intellectual rights arises from the initial subject from the moment the RIA is created, and not only, as indicated in paragraph 3 of Art. 1228 of the Civil Code of the Russian Federation: «the exclusive right arises from the author». The right of authorship to RIA arises regardless of RIA registration.*

Keywords: *moment of origin of the right; intellectual rights; exclusive right; other intellectual rights; right of authorship.*

In matters of exercising and protecting intellectual property rights, there remains legislative uncertainty about the moment when intellectual rights arise in relation to a protected result of intellectual activity (RIA), which is important when resolving a dispute related to a collision of rights to results that are confusingly similar or identical. Defined in paragraphs. 4 p. 1 art. 8 of the Civil Code of the

Russian Federation, the moment of the emergence of civil rights by virtue of the basis associated with the creation of the result of intellectual activity, obviously indicates the moment of the emergence of intellectual rights as civil rights in relation to RIA recognized as protected. However, in relation to the protected result, the law (Article 1226 of the Civil Code of the Russian Federation) recognizes not a single civil right, but three types of civil rights. Part 4 of the Civil Code of the Russian Federation contains separate articles defining the moment of emergence of one or another type of intellectual property rights in relation to a particular type of protected result without their correlation and does not contain a rule on a single moment of occurrence of all intellectual rights in relation to a protected RIA.

In addition, in the system of intellectual rights specified in Art. 1226 of the Civil Code of the Russian Federation, a special place is occupied by other intellectual ones. They are present in almost each of the institutions of part 4 of the Civil Code of the Russian Federation (for example, clause 3 of article 1255 - for works; clause 3 of article 1345 - for objects of patent rights, etc.). In Art. 1226 of the Civil Code of the Russian Federation, they are practically only mentioned as some kind of special kind of right (*sui generis*), - as “other” intellectual rights, indicating as an example individual rights (rights of following and access). They are not indicated either through their legal nature, as rights establishing a connection between the result of intellectual activity (RIA) and the personality of the person who created it (the author) and are designated in Art. 1266 of the Civil Code of the Russian Federation as personal non-property intellectual rights. Moreover, they are not named, since the right that provides protection of intellectual property from the actions of third parties and participates in civil circulation, denoted by the term “exclusive right”, is named, which is an independent civil right, absolute and property.

Perhaps this has a certain explanation, since the legislator refers to the group of other intellectual rights a whole list of rights, which is different for each of the protected intellectual property. At the same time, we believe that their naming can be indicated based on their nature, as this is done for personal non-property rights.

The interpretation of the articles regulating the exercise of rights referred by law to “other” intellectual rights allows us to establish that these are rights of obligation (for example, the right to receive remuneration - Articles 1295 and 1370 of the Civil Code of the Russian Federation, the right to obtain a patent - Article 1357 of the Civil Code of the Russian Federation, the right to follow, access and others). These rights are exercised in the situations specified by law in favor of an authorized person - a subject of law (this is always the author or copyright holder), endowed with the right to claim against the obligated subject and active actions of the obligated subject.

In relation to RIA, other intellectual rights perform the function of additionally securing the interests of an authorized subject in a situation established by law,

when the ownership of only an exclusive right or a personal non-property right does not allow the authorized person to fully realize a property interest in relation to his RIA.

Fixing in Art. 1226 of the Civil Code of the Russian Federation, indications that other intellectual rights are rights of obligation, we believe, will allow both the persons exercising the right and the law enforcer, when protecting intellectual rights, to determine, based on the nature of the right, measures for its protection, as indicated in paragraph 1 of Art. 1250 of the Civil Code of the Russian Federation on the choice of a method for protecting intellectual property rights, taking into account the essence of the violated right and the consequences of its violation.

The legislator, while recognizing in relation to the protected RIA not only the exclusive right and personal non-property rights, but also other intellectual ones, at the same time does not indicate anything about the ways to protect them, defining in Articles 1251 and 1252 only ways to protect the exclusive right and personal non-property rights. Fixing in the law a list of other intellectual rights and their nature will eliminate the existing uncertainty when choosing a method of protection, as it took place when resolving a dispute on the protection of the architect's right to copyright control [1, p. and whether it is possible to apply a compensation mechanism both for violation of an exclusive right and a personal non-property right.

In the scientific literature, they noted the need to “clarify the features of intellectual rights”, their nature, since “many intellectual rights can exist regardless of the exclusive right”, which can be alienated to another person or cease to exist, “but from this they do not lose their nature of intellectual rights » [2, p. 281].

The question arises whether all of those specified in Art. 1226 of the Civil Code of the Russian Federation, the rights arise simultaneously when creating a RIA, or do the personal non-property rights of the author initially arise (the right of authorship, the right to a name) and, on its basis, are the remaining intellectual rights recognized by law in case of protection of the created result? Is the protection of intellectual rights interdependent or can each right be protected independently of the recognition of other intellectual rights?

So, in paragraph 3 of Art. 1228 of the Civil Code of the Russian Federation, in Chapter 69 on general provisions on the protection of RIA and, therefore, part 4 of the Civil Code of the Russian Federation applicable to all objects, it is indicated that the exclusive right to RIA created by creative work initially arises from its author. We believe that such a formulation is applicable only to the results protected by the creative system. It is applicable to works - objects of copyright and objects of related rights, protection (emergence and exercise of rights) and protection of rights in respect of which does not require compliance with any formalities, within the meaning of paragraph 4 of Art. 1259 of the Civil Code of the Russian Federa-

tion. That is, it can be assumed that in relation to a work, from the moment of its creation, the entire set of intellectual rights is established (clause 2, article 1255 of the Civil Code of the Russian Federation), called copyright law (clause 1, article 1255 of the Civil Code of the Russian Federation).

With regard to the results protected by the registration system (objects of patent law, selection achievements (SA)) the wording of paragraph 3 of Art. 1228 is not applicable, since when creating a result, the author does not have an exclusive right, but only the right to obtain a patent, as specified in Art. 1357 and Art. 1420 of the Civil Code of the Russian Federation. At the same time, as we justified earlier [3], the right to obtain a patent is another intellectual right within the meaning of paragraph 3 of Art. 1345 and paragraph 2 of Art. 1408 of the Civil Code of the Russian Federation. It would seem that there are no serious contradictions, since paragraph 3 of Art. 1228 and paragraph 1 of Art. 1357, paragraph 1 of Art. 1420 of the Civil Code of the Russian Federation indicate the initial occurrence of the corresponding right precisely with the author. At the same time, it is not entirely clear whether these rights are subject to independent protection or the right to protect them is predetermined by the presence of some other intellectual right in the subject of protection?

So, for example, if, within the meaning of paragraph 4 of Art. 1259 of the Civil Code of the Russian Federation in conjunction with paragraph 3 of Art. 1228 stipulates that the entire set of intellectual rights to a work arises from the moment of its creation, therefore, the author of the work can protect each of the rights recognized by law. With regard to the results protected under the registration system, such a conclusion cannot be drawn. Can an inventor protect his copyright or a breeder protect his right to a CA name before obtaining a patent?

In the scientific literature, there is traditionally an opinion that before the issuance of a title of protection, the result subject to protection, as it were, does not exist and authorship arises from the moment of state registration of the object of patent rights [4, pp. 358-361; 5, p.430]. The personal non-property right of the author “is of a conditional nature - state registration confirms or refutes the existence of this right” [6, p.58]. Such a representation is also reflected in the relevant norms linking the protection of the right of authorship with the recognition of a patent (document) as invalid, if the person is not indicated in it as the author of the invention (clause 5, clause 1, article 1398), and for the SA literally, only if not the patent holder is indicated (clause 2 clause 1 article 1441 of the Civil Code of the Russian Federation).

We believe that such doctrinal ideas and the state of legislation on the moment the right of authorship arises do not fully contribute to its protection. After all, on the date of filing the application, the person indicates himself in the application materials as the author, i.e. implements its right of authorship, and for some rea-

son the right is subject to protection only after the exclusive right to the declared result is recognized. We believe that even if the result indicated in the application is recognized as not meeting the conditions of patentability, the person continues to be the author of the scientific work that is the application for an invention. In addition, a person can use the created result without having an exclusive right, for example, being a prior user (Article 1361 of the Civil Code of the Russian Federation).

As you can see, there are rules by which the legislator recognizes the interests of the person who created the result by creative work, considers it the author, even if the result is not established an exclusive right. To ensure the interests of the author, allocates him with another intellectual right - the right to receive remuneration. For example, an employee-author has the right to receive remuneration from the employer if the employer decides to keep information about the result secret or does not patent at all (Articles 1237, 1430 of the Civil Code of the Russian Federation).

We believe that for the registration system of protection, authorship of the result should be recognized not from the moment the result is registered, but “from the moment the creative result is achieved and expressed in an objective form, since it is from this time that the danger of its appropriation by other persons appears” [7, p. 504].

The existing legislative uncertainty with the protection of the right of authorship in relation to the result subject to protection under the registration system was initially eliminated by the decision of the Supreme Court of the Russian Federation, which noted, when resolving a specific dispute, that “the right of authorship does not depend on the issuance of a patent and arises by virtue of the very fact of creating a result by creative work” [8]. Subsequently, this legal position was enshrined in par. 3, paragraph 121 of the resolution of the Plenum of the Supreme Court of the Russian Federation [9], which indicated that “cases of authorship can be considered even before the grant of a patent.” Thus, the judicial practice of applying the norms of part 4 of the Civil Code of the Russian Federation confirmed the independence of personal non-property rights and the independence of their protection from the existence of an exclusive right to intellectual property.

We believe that for any result created by creative work, the rule about the emergence of the entire set of intellectual rights in the original subject of intellectual rights (who created RIA through creative work) is true. This is an exclusive right, except when the law recognizes the right to obtain a patent for the acquisition of an exclusive right, and in cases provided for by law - personal non-property rights and other intellectual rights, which are rights of obligations. With regard to personal non-property rights, the subject authorized by them is the author. The subject authorized in relation to the exclusive right is the right holder. Therefore,

it is incorrect to designate the owner of the entire set of intellectual rights as the author. It should be designated as the original subject of intellectual rights. Each of the intellectual rights is an independent right and is subject to protection from the moment of its occurrence, regardless of the existence or implementation of other intellectual rights.

Thus, we believe that consistent formulations of the norms of legislation on the types of intellectual property rights, the moment of their occurrence, their legal nature and their function are necessary.

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公司投资法中的数字责任

DIGITAL LIABILITIES IN CORPORATE INVESTMENT LAW

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抽象的。 这篇文章涉及改变俄罗斯联邦民法典规范的规定, 涉及新的民权对象: 股票投资代币、信息技术数字权利、衍生金融工具或其等价物、义务。 随机智能义务作为信托义务的特殊部分, 涉及数字金融资产的责任问题, 数字权利作为基于合同的民事权利的新客体, 法律模型应用的有效性 法律义务的规定。 本文特别介绍了公司领域, 并将讨论涉及与外汇交易商签订的合同的衍生品权利的实施。 它还将考虑适用拒绝履行合同、放弃此类合同以及其他一些涉及使用技术和电子手段行使权利的法律关系的可能性。 此外, 还分析了第 259 号联邦法“关于数字金融资产”的规定。

关键词: 特殊信托义务, 随机义务, 侵犯数字权利的责任, 分布式登记处的权利, 程序源代码的权利, 数字金融资产衍生金融工具, 投资资产的权利。 衍生品, 自动履行, 合同权利的实施, 单方面拒绝合同, 金融领域证券市场的专业参与者, 智能合同, 合同权利的行使(合同的签订), 衍生品, 外汇交易商, 自动履行, 实施联系权、合同的订立、合同的终止、弃权。

Abstract. *The article deals with the provisions of changing the norms of the Civil Code of the Russian Federation in part of new objects of civil rights: investment tokens for shares, digital rights for information technology, derivative financial instruments or their equivalents, obligations. Stochastic smart-obligations as the special part of fiduciary obligation, the issues of liability regarding digital financial assets, digital rights, as new objects of civil rights on the basis of the contract are touched upon, the effectiveness of the application of the model of legal regulation of legal obligations. This article introduces especially corporate area and will discuss the implementation of rights on derivatives involving a contract with a forex dealer. It will also consider the possibility of applying the institutions of the refusal to execute the contract, the waiver on such contracts and some other legal relations involving the exercise of rights using technical and electronic means. Additionally, the provisions of the Federal Law No. 259 'On digital financial assets' was analyzed.*

Keywords: *special fiduciary obligation, stochastic obligation, liability for violation of digital rights, rights in a distributed registry, the right to the source code of a program, digital financial assets a derivative financial instrument, rights to an investment asset. derivatives, automated performance, implementation of contact rights, unilateral refusal of a contract, professional participant of the securities market in finance area, smart contract, exercise of contractual rights (conclusion of a contract), derivatives, forex dealer, automated performance, implementation of contact rights, conclusion of a contract, termination of a contract, waiver.*

Introduction

Modern prospects for the development of civil law are largely related to the law enforcement aspect of the use of digital technologies in the field of property relations and are determined by the future awareness of the effectiveness of the application of the model of legal regulation of obligations in the field of digital rights and the possibilities of civil circulation of digital technologies.

The judgment about the characteristic as a new object of civil law - “digital property” - is based on the absence of a material form, is an algorithmic code, is the result of a computer program (in the form of computer calculations), cannot be used and handled outside the information system, the owner of which is built-in into the corresponding infrastructure and the cost of which for the participants in this system is expressed in a derived form. The smart contract itself can differ, act both as a computer code and as a legal relationship [4. P. 23-30].

The task of the practical purpose of using rights in a distributed data registry and the obligations arising from this from digital assets for further use in domestic corporate law for investment purposes remains open and debatable. The sharpest part of the discussion against the general prohibitive legislative background determines the need to study these legal phenomena when using stock tokens as an investment tool.

Test for the legitimation of a digital obligation for investment transactions.

The appearance as a result of the reform of the first part of the Civil Code of the Russian Federation in paragraph 3 of Art. 48 of the Code, the wording that legal entities, in respect of which their participants have corporate rights, include corporate organizations, gave a confusion of the concepts of the presence of shares (shares) of property rights to the property of legal entities and the unitary-corporate nature of a legal entity, entailed difficulty in qualifying legal relations regarding the “tokenization” of rights (the use of records in a distributed data registry in an information system for investment purposes), for example, for shares and, accordingly, transactions with them. There is no generalized concept of “digital assets” in Russian legislation, which would include “tokens, cryptocurrency, big data, domain names and accounts, virtual gaming property, etc.” [5. P. 19-38].

In addition, attempts to replace obligations between shareholders and a business entity with corporate relations during “tokenization” make this approach even more difficult, as they mix obligations and non-property rights. The doctrine of corporate law in the field of administrative and property transactions does not answer this question either.

The thesis that digital currency is not the right of a person, but his property in the form of electronic data, but not digital rights, seems significant and significant. Whereas for the purposes of participation in the capital of a non-public joint-stock company, in turn, a digital asset cannot be perceived outside the information system, even if it is a monetary claim or a security right. Obviously, the service token (the personification of the organizational, non-property nature of legal relations) in the sense of managing corporate organizations has a legal meaning in the form of special data - digital “tags”. Along with this, the obligation rights of claim (investment token), in contrast to the rights associated with the management of corporate organizations, have an object of corporate relations of property content. Such a division seems to be correct from the point of view of administrative and property transactions in this area.

And in cases of evaluating these provisions, there is a debatable opinion that such two types of new economic benefits as digital rights and participation rights in the capital of a non-public joint-stock company are absolute, which appear only in the aggregate of electronic data (digital code or designation) and which require preliminary activities for provision of services in the real sense of fulfilling obligations (transfer of property, works, services) aimed at ensuring the issuance of digital currency or the issuance of shares in the form of digital financial assets [2. P. 340-345]. For example, the definitions of paragraph 8 of Art. 1 of the Law on Digital Financial Assets means that without linking civil and corporate rights to the information system, digital rights as objects of civil rights cannot arise and exist. Users of an information system are its nodes, i.e., parts of the “chain”, and based on a distributed data registry (for example, “blockchain”), subsequently, as a set of databases, they provide verification of information using special procedures and corresponding records.

However, such a “pure” approach does not characterize any information system as “unsuitable” for using such rights in a distributed data registry (like “blockchain” or otherwise) for structuring investment transactions. A more significant factor should be called the lack of infrastructure and technical readiness for ICO and STO and the possibility for the emergence of such a “dealability”, which, taking into account the balanced approach of the legislator to the status of “information and technical intermediaries”, will give the legal infrastructure that consumers and performers, taking into account the least damage to the rule of law. That is, those oracles that ensure the interaction of a smart contract with an external

information source [3. P. 372-376]. It seems that the existing civil law contractual structures cannot yet give an answer to these challenges, as well as the structure of the obligation with the participation of a third party (information intermediary, aggregator, etc.), including as an agent for the relevant contract.

Only taking into account such a “superstructure” potential legal paradigm - as a hypothesis - will it become possible in the future to carry out such investment transactions, including “tokenization” - STO, in local information systems and, as a result and as a reason, - the lack of legal infrastructure, including the unformed “class of intermediaries” of legal entities (owners of information platforms; technical and technological intermediaries) - to clarify the weighted rules for the parties to obligations, for example, the transfer and maintenance of a data registry, by a single regulator and / or community, standardization of local rules of information systems and etc.

Thus, an example of the use of “tokenized” digital rights can be their identification and identification with digital forms of accounting that create some “shell” values, while without specifying their content.

In the same way, the “generation” of values based on their definition as an underlying asset in the digital environment prospectively suggests that the cost criteria and forms of identifying them as an equivalent of financial participation, for example, in the authorized capital of a non-public joint-stock company, will be correct and promising, provided that they are reflected in corresponding norm. Procedural issues can serve as such an example, firstly, the identification of such assets as underlying assets, and secondly, the securitization of such assets as a result of an offer and issue, a set of civil law transactions, including equity equivalents, including number of securities and obtain as a result of this action the correct value of the right to the asset for subsequent use in such a liability. So far, only the normatively defined definition of Art. 13 of Federal Law No. 259-FZ “On Digital Financial Assets” on the issue of a digital financial asset certifying the right to participate in a non-public shareholder company. In view of the foregoing, the investment function of such an entry in a distributed data registry (“token”) is still seen as illusory and ineffective in Russian jurisdiction. The above eliminates the meaning of such an investment, since the separation of rights to “tokens”, certifying the right to receive profit and the right to vote in one company, can so far only exist separately and separately from the shares of another company, in which, for example, the first one is going to invest.

“Tokenized” assets - rights distributed in data registers - can be classified as types of property in the presence of special standardization and with a positive decision on the securitization of the asset that constitutes the property. So, and similarly in the future, the subject of transactions may include property complexes and obligations as a result of the transfer of debt. That is, the transfer of duties can

be associated with the fact of the transfer of property rights under the transaction and included in the distributed data registry (blockchain).

The conceptual apparatus of the category “digital asset” does not include the characteristics of the underlying asset, as is done by the state regulator in relation to transactions with derivative financial instruments on a centralized basis, if they are not an electronic record.

It seems significant and debatable the judgment that “it is not the code entry itself that has value, but the right certified by it to the object encrypted in it, which includes the right to access the code (login, password, “crypto wallet”, etc.), as well as the right to dispose of digital assets” [5. P. 34-37].

In this regard, the theses on the possible issue of shares in the form of digital financial assets by a non-public joint stock company, emphasizing its virtual status quo, despite the denial by some authors in the doctrine [2. P. 17-21]. At the same time, one should not forget about the prohibitive provisions established in the legislation. In addition, there is an opinion that it is incorrect to recognize the possibility of transactions with “digital currencies” as with other property by the rules of a single information system, it is emphasized that digital currency, both as a payment and as an investment, is not directly related to any specific obligation. Digital currency is a set of electronic data that has a property value in any information system; it is created in the relevant information system and there is no obligated person in relation to it in front of each data carrier. The exception is system operators as a special class of information intermediaries in accordance with the rules of the system, regulatory boundaries (rules) for activities that have not yet been established.

Conclusion.

The civil law method when using digital rights makes it possible to substantiate the conceptual assessment of digital civil circulation, which in its content involves the change of digital rights carriers through the use of digital technologies that provide consistent mathematical operations of computer code in the form of digital records that serve as a form of expression of certification and transfer of digital civil rights to digital objects. That is, a smart contract is implemented on the basis of the principle of contract formation through software, through which the will of the parties is expressed at the time of reaching an agreement on the terms of the contract, and a smart contract in the form of a software product covers an ordinary civil law contract.

The thesis about the characterization as a new object of civil law - “digital property” is based on the absence of a material form, since it is the result of a computer program (in the form of computer calculations), and therefore cannot be used and handled outside the information system. However, prospectively, the possibility of the existence of the “digital property” model itself as an object outside the

information system is not excluded. The smart contract itself can be distinguished as a computer code and as a legal relationship.

There is no generalized concept of “digital assets” in Russian legislation, which would include tokens, cryptocurrency, big data, domain names and accounts, virtual gaming property, etc. In this regard, investment transactions regarding the “tokenization” of shares are still impossible. Such a norm could be adopted in the future, when a share in the authorized capital would be part of the shareholder’s right of obligation (token) to the company. And the right to a token, being part of the right to claim against society, could be involved in circulation as property. And since, according to Art. 93 of the Civil Code of the Russian Federation, shares in the authorized capital can be divided into parts, obligatory relations of them are obligations with a plurality of creditors with legally possible implementation in parts.

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专业教育中的差异化和个性化方法是教育集群形成和发展的先决条件（以斯塔夫罗波尔边疆区为例）

**DIFFERENTIATED AND INDIVIDUAL APPROACH IN
PROFESSIONAL EDUCATION AS PREREQUISITES FOR
THE FORMATION AND DEVELOPMENT OF EDUCATIONAL
CLUSTERS (ON THE EXAMPLE OF THE STAVROPOL KRAI)**

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抽象的。 本文致力于分析在职业教育现代化过程中实施集群模式的理论和实践问题，这是由中等职业和高等教育系统现代化的现代趋势的实现所引起的。 文章还概述了斯塔夫罗波尔边疆区职业教育系统现代化的规定，旨在提高职业教育的质量，提高劳动力市场需求专家的竞争力； 定义了进一步搜索灵活多功能集成系统的集群单元的实用级别的任务。

关键词：职业教育，教育集群，区域劳动力市场，现代化，竞争力。

Abstract. *This article is devoted to the analysis of theoretical and practical issues of the implementation of the cluster approach in the process of modernization of vocational education, which is caused by the actualization of the modern trend towards the modernization of the system of secondary vocational and higher education. The article also outlines the provisions for the modernization of the vocational education system in the Stavropol Territory, aimed at improving the quality of vocational education and improving the competitiveness of a specialist in demand on the labor market; tasks for further search for the level of utility of cluster units of a flexible multifunctional integral system are defined.*

Keywords: *vocational education, educational clusters, regional labor market, modernization, competitiveness.*

The creation of the country's innovative economy, the development and implementation of promising science-intensive technologies, is currently a priority in the development of modern vocational education.

For our state, another problem has arisen related to the growth in the number of non-competitive Russian universities, which coincides with the observed acute shortage of qualified specialists in the regions and sectors of the economy. This fact began to hinder innovative development, which in turn led to the need to make changes to the concept of higher education, which is currently modernized. The result of this modernization was the enlargement of Russian universities, as well as the branch association of institutions of secondary vocational and higher education.

With the ongoing substantive changes, it became necessary to simultaneously carry out organizational and structural transformations both in the system of secondary vocational and higher education. The urgent need to search for new forms, methods and technologies at all stages of this work is obvious.

The new paradigm of higher education is characterized by accessibility, openness, education in the process of professional activity on the job, as well as "throughout life" [3]. In our opinion, the achievement of the main goal of continuous education in the knowledge society (lifelong enrichment of the creative potential of the individual) is possible only in a cluster environment.

Due to the fact that the classical university, located in the center of the unified educational space of the region, performs both an educational mission and is the most important social institution, the system of (classical) state universities has a special role in the innovative development of regions: they act as integrators of professional education, science and the culture of the region as a whole. It should be noted that, in this case, classical universities should be used as forming the innovative infrastructure of the region, and should also influence the development of the regional economy.

After analyzing scientific works, we concluded that the theoretical basis for the study of educational clusters was:

- works of G.V. Mukhametzyanova, E.A. Korchagin, N.B. Pugacheva, A.V. Leontiev devoted to the cluster approach in vocational education;
- works of V.V. Davydova, A.N. Leontiev, V.P. Bepalko, G.I. Ibragimova, M.I. Makhmutova, V.A. Slastenin devoted to the theory of activity and pedagogical design;
- works of B.S. Gershunsky, G.V. Mukhametzyanova, A.M. Novikov, describing research into the concept of lifelong education;
- studies that revealed the problems of social partnership, education quality management in the system of secondary vocational and higher education Anisimova P.F., V.A. Burlyaeva, Mukhametzyanova G.V., Ibragimova G.I., Schubert Yu.F., Korchagina E.A., A.S. Subetto;

- works devoted to the study of regional aspects of the development of the higher education system Abrosimova A.G., Vasilchenko N., Ivanov V.S., Kovalevsky V.P., Maiburova I.A., Milyaeva L.G. etc.

Trends in the development of professional and higher education require the development of more advanced methods of regulating the educational services market, since the existing structure and quality of education contradict the tasks of social and economic development of both the country as a whole and individual regions[4].

It is noted that innovations, the introduction of commercialization in education, managerial decentralization and regionalization, in addition to a positive impact, also lead to negative consequences that affect the quality of training of specialists in various sectors of the national economy [5]. When relying on cluster development, it is necessary to take into account such side effects as: single companies can become more competitive compared to cluster companies; the threat of hyper-specialization of individual regions and centers in certain industries to the cluster.

A differentiated and individual approach to vocational education is a prerequisite for processes, one of which is the formation and development of educational clusters [6]. In the short term, it is the cluster development policy that will play the main role in ensuring the sustainable competitiveness of the national economy, since even today the formation and development of regional clusters is assessed as an important competitive advantage of the modern economy, which provides a real synergistic effect in the global economy.

Analyzing the conclusions of the American economist, Professor of Business Administration at Harvard Business School Michael Eugene Porter, on competitive advantages, clusters reflect a trend towards integration and socialization of the economy [7,8,9]. The leaders of economic development should be those regions in which clusters are formed and function.

At present, in modern Russia, there is an urgent need to modernize vocational education, taking into account the requirements of the economic, political, and ethno-spiritual situation. In the current conditions of demand for top areas of training, it is necessary to develop a soft mechanism for the transition to the creation of a flexible multifunctional integral system of vocational education. The existing attempts at the legal level to ensure the real development of this process cannot fully satisfy the requirements of the real economic, social, eco-cultural and ethno-spiritual order of society. Most often, we have to deal with isolated episodes of attempts to cluster different areas of vocational education.

Despite the fact that there is certainly valuable experience accumulated in this direction, a number of the most important aspects of the formation of a competitive specialist, in terms of taking into account the potential of the region's cultural traditions in the field of the environment, socio-economic development, practi-

cally do not contribute to building a single integrated system of professional education . At this stage, there are scattered attempts to model the complex dynamic systems of the vocational education industry from the standpoint of the cluster approach. At the same time, the cluster approach allows us to explore the problem from the standpoint of combining related competencies, thus building typical blocks of competencies that hold the level of the format of the functionality of a modular-block organization.

For a detailed analysis, in our opinion, it is advisable to turn to the method of limited chaos, which gives us the opportunity to plunge into a situation of relative maximization of the utility function and specification of modern pedagogy technologies in assessing the quality of vocational education in the Stavropol Krai and its impact on the formation of the competitiveness of a graduate specialist. In this case, the totality of the system's utility is denoted by the sum of the utility coefficient functions of order from chaos, and the principle of imposing restrictions ensures the ease of isolating the corresponding information flow of cluster units of the process being modernized. From this point of view, the following interpretation of the triune concept of "education" itself is necessary, which in its integrativity gives us a quality:

- as a process
- as a result
- as systems.

From the point of view of processability, in the Stavropol Krai, conditions are created for vocational education that contribute to the implementation of the individual development trajectory of the student, emphasis is placed on the social orientation of events available for participation by anyone, including those with health limitations (HL). The introduction of practice-oriented forms of education using advanced technologies has been intensified as part of the development and improvement of dual education. A demonstration exam has been introduced into the state final certification in almost all educational organizations. The implementation of a project-targeted approach is being actively carried out, designed to use the mechanisms for implementing projects on a competitive basis, contributing to an increase in the level of motivation and responsibility of all participants in the educational process.

At the moment, the listed innovative features of procedurality are consistent with the developed and already approved professional standards, since the standards are intermediaries between the process of training mid-level specialists and their use in specific types of activity that are in demand on the labor market.

On the other hand, considering the declared procedurality, it is necessary to pay attention to the development of the competence of teachers and heads of educational organizations. Teachers need to master the programs and methods of working with students of different levels of education who have disabilities and

national identity, and also take into account the need to timely identify and support gifted students, allowing them to improve themselves and achieve a certain personal growth. At the moment, the Ministry of Education of the Stavropol Krai is working on the transition to the conclusion of an effective contract with teachers and heads of professional educational organizations.

We also note that we should not forget that the quality of the process of vocational education also depends on today's students mastering programs in the direction of training "Pedagogy and Education". We must understand that future teachers should already be motivated today to work with human resources and human capital.

Speaking about modernization, we initially stated not only the procedural nature, but also the effectiveness of the education process, where the leading activity is to increase the competitive ability of a graduate of secondary vocational education at the national and global level. To this end, work is underway to introduce a national and regional system of independent monitoring of educational institutions of vocational education.

Participants in educational activities and independent experts, to study the quality of professional excellence, develop new tools and procedures. For example, employers take part in the final state certification; assessment of individual achievements of students and graduates of professional educational organizations is carried out taking into account the specifics of the assessment tools developed by industry centers for assessing qualifications. In order to introduce a regional standard for staffing industrial growth in the Stavropol Territory, on the recommendation of the FSBEI FVE «State Institute for New Forms of Education», work was carried out to compare WSI standards and federal state educational standards of secondary vocational education, which, unfortunately, has now lost its relevance. Also, a regional coordination center has been established and is functioning in the Stavropol Territory. It should be noted that an independent assessment of the quality of educational activities was carried out in 54% of state professional educational organizations subordinate to the Ministry of Education of the Stavropol Krai.

Students from professional educational organizations of the Stavropol Territory regularly take part in regional, national and industry championships of professional skills, in the regional and final stages of the All-Russian Olympiad of professional skills in professions and specialties, as well as in competitions for promising and popular professions and specialties of secondary vocational education.

And of course, speaking of modernization, we must understand the system, in this regard, the goals and objectives, directions and activities, means and stages of implementing a promising program for the development of Russian education at

all levels, based on the requirements of the concept of long-term socio-economic development, are a guideline for us.

Based on this, the goal of modernizing the system of vocational education in the Stavropol Krai is to improve the quality of the service, which determines the demand for qualified graduates from the standpoint of the end consumer - the employer. To achieve the stated goal, from the point of view of consistency, a holistic (integrative-cluster) view is needed:

- to improve human resources,
- to bring the infrastructure of organizations in line with the modern requirements of innovative technologies of enterprises,
- to improve financial mechanisms.

Currently, the vocational education system of the Stavropol Krai includes educational institutions of secondary vocational education, which provide training in more than 150 professions and specialties that are in demand on the labor market of the Stavropol Krai. ACF are formed in accordance with the forecast needs of the Ministry of Labor and Social Protection of the Population of the Stavropol Territory). There are also fourteen resource centers, three intersectoral resource centers (ISRC), eight specialized centers of competence, four multifunctional centers of applied qualifications. The effectiveness of the vocational education system is evidenced by the employment rates of graduates, in 2022 it is more than 50% (excluding graduates serving in the Russian Army).

The number of students in secondary vocational education programs per employee belonging to the categories of teachers and masters of industrial training is 19.1 people, which significantly exceeds the Russian figure of 12.7 people and indicates the effectiveness of budget spending.

Thus, analyzing the stated provisions of the modernization of the vocational education system in the Stavropol Krai aimed at improving the quality of vocational education and improving the competitiveness of a specialist in demand on the labor market, it is necessary to further search for the benefit (utility level) of cluster units of a flexible multifunctional holistic system, search for integral criteria for competencies requested by employers when translating values of established traditions, which in general should be based on integration.

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不同位置足球运动员速度移动的动态
**DYNAMICS OF SPEED MOVEMENTS OF FOOTBALL PLAYERS
OF DIFFERENT POSITIONS**

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抽象的。这篇文章处理了俄罗斯 2022/23 联赛中处于领先地位的甲级联赛球队不同位置球员速度移动的量化指标。数据按照连续10场比赛的结果呈现。具有游戏克服距离的总体积,以及分别以 14.4 -18.9 公里/小时、18.9-25.2 公里/小时、25、2> 的速度进行的加速和急动 公里/小时显示。绝对运动量最高的是中后卫 9894.6 米。在25.2>公里/小时的最高速度下,极端中场球员的移动越来越频繁,而在18.9-25.2公里/小时的极端后卫中发现了最佳值。

关键字。不同角色的足球运动员,速度运动,第一联赛。

Abstract. *The article deals with the quantitative indicators of the speed movements of players of different positions of the first league team, which is in the leading group of the championship of Russia 2022/23. The data are presented according to the results of 10 consecutive games. Features both in a total volume of the overcome distance for a game, and separately taken accelerations and jerks at a speed of 14,4 -18,9 km/hour, 18,9-25,2 km/hour, 25, 2>km/hour are revealed. The highest absolute volume of movements was found in the central defenders 9894.6 m. At a maximum speed of 25.2>km/hour, the extreme midfielders moved more often and more, while at 18.9-25.2km/hour the best values were found in the extreme defenders.*

Keywords. *Soccer players of different roles, speed movement, first league.*

Introduction. The management of the training process of football players is closely related to the timely and accurate assessment of the fitness of football players. Evaluation of competitive activity allows specialists to find those criteria that meet the needs of the coaching staff. The competitive activity of football players is characterized by the volume of high-speed work, as well as the number and accuracy of technical and tactical actions [5]. The indicators of the competitive activity of qualified football players allow setting the highest standards for the develop-

ment of motor activity [3,6]. Based on the information received, the coach makes appropriate adjustments to the team's current training plan. After the introduction of the GPS navigation system into the system for monitoring the movement of athletes, the analysis of competitive activity in terms of high-speed movements of elite football players became noticeably more active. Such studies have been carried out abroad for more than 10 years. In recent years, in our country [5,6].

Currently, satellite navigation systems (GPS) are widely used to visualize the performed high-speed physical activity both with and without the ball. Studies of the movement of football players were used to study the specifics of the movements of players of various roles [1]. In these studies, a modern Catapult global positioning GPS system was used, coupled with the OpenField cloud analytical platform in 5 speed ranges [2]. In beach soccer, players' movements were also recorded in five speed modes, but different from classic football: positional play - walking (0–3.9 km/h), jogging (4.0–6.9 km/h), fast running (7.0–12.9 km/h), high intensity running (13.0–17.9 km/h), and sprint (>18 km/h) [4].

Modern scientific research is aimed at studying the motor potential of athletes, without which it is not possible to achieve success. The situation in team sports is not so unambiguous. First of all, this is due to playing roles, which in turn impose different requirements on the model characteristics of athletes. In football, as in other team sports, new game structures (schemes) are constantly emerging, as a result of which the distribution of roles and functions of players undergoes significant changes. Due to the peculiarities of new tactical formations, regular monitoring and comparison of movement parameters with the model characteristics of players of a given role is necessary to optimize training loads [2].

Main part. The following tasks were set before the study: 1. To analyze the high-speed movements of football players of various roles; 2. To identify the features of high-speed movements and compare them with the total mileage of movement by football players per game in the dynamics of 10 consecutive games of the regular championship of the country of the teams of the first league. We used data from the OpenField analytical platform obtained using the Catapult system. The data of 15 players of various roles in 10 consecutive games of the national championship of one of the first league teams that played at least 70% of the playing time were analyzed. The team successfully competes in the championship and is in the top three. Table 1 shows the indicators of high-speed movements of football players of various roles.

Table 1.
Indicators of high-speed movements of football players of various roles based on the results of 10 games (M± m)

Position	total travel distance per game	high-speed movements			% of total distance per game
		14,4-18,9 km/h	18,9-25,2 km/h	>25,2 km/h	
Center forwards	7208,8 ±3271,5	1189.6±526.9	423.4±180.3	63.1±41.9	24.3
Wing backs	7305,5±3069.7	980.3±584.6	410.7±244.8	115.8±78.8	20.4
Central midfielders	6476.9±4240.7	1131.0±890.1	387.1±246.5	49.9±51.9	29.2
Central defenders	9894.6±715.0	1130.1±200.8	321.9±111.1	72.6±62.9	15.3
Wing backs	8245.2±3595.6	1257.6±599.1	474.8±264.5	85.3±76.4	22.6

We operated only on the data of high-speed movements of football players, taking into account the total mileage per game. Thus, the highest indicator of the volume of fast movements was noted in the central midfielders (29.2%), which were based on accelerations at a speed of 14.4-19.2 km/h. (1131.0±890.1 m), then center forwards 24.3%, wing backs 22.6%, wing backs 20.4%. The minimum volume of high-speed movements was performed by the central defenders 15.3% against the background of a total mileage per game of 9894±715.0 m, which, in our opinion, is associated with the functions of a positional, volumetric game in “cruising” movements than high-speed work in active tackle or pressing.

Against the background of the indicators of the total distance of movements of the first league football players presented in Fig. 1, including walking, jogging,

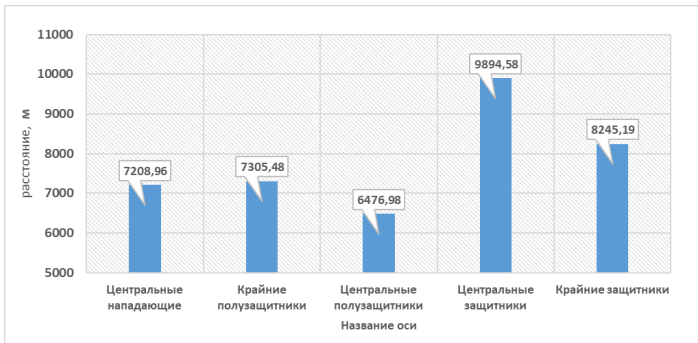


Figure 1. *Indicators of the total distance (m) of movement of football players in the first league in the game*

“cruising” movement at a speed of 9.5-14.4 km/h we were more interested in the features of high-speed movements of football players of various roles in the dy-

namics of 10 consecutive games of the regular championship of the country. By differentiating the speed of the playing segments, we can talk about high (14.4-18.9 km/h), very high (18.9-25.2 km/h) and maximum (25.2> km/h) speeds of football players. On fig. 2 presents comparative data on the movements of football players at a speed of 14.4-18.9 km/h. Most of all, the extreme defenders and central forwards moved at high speed, respectively 474.8 ± 264.5 m and 423.4 ± 180.3 m on average per game. In general, there was no significant difference between the players of all roles $p > 0.05$. The exception was the extreme midfielders, their volume of movements at a speed of 14.4-18.9 km/h. was lower $p < 0.05$ than that of the full-backs, which, in our opinion, is due to the tactical functions of the midfielders.

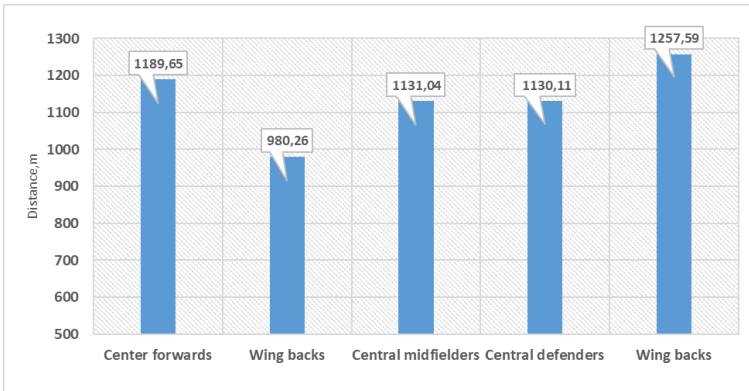


Figure 2. Comparative data on the movements of football players of various roles at a speed of 14.4-18.9 km/h.

The high and maximum speed shown by the players of the first league team averages 4-7.2% of the total mileage per game. In absolute terms, from 393 to 559 meters per game. Figures 3 and 4 present comparative data on the movements of football players of various roles at speeds of 18.9-25.2 and 25.2> km/h. Full-backs draw attention to themselves with high-speed maneuvers, compared to players of other roles, both at a very high speed of 18.9-25.2 (474.8 ± 264.5 m) and at a maximum speed of 25.2> 85.3 ± 76.4 km/h.

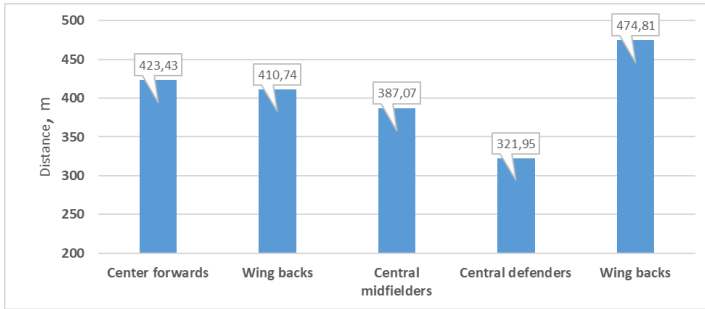


Figure 3. Comparative data on the movements of football players of various roles at a speed of 18.9-25.2 km/h.

It is also worth noting the extreme midfielders in figure 4, who performed the most maximum jerks on average per game 115.8 ± 78.8 km/h.

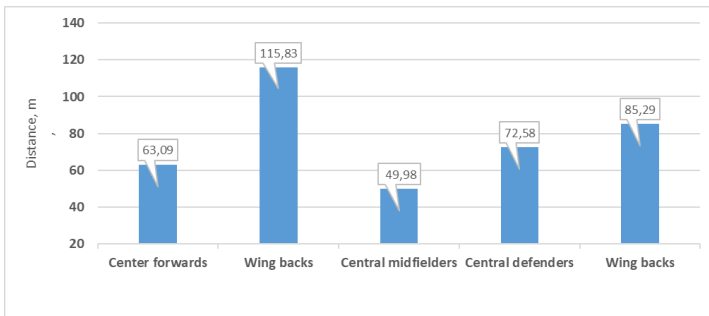


Figure 4. Comparative data on the movements of football players of various roles at a speed of 25.2 > km/h.

Thus, a comparative analysis of the play of football players of the first league showed a versatile structure of high-speed maneuvering, depending on the role. In our opinion, each team has its own tactical schemes, which are based on performers who are able to maneuver both with the ball and without it at various speeds.

Conclusions.

1. Central midfielders, compared to players of other roles, were distinguished by a high volume of high-speed work (29.2% of the total distance of movement per game 6476.9 ± 4240.7 m.). The basis of these movements were accelerations at a speed of 14.4-19.2 km/h, on average per game 1131.0 ± 890.1 m.

2. Revealed significant differences in the number of movements at a speed of 14.4-18.9 km/h. extreme defenders 1257.6 ± 599.1 m compared to extreme mid-

fielders 980.3 ± 584.6 m $p < 0.05$, to a certain extent can determine the style of play of the team under study.

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信息和计算机技术在附加教育中的应用
**APPLICATION OF INFORMATION AND COMPUTER
TECHNOLOGIES IN ADDITIONAL EDUCATION**

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抽象的。这篇文章的作者着重于信息和通信技术的重要性以及它们在与学龄前儿童一起工作时的特殊性

关键词：ICT 技术、附加教育、学龄前儿童、教育过程、系统活动方法、游戏、个性发展、兴趣。

Abstract. *The authors of the article focus on the importance of information and communication technologies and the peculiarities of their application in working with preschool children in the direction of additional*

Keywords: *ICT technologies, additional education, preschoolers, educational process, system-activity approach, game, personality development, interest.*

The modern education system is characterized by the active use of information and communication technologies in various fields of human activity, their introduction into the educational process at all levels of education (preschool, primary general, general secondary, secondary vocational, higher, etc.), which is associated with the expansion of the information space and the formation of the necessary competencies that help to navigate a large information flow and master high-quality professional skills, apply advanced technologies.

We emphasize that ICT technologies are not an end in itself, but a means of development, which requires their reasonable use in the educational process and work with children of different ages, avoiding unnecessary overload. Not separating them away from nature, but harmoniously complementing various real and virtual spheres. What should be included in the culture of human life.

The use of ICT technologies cannot be called a newfangled trend! In the modern world, information technology is a necessity dictated by the real level of development of education.

A modern teacher today should be aimed at such an organization of learning and active activity of the child, which will allow him to form the skills of quick response and adaptation to changing conditions of the surrounding reality, the ability to detect new problems and tasks, find ways to solve them. To get a qualitative result in the fulfillment of the above task, really, through the implementation of innovations, a systemic-activity approach in training, which ensures the transition to a creative and productive level. The means of achievement are ICT technologies.

The modern system of additional education for children can be attributed to a flexible socio-pedagogical system that is able to be adaptive to relations in a market economy, provide a variety of educational services that create conditions for the personal, professional, creative development of the child [3]. The innovations actively introduced into the practice of additional education involve the inclusion of modern educational technologies based on the use of information and communication technologies, which can be considered as one of the strategic directions in the development of the system of additional education of the younger generation.

In the system of additional education for children, the main functions of educational technologies based on ICT can be distinguished [2]:

- development of the information and communication culture of the child in the conditions of continuous education;
- Satisfaction of personal and educational needs of pupils and students;
- pedagogization of the information-informal environment;
- unity of training and education;
- priority of humanization ideas over the technocratic approach.

In working with children of different ages, the priority of using ICTC technologies is determined by the following parameters and factors [3]:

- attractiveness: movement, sound, brightness and variety of colors contributing to the information transfer of information in an accessible and understandable form;
- novelty of the performed activity, contributing to the increase of interest and strengthening the educational motivation of the study;
- increasing the level of cognitive and research opportunities;
- implementation of individual training;
- application of practical manipulation, which facilitates the process of cognition and memorization;
- is considered as a means of independent activity of the pupil.

Let us designate the main advantages of the multimedia method of presenting information in comparison with traditional forms of teaching children [1]:

- information on the screen is presented in a playful way and promotes the child's interest and participation in activities;
- a computer acts as a figurative understandable type of information that allows you to keep the attention of the pupil for a long time;

- stimulus for the activation of cognitive activity in preschoolers are problematic tasks and encouragement by the computer itself (fairy tale hero) with the correct solution of the problem;
- the ability to simulate situations that cannot be seen in real life (rocket flight, plant growth, a variety of effects), which increases self-confidence;

The main *goal* of using ICT technologies in working with students and pupils in additional education is to *improve the quality of educational activities*, which is aimed at solving the following tasks[4]:

- creation of conditions for self-education and improvement of pedagogical skills;
- creation of conditions for the formation of «new literacy», which involves the manifestation of high independence of students in the process of working with information;
- variable use of forms and methods of teaching;
- implementation of the principle of integration of educational and creative activities;
- designing teaching and educational activities, taking into account a higher information level;

The main directions for solving the identified problems are [5]:

- development of slide presentations for classes;
- development of differentiated tasks - cards;
- selection of additional material;
- inclusion in the learning process of ready-made educational electronic materials.

Using multimedia presentations allows you to:

- more effectively implement the principle of visualization, promote better perception and memorization of the material, based on the features and consideration of visual-figurative thinking of children of different age categories;
- cause increased cognitive interest in the process of submitting information through a computer;
- characterized by a figurative type of information understandable to different categories of children;
- stimulate the cognitive activity of pupils;
- provide opportunities for individually differentiated learning;
- contribute to the manifestation of positive motivation for learning, activate the cognitive activity of pupils;
- create conditions for psychological discharge of high emotional tension and revitalization of the educational process (taking into account the psychophysical characteristics of children of different age categories, which

is associated with the long-term predominance of visual-figurative thinking over abstract-logical thinking);

The implementation of the developmental and educational function in the system of additional education of children implies the development of educational programs and the implementation of educational technologies based on the use of information and communication technologies, which must meet the basic requirements [3]:

- computer - acts as a unique means of achieving creative tasks that the subject of educational activity sets for himself);
- the process of cognition (taking into account the organization of distance learning) is carried out based on the mandatory communicative influence of the subjects of educational activity;
- software created and used in the educational process, involving the development of interactive creative tasks for students, based on the principle of technocratic, humanization (takes into account moral and aesthetic requirements, provides for the possibility of participation of the subjects of the educational process, creates conditions for the manifestation of the situation of «success» of each child).

An example of the use of information technology in the process of teaching pupils can be the creation of the Young Technician's Club «Rocket Modeling» on the basis of educational institutions, which includes the use of fixed ICT tools:

- computer (laptop);
- multimedia projector (for creating presentations, cartoons);
- printer, scanner;
- camera;
- mobile phone (photo, internet, voice recorder)
- a video camera;
- electronic board;

These information technology tools are focused on the performance of the main functions [2]:

- is a source of additional information in the form of cognitive material in the framework of solving educational problems, material for creating an information environment (stands, scenarios, periodicals, studying advanced pedagogical experience);
- is a means of preparing various materials (development of presentations based on the PowerPoint program, viewing illustrations, slides, models, organizing virtual tours);
- is a means of storing materials (a compressed form of storing normative documents, information on students and their parents, etc.).

The use of information and communication technologies in working with children in the system of additional education creates conditions for creating joint

attractive activities, active, creative solutions to cognitive research problems that are based on a visual basis.

The main criteria for the use of ICT technologies in the work of children are [4]:

1. The use of visualization systems for educational material that is presented to the child.
2. The use of special computer products and programs that are included in the main educational curriculum.
3. Accounting for the potential of social networks.
4. Application of special equipment.
5. Work with a smartphone.
6. Work on the creation of an electronic textbook

Thus, the use of ICT technologies in additional education makes it possible to: improve the professional level of a teacher, motivate them to search for new non-traditional forms and methods of teaching, and show creative abilities; to increase interest in learning, to intensify cognitive activity, to improve the quality of the child's assimilation of the program material; to increase the level of pedagogical competence of parents, their awareness of the nature of the activities and features of the educational organization, correlated with the results of the child himself, creates conditions for organizing cooperation between the institution of additional education and parents, which in turn contributes to the fact that the institution reaches a new qualitative level, taking into account updating the content of the educational process, ensuring the quality of education.

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海事实践作为语言能力发展的一个因素
**MARITIME PRACTICE AS A FACTOR IN LANGUAGE
COMPETENCE DEVELOPMENT**

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抽象的。船上的沟通至关重要，因为只有管理得当且互动良好的船员才能有效地管理船舶。船员之间关系密切，他们的安全取决于他们相互理解的能力。国际航行条件下的海事实践是激发学员发展沟通技巧作为主要专业能力的众多因素中的核心之一。学员国际航行归国后专业自组织要素分析有助于进一步完善专业语言培训，包括英语授课。

关键词：STCW 公约、专业自组织、外语能力、海洋专家。

Abstract. *Communication on the ship is vital, because only a properly managed crew with well-established interaction is able to effectively manage the ship. The crew members are closely related to each other, and their safety depends on their ability to understand each other. Maritime practice in the conditions of international voyages is one of the central among many factors inspiring cadets to develop communication skills as the main professional competencies. Analysis of the elements of professional self-organization of cadets upon return from international voyage helps to further improve professional language training, including courses brought in English.*

Keywords: *STCW convention, professional self-organization, foreign language competencies, marine specialists.*

Each cadet strives to be a competent and reliable specialist, actively realize their capabilities in real teamwork, where each person is in his place, and the entire crew of the ship is like a well-established mechanism. Leadership qualities play an important role in the seafarer's profession, since discipline, order, and a clear distribution of responsibilities are provided not only by a skillful organization, but, above all, motivation and support in difficult conditions at sea. Leadership qualities are required in accordance with the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (Application of Leadership and Teamwork Skills: STCW. Tables: A-II/1; A-III/1; A-III/6) Lead-

ership can be defined as the direction of other people's activities and influence on it to achieve the desired results [1]. A number of skills and abilities are required to master this, and developed communication skills play a primary task.

Despite the fact that the rapidly developing economic and political situation affects the maritime industry, the most important thing remains unchanged, first of all, the issues of safety on board, as well as the need to work productively and effectively perform their duties.

Teaching English at the Maritime University (the working language of the Maritime industry) should lead each graduate to fluency in it and a developed vocabulary, at least within the profession. It's no secret that cadets have different abilities. As practice shows, it is necessary to introduce intensive teaching methods that lead to increased efficiency in the conditions of studying at the university.

The activity of the Department of Foreign Languages at the Maritime University is focused mainly on the formation of professional foreign language competences, which reflects professional self-realization and self-development. Therefore, the issues of professional self-organization were in the center of our attention [5, C. 388-397; 6, C. 106-108.].

Professional self-organization is understood as the ability to consciously apply, control and develop one's qualities and professional competencies in the process of responsibly solving tasks that are relevant from a professional and personal point of view, choosing the most rational way [7]. The department is developing a system of educational and methodological complexes, IT technologies and simulator training are actively used [3; 4], an integrated and interdisciplinary approach is involved [8, C. 351-356.]. The idea of increasing the intensification of learning through the element of deep immersion in the language, when the cadet is forced to change the viewing angle and consider a foreign language not as a subject of study, but as a means, a tool for learning a new field of knowledge led to the development and active implementation of a series of professional training courses. Courses for various specialties and areas of training "Leadership and teamwork skills", "Psychological fundamentals of ship crew management", "Fundamentals of communication in the ship's crew", "Management of social and labor relations in the ship's crew" have been developed in accordance with the requirements of the international STCW convention, and are taught in English. [9, C. 86-92]

Within the framework of the courses, the literature on the topics of the courses is analyzed, sets of practical tasks and recommendations for improving communication skills are developed. Analytical methods of intercultural communication are used in the course of studying accidents related to violations of multilingual communication both during pilotage and on the high seas [10, C. 85-88].

To activate professional self-organization and self-development, taking into account the needs of cadets and the experience of working in quarantine and pan-

demic conditions, online courses with mandatory video content and audio accompaniment of materials, step-by-step testing and providing intermediate certification for courses are being actively developed [11, C. 302-305; 12, C. 324-332].

A special place is given to maritime practice. The cadets undergo two large practices on ships, spending a total of more than a year in foreign navigation, often in mixed crews, without the possibility of communicating in their native language.

In the conditions of the sea there are a number of adverse factors and increased risks, which the guys know in advance and prepare themselves for them. Among them are frequent changes of time and climate zones, severe weather conditions (storm, heat and cold, ice conditions), pitching, constant noise of working mechanisms and engine, limited space, regular night watches, lack of weekends and holidays on the voyage. A significant impact on health has a change in the usual diet and water, monotonous products after freezing, the inability to get high-quality and fast medical care. The sea is testing for strength and practice should show capabilities and professional reliability. For many cadets their separation from family and friends for a long time becomes an unbearable ordeal, homesickness. This is especially evident in the conditions of working in mixed crews, constantly being surrounded by people of another culture, when the only way to communicate, not only between ships and with the shore, but also on board, is English

Some cultural aspects of communication with representatives of other nationalities cannot be fully assimilated within the framework of the English language course and, even in conditions of studying in mixed groups and teaching in the language.

IMO and national maritime organizations are making efforts to effectively influence the emerging communication problems in the international industry. Some of the strategies used have definitely benefited. Standard Marine Communication Phrases was adopted in 2021 [2], and it is a valuable source of common phrases understandable to every competent seaman. However, it is limited exclusively to professional vocabulary in certain situations. [13, C. 247-257].

Another factor is the need to deepen language skills due to competition between job seekers, the need to undergo a multi-stage selection of personnel, which greatly activates the cognitive activity of cadets, but also tests stress resistance in the long-term perspective.

In order to improve professional language training, regular monitoring is carried out not only of the learning results obtained, but also of the analysis of cadets' self-organization at the stage of self-control and planning, including after the internship [14, C. 139-145].

As part of the development of professional self-organization, the cadets of the Deck Department, who returned from their first six-month international voyage, are invited to conduct self-analysis and share the results through a prepared inter-

view and a specially designed questionnaire. Among the data received were the following:

The cadets regularly kept a navigation watch, taking an active part in all procedures on board the ship. All cadets working on board ships with a mixed crew practiced their communication skills in English on a daily basis.

One third of all survey participants used English to communicate with colleagues more often than Russian. In the case of communication between courts, 73% used English. In the course of ship-to-shore communication (or at least with shore workers), the share of English increased to 81%. The most common communication skills in English were: speaking – 81%, reading and listening – per 39%, writing – 33%, typing – 25%.

The question of the difficulties encountered on board made the cadets think. In an interview, the most cadets proved that their level of English proficiency is sufficient, and they will not stop developing their skills by practicing it at university, since the chosen strategy, methods and lessons have generally proven their effectiveness. However practice revealed some further direction of desired development.

33% of the participants were sure that a variety of accents sometimes prevented them from understanding clearly and quickly and forced them to ask for repetition and explanation more often. 8% noted that they felt increased nervousness when speaking in English, and this was perceived as a difficulty that prevented them from communicating normally. Lack of communication experience was mentioned by 8% of cadets. 6% noted insufficient vocabulary. 3% of the cadets were faced with the incompetence of colleagues whose English was not native and their level was insufficiently developed.

Among the communication skills that help solve problems, the following were named: 86% – feedback and repetition of orders; sociability and developed personal communication skills, such as a good sense of humor and a positive attitude – 34%; directed attention– 32%; deeper self-control when using general English language skills - 17%; SMCP was mentioned by 14% of cadets. 11% of respondents noted that in case of difficulties they tried to choose easy-to-understand words to communicate with foreigners for whom English is not their native language. 6% turned to their English textbook to improve their ability to speak fluently and improve their understanding. Non-verbal communication, for example, gestures, was mentioned by 6% of respondents.

All participants noted the benefits of courses conducted at the university in English. Among the advantages of such training were named: 33% agreed that during these lessons they accelerated the development of their communication skills; 31% were satisfied with the constantly used English and acquired fluency of speech; 14% were able to improve their listening skills at lectures; 12% of participants wrote about increasing self-confidence and correcting speech errors

Others have mentioned: role-playing games with the use of simulators and communication equipment; ability to expand vocabulary; selection of interesting information and practical examples; the use of audio and video accompaniment, which increases the efficiency of independent study of the material; the ability to work on a subject while improving your English language skills; creative tasks and active forms of work.

Speaking of shortcomings and wishes, most of the cadets, 80% indicated that the courses are limited in time and that they would like to continue such lessons; 35% complained about the extensive coverage of the material, which requires more thorough study and they see prospects to return to these issues later in their practice; 16% indicated the need for a broader discussion of issues of intercultural communication and corporate etiquette in the course of the discipline.

Others have mentioned the need to spend more time doing homework if the level of English leaves much to be desired; a request to remove time limits and attempts to pass tests.

A comparison of the results obtained with studies of previous years revealed a tendency to increase positive self-confidence (14%), as well as an increase in the proportion of cadets who, interpreting the experience gained, used professional methods from the field of management, psychology and based on instructions (13%). Thus, the results obtained after a comprehensive and versatile analysis are used in the further development of courses of the Department of English at the Maritime University. Adjustments are made to the order and content of the studied content, effective elements of educational and methodological complexes are activated, methodological material is added and critically processed, diversity is introduced into the forms and means of teaching with the involvement of the latest technologies. Simulators are involved and situations from practice are analyzed, including from the experience of cadets.

Officers on board modern ships must have developed communication skills. Many factors encourage cadets to master their communication skills as core professional competencies, while practice plays a central role in professional self-esteem and encourages people to improve their level of development.

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视频博客作为教授外国学生俄语口语独白的工具

VIDEOBLOG AS A TOOL FOR TEACHING FOREIGN STUDENTS ORAL MONOLOGUES IN RUSSIAN

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抽象的。本文致力于解决使用视频博客 (vlog) 作为俄语口语独白教学手段的问题。由于信息和通信技术的强大发展,借助视频博客发展外语演讲技能成为可能。根据最新的研究结果,作者考察了使用视频博客的积极和消极方面。证明了在外语课上使用视频博客的权宜之计。得出的结论是,有必要开发和测试一个练习系统,以发展俄语作为外语的口语和演讲技能。

关键词: 外语独白演讲; 教育手段; 口语和演讲技巧; 视频博客/vlog; 俄语作为外语。

Abstract. *This article is devoted to the problem of using a video blog (vlog) as a means of teaching an oral monologue in Russian. Thanks to the powerful development of information and communication technologies, it became possible to develop the skills of foreign language speech with the help of video blogs. Based on the results of the latest research, the author examines the positive and negative aspects of working with video blogs. The expediency of using video blogs in foreign language classes is proved. It is concluded that it is necessary to develop and test a system of exercises for the development of oral and speech skills in Russian as a foreign language.*

Keywords: *foreign language monologue speech; means of education; oral and speech skills; video blog/vlog; Russian as a foreign language.*

As many methodologists note, in the process of teaching foreign language monologue speech, a number of difficulties arise for both students and teachers [1]. One of the main reasons is the fact that the production of monologue speech in a foreign language requires the speaker not only to strictly observe grammatical rules and adequate use of lexical units, but also to be rich in content, logical sequence, etc. In addition, a monologue as a type of oral public communication implies a high level of sociocultural competence.

Monologue speech has a number of important psychological characteristics, so the speaker must be able to overcome the psychological barriers (nervousness,

fear, anxiety) that arise when communicating with the audience. However, the traditional means of teaching speaking, widely used in teaching a foreign language, are largely focused on memorizing typical syntactic patterns, which reduces the motivation of students and does not allow optimizing the process of developing monologue skills in the target language.

The powerful development of information and communication technologies (ICT) has led to the interest of methodologists in the problem of using a video blog (vlog) for teaching a foreign language. A video blog is considered as a constantly updated and expanded series of video materials, united by a common theme, which are published by the author in any video hosting. As a rule, bloggers create video blogs for various reasons: to communicate certain information, share experiences, demonstrate certain skills, provoke an exchange of opinions, etc. [2, p. 85–86]. Bloggers record the events of their lives through video selfies and self-reports, the author narrates in the first person and edits the captured video, adding written text and images, as well as a soundtrack to create a unique product and interest subscribers or channel guests with unknown facts, composition, effects.

Now the Internet hosts a huge number of video blogs on a wide variety of topics, new genres of vlogs are emerging, so it is quite difficult to solve the problem of their classification.

V.A. Lushchikov and M.V. Tersky, based on the functional and thematic specifics, divide video blogs into:

- entertaining (musical parodies, «harmful» advice, fan videos, coubs, absurd and recursive videos, etc.);
- cognitive (instructive, video reviews);
- informational (political blogs, etc.) [3].

The authors identified the most popular types of video blogs:

- *Beautyblog*: video blog about beauty, makeup, self-care;
- *Lifestyleblog*: a video blog in which the blogger «lives for the show», such vlogs are recorded daily;
- *Fashionblog*: video blog, the topics of which are related to the fashion industry, design, etc.;
- *Gameblog*: a type of video blog that is very popular among gamers and video game lovers. There are several formats: летсплей (from English - let's play), a review of video games, etc. ;
- viral video review: a humorous vlog that makes fun of funny non-produced videos from around the world;
- *Travelblog*: a video blog in which travelers share their impressions of visiting places;
- social experiments (pranks): in such videos, prankers simulate some situation, most often negative, that could happen in reality; the filming is conducted

covertly so that the participants in the social experiment (passers-by) do not know about it. At the end of the video, statistics are given, and then a reasoned conclusion;

- political vlog: a vlog used for political advertising;
- film blog: a video blog dedicated to reviewing films;
- fitness blog: a video blog in which a professional athlete or amateur shows how to properly perform certain exercises, talks about proper nutrition, weight loss methods, etc.;
- Techblog: a video blog in which the author shares a subjective opinion about a technical novelty [3, p. 58].

O. Starkova, in addition to informational and entertaining video blogs, highlights educational blogs [4].

Despite the wide variety of video blogs in terms of topics and content, the language tools used in them are somewhat similar. It can be argued that video blogs have certain rules and a logical structure of speech actions in order to ensure a holistic perception of the video, as well as interaction between the author and the viewer. In our opinion, the constant elements of a video blog include:

- appeal (*guys, friends, followers*);
- initial contact-establishing remarks (*Hello, with you ...; Hello everyone!; Hello everyone, my name is ...*);
- introduction to the topic (*Let's go!; What are we going to talk about?*);
- provocative remarks (*you will probably be surprised now: why ...?*);
- final remarks (*Well, was (a) with you ...*);
- encouragement to continue communication (*Subscribe to my channel. Put likes; Join the group; Follow ...*);
- farewell formulas (*Bye! Bye-bye!*);
- gratitude (*Thank you all!*).

Back in 2015, O. Karpilov, General Director of the Polylog consulting group, noted that “Russian video blogging <...> from the stage of inception, which began in 2005, is moving into the stage of active development. We see how fast the audience is growing. The most popular video bloggers have a monthly increase in new subscribers of approximately 50-100 thousand people. I believe that growth will continue successfully for 5-10 years, and by 2020-2025 video blogging will become a classic medium of mass communication» [5, p. 20]. We add that the development of video blogging in Russia contributes to its involvement in the process of teaching foreign languages, including Russian as a foreign language.

The importance of using video blogs for the development of students' oral speech was first pointed out by teachers of English as a foreign language. Thus, the following positive aspects were noted: attractiveness for students; self-presentation; increased time for practice; autonomous learning [6, p. 14].

T.S. Malysheva suggested using a video blog to stimulate the oral monologue speech of students [2]. The researcher conducted an experiment on teaching German as a foreign language for two years (2019-2021). The experiment involved a combination of traditional forms of monologue and monologue speech in videos recorded by students. At the end of the experiment, a conclusion was made about the effectiveness of the developed methodology for teaching monologue speech in a foreign language.

The main advantages of using this monologue format are:

1) The speech situation when creating a video blog is as close as possible to natural communication. The blogger understands that he is communicating with an imaginary or expected audience, so he is ready to anticipate different reactions of the audience;

2) The video blog allows the author to show their personal qualities in a favorable light, which helps to increase students' motivation for foreign language speech communication (self-presentation);

3) In the video blog, students actively use non-verbal means of communication (facial expressions, gestures and postures), which makes the monologue expressive and emotional, therefore, also brings the speech closer to the real conditions of communication;

4) Video blogging allows students not only to learn how to accurately express thoughts and structure the statement, but also to improve themselves, developing themselves as a linguistic personality (self-development and reflection);

5) Creating video blogs can unleash the creative potential of students through the use of music, computer graphics, infographics, special effects [2].

To this list of benefits, one could add stimulating interest in the language being studied and students' enthusiasm for creating their own product.

At the same time, there are also negative aspects of using video blogs, which must be taken into account when developing tasks for teaching speaking:

1) The excitement that students may experience in front of the camera leads to an increase in the number of language errors;

2) This utterance format requires a lot of time from students, and is associated with certain technical difficulties when recording and editing a blog;

3) A blogger should have such qualities as sociability, emancipation, initiative, so the video blog format is not suitable for all students [2, p. 87].

T. S. Malysheva's judgment is quite fair that video blogs "should not completely replace traditional forms of training and control, but can be used as an alternative to them, as a means of increasing the communicativeness of speech utterance" [2].

Summarizing the above, it can be argued that the use of video blogs has methodological prospects, therefore it is necessary to develop and test a system of tasks

for teaching speaking based on vlog as an effective means of developing oral speech skills in Russian as a foreign language.

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为研究 M.I. 的声乐技术过程提供的音乐和说明材料的大致清单的方法建议。
中国学生的格林卡

**METHODOLOGICAL RECOMMENDATIONS FOR THE
DEVELOPMENT OF AN APPROXIMATE LIST OF MUSICAL AND
ILLUSTRATIVE MATERIAL AS EQUIPMENT FOR THE PROCESS
OF STUDYING THE VOCAL TECHNIQUE OF M.I. GLINKA BY
CHINESE STUDENTS**

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抽象的。这篇文章提出了一些方法论建议，用于开发音乐和说明材料的大致清单，以装备中国学生学习 M.I. 声乐技巧的过程。格林卡。由于感知俄罗斯音乐的语调和听觉体验不佳，俄罗斯大学的中国学生在熟悉这种技术时面临许多困难。这意味着需要在课程中包括音乐材料，可能旨在让学生意识到对 M.I. 形成的影响。俄罗斯民间歌曲创作、俄罗斯神圣音乐和意大利声乐学校传统的格林卡。

关键词：指南，近似列表，音乐素材，M.I. 格林卡、俄罗斯神圣音乐、俄罗斯民间歌曲创作、声乐流派、歌剧咏叹调、传奇故事。

Abstract. *The article presents methodological recommendations for the development of an approximate list of musical and illustrative material as equipping the process of studying by Chinese students of the vocal technique of M.I. Glinka. Getting acquainted with this technique, Chinese students of Russian universities face a number of difficulties due to the poor intonation and auditory experience of perceiving Russian music. This implies the need to include musical material in the lessons, potentially aimed at students' awareness of the influence on the formation of M.I. Glinka of Russian folk songwriting, Russian sacred music and the traditions of the Italian vocal school.*

Keywords: *guidelines, approximate list, musical material, M.I. Glinka, Russian sacred music, Russian folk songwriting, vocal genres, arias from operas, romances.*

In the pedagogy of musical education, the understanding of musical knowledge as an integral component has become traditional. So, E.B. Abdullin and E.V. Nikolaeva subdivide musical knowledge into knowledge about music and knowledge of music itself [1]. Therefore, it is logical in the process of studying the vocal methodology of M.I. Glinka to form in students not only historical and pedagogical knowledge, but also to enrich the intonational and auditory experience of future music teachers, which will help to realize the influence on the formation of M.I. Glinka of Russian folk songwriting, Russian sacred music, traditions of the Italian vocal school.

Forming the ideas of Chinese students about the influence on the formation of the vocal methodology of M.I. Glinka of Russian folk song art, it is necessary to promote the formation of students' listening experience in the perception of various genres of Russian folk songs, which will contribute to the understanding of Russian folk art as an inexhaustible source of inspiration for the composer. It is no coincidence that M.I. Glinka said that the people create music, and composers only arrange it. Arranged by M.I. Glinka understood the deep comprehension of the spirit of folk music and its free, creative expression.

Researcher of Russian folk art T.V. Popova rightly noted that the Russian song is extremely diverse, the range of its images is wide: lyrical, dramatic, epic [2], [3]. The diversity of the Russian song required and still requires a different embodiment, with the features of which the Chinese students will be able to get acquainted by referring to the recordings of the Russian Folk Choir named after Pyatnitsky, as well as the Orlovsky Russian Folk Choir, the Belgorod Folklore Ensemble "Peresek" (artistic director N. Karacharov) and other folklore groups of Russia. Taking into account the modern possibilities of digital technologies, it is desirable to use not only audio, but also video recordings, as well as musical texts of folk songs for learning in practical classes.

As you know, M.I. Glinka rarely quoted folk songs. Knowing their characteristic features, and in particular, intonation warehouse, the composer created his own themes, perceived by the audience as genuinely folk. A confirmation of what for students can be the wedding choir "They roamed, spilled" from the third act of the opera "A Life for the Tsar". Listening to it, Chinese students will pay attention to the simplicity of the melody, the transparency of the harmony, the variable mode, the five beat meter, which bring this opera number closer to the ritual Russian folk song. Also contribute to the formation of awareness by Chinese students of the phenomenon of the influence of Russian folk art on the appearance in the work of M.I. Glinka of the Russian national opera will also have other musical material from the opera A Life for the Tsar, and in particular, Ivan Susanin's aria from Act IV.

As a result, students will come to the conclusion that the idea of creating a national opera required M.I. Glinka's purposeful work on the multifaceted study

of the phenomenon of opera and operatic art, the accumulation of impressions, the development of mature own ideas about opera performances, which the composer visited many times while in Italy. In this regard, the appeal in the process of studying the vocal methodology of M.I. Glinka to fragments of the opera “Ruslan and Lyudmila”. This is appropriate, for example, in the framework of considering the general and characteristic features of the Russian and Italian vocal schools. We can offer Chinese students to compare Rosina’s aria from Act II of G. Rossini’s opera “The Barber of Seville” and Lyudmila’s cavatina from Act I of the opera “Ruslan and Ludmila”. Lyudmila’s cavatina is a scene with the participation of the choir and consists of several sections depicting the heroine of the opera in different states of mind: sometimes sad, sometimes coquettish, sometimes affectionate and cordial. The first section of the cavatina is saturated with the intonations of an urban lyrical song-romance. The vocal part is decorated with numerous melismas and roulades, giving it an external brilliance. But these decorations are not empty: they characterize the cheerfulness of the heroine, in contrast to the display of the singer’s vocal abilities in Rosina’s aria.

In order to form the ideas of Chinese students about the influence on the formation of the vocal methodology of M.I. Glinka of Russian spiritual singing positively get acquainted with the recordings of Russian spiritual chants (performed by I. Kozlovsky); recordings of the Kiev-Pechersk Lavra, the Holy Trinity St. Sergius Lavra, the album “Russian Sacred Music” (performed by the family ensemble “Good News”).

As V.P. Ilyin, church hymns have always been distinguished by a calm, majestic narrative character. Smooth melodies, the absence of large intervals, average tessitura, and narrow sound volume made singing initially comfortable for the voice [4].

Acquaintance with the images of Russian spiritual music will help Chinese students to more clearly imagine:

- the requirements of “quiet” singing, which in Russian sacred music excluded the forcing of the voice, protecting it;
- the root causes of deep singing breathing, which is due to the length of the musical phrase, the slow pace and calm nature of church music.

Of course, the study of the vocal technique of M.I. Glinka is inconceivable without acquaintance with the composer’s romances, a kind of musical diary of the composer.

Glinka’s romances are mostly lyrical works. At the same time, the artist’s subjective feelings in romances acquire a high universal significance, according to the musicologist O. Levasheva [5].

Analyzing the romances of M.I. Glinka, Chinese students will get acquainted with the stylistic features of the composer’s vocal work in this genre:

- the presence of traditions coming from the chamber vocal culture of the 18th century;
- genre diversity (based on the genres common in the 19th century: sentimental-lyrical romance, elegy, “Russian song”, ballad);
- the singing nature of melody (the leading role of the performer-singer);
- intimacy of the accompaniment style (lack of complex texture, “concert”, external virtuosity);
- clarity of forms (lack of free, “through” development, preference for a couplet form, three-part or three-five-part with a contrasting middle episode [5].

It is advisable to include the romances “I am here, Inezilla”, “I remember a wonderful moment” to the words of A.S. Pushkin, “Do not say that your heart hurts” to the words of N. Pavlov and others.

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俄罗斯联邦高等教育机构音乐教育教学方法现代化的主要方向
**THE MAIN DIRECTIONS OF MODERNIZATION OF
APPROACHES TO TEACHING METHODS OF MUSIC
EDUCATION IN HIGHER EDUCATIONAL INSTITUTIONS OF
THE RUSSIAN FEDERATION**

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抽象的。文章介绍了方法论科学发展的主要方向，表明与俄罗斯社会在现代世界中地位的变化、政治条件密切相关，以及现代化的联邦国家小学教育标准的基本原则和优先事项。普通教育和基础教育以及俄罗斯联邦项目“现代学校”的路线图。作者定位了俄罗斯音乐教师和附加音乐教育教师的竞争力，他们能够在高专业水平上解决具有丰富经验和科学和教学潜力的俄罗斯联邦教育系统的目标和目标，包括在精神和道德教育领域以及培养年轻一代的创造能力。

关键词：主要发展方向，方法论科学，俄罗斯社会，联邦州教育标准，路线图，俄罗斯联邦项目，现代学校。

Abstract. *The article presents the main directions of the development of methodological science, suggesting a close correlation with the changed political conditions of the position of Russian society in the modern world, as well as the basic principles, priorities of the modernized federal state educational standards for primary general and basic education and the roadmap of the Russian federal project “Modern School”. The authors position the competitiveness of music teachers and teachers of additional music education in Russia, who are able to solve at a high professional level the goal and objectives of the education system of the Russian Federation, which has rich experience and scientific and pedagogical potential, including in the field of spiritual and moral education and the development of the creative abilities of the younger generation.*

Keywords: *main directions of development, methodological science, Russian society, federal state educational standards, road map, Russian federal project, modern school.*

The main directions in the development of methodological science imply a close correlation with the changed political conditions of the position of Russian society in the modern world, as well as the basic principles, priorities of the modernized federal state educational standards for elementary general education [1], basic general education [2] and the road map of the Russian federal project “Modern school” [3].

So, today the task of developing the *competitiveness* of music teachers and teachers of additional music education in Russia, who are able to solve at a high professional level the goals and objectives of the *domestic* education system, which has rich experience and scientific and pedagogical potential, as well as in the field of spiritual and moral education and development of the creative abilities of the younger generation.

Another, no less significant task is *to strengthen the practice-centric orientation of the educational process in the teaching methodology*, which is naturally associated with the emergence of a new category of “*functional literacy*” in the federal educational standards that came into effect on September 1, 2022. This task actualizes the mechanisms of *educational, quasi-professional and educational-professional activities*¹:

- contributing to the acquisition of professional experience in conjunction with the theoretical development of the traditions and innovations of Russian musical and musical-pedagogical education;

- modeling the professional work of a teacher-musician who is able to design the educational process, carry out the musical education of children, diagnose the level of development of the musical culture of students and contribute to their creative implementation in the art of music;

- forming the ability of future music teachers to initiate the solution of learning tasks and life situations by students on the basis of subject, meta-subject and personal results obtained in musical and creative activities.

The updated standards of primary general and basic general education activate the principle of *individualization*. In teaching methodology, this systemic element of the organization of the educational process is based on the equality of the invariant and the variable component.

The invariant is the general methodological guidelines determined by normative documents - federal education standards, the teacher’s professional standard, the federal law “On Education”. The variable component makes it possible to take into account in the educational process: the possibility for students to choose the topic of a course project according to the methodology of music education; music programs of one or another author (V.V. Aleeva; G.P. Sergeeva; L.V. Shkolyar, etc.) when performing practice-oriented tasks; topics of presentation at the semi-

¹ | Terminology by A.A. Verbitsky.]

nar in accordance with professional interests in the field of music/music-pedagogical education. Such an approach initiates the formation of self-determination in the problem field of the pedagogy of music education, allows students to reveal their individual potential and personal resource. In addition, the individualization of learning in mastering the methodology allows students to «see from the inside» the possibilities of implementing this principle in the further independent work of a teacher-musician. After all, even in the field of vocal and choral art, which, it would seem, is associated with the opposite category of “*collective beginning*”, “the whole is made up of separate units, and each unit retains its own peculiarity, originality, individuality” [4].

Along with the individualization in teaching of the methodology of music education in the light of the updated federal state educational standards for primary and basic general education, the following *principles* are being further developed:

- *differentiation*, which contributes to the formation of future musicians’ competence in modeling evaluation procedures as multi-level educational tasks - reproductive, productive and reflective;
- actualization of *soft skills* (flexible competencies), personal qualities that allow a person in the field of art to effectively and harmoniously interact with other people in society.

As can be seen from the above, the modernization of the federal educational standards of the modern school led to the requirement to return to the model of the unity of educational and educational activities. In this regard, in determining the directions for updating methodological science in the educational field «Art», the concept of B.M. Nemensky [5], who rightly believes that the rational-logical, scientific sphere and the emotional-figurative, artistic one have different objects of knowledge. In one case, this is an objective reality, in the other, a personal, human attitude towards it, and, accordingly, different forms of cognition, forms of activity, the path of development, the results of cognition and the results of development.

Table №1.
Comparative analysis of the rational-logical and emotional-figurative spheres of cognition (the concept of B.M. Nemesky)

Form of thinking	Form of knowledge	Form of activity	Subject of knowledge	Path of development	The results of knowledge	Development results
Rational-logical	concept	natural science	Reality	Exploring content	Understanding: patterns of nature and society	Scientific and theoretical thinking

Emotionally figurative	Artistic image	artistic	Relationship to reality	Experience (living content)	Attitude: emotional and value criteria of life	Emotional, artistic-imaginative thinking
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Along with understanding the importance of educational tasks in teaching the methodology of music education, it is necessary to strengthen the activity component, which will help future music teachers to realize the normative documents that determine the importance of: developing the ability of students to express themselves creatively in the art of music; formation of performing skills in children in various types of musical creativity.

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中国学生掌握的俄罗斯联邦师范大学作为一门学科的教师-音乐家的研究活动
**THE RESEARCH ACTIVITY OF A TEACHER-MUSICIAN AS AN
ACADEMIC DISCIPLINE IN PEDAGOGICAL UNIVERSITIES OF
THE RUSSIAN FEDERATION, MASTERED BY STUDENTS
OF THE PRC**

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抽象的。 文章介绍了未来教师-音乐家掌握研究活动的目标、目标和计划结果。 根据联邦国家预算教育高等教育机构“莫斯科国立师范大学”音乐艺术学院的经验, 拟议材料中的重点是证实学科在教育计划课程中的地位 44.03.01 教育学, 概况“音乐教育”(针对外国学生), 评估工具的内容和资金。

关键词: 研究活动、教育计划、课程、计划结果、目标、任务、内容、评估工具的资金。

Abstract. *The article presents the goal, objectives, planned results of the future teachers-musicians mastering research activities. Significant attention in the proposed materials from the experience of the Faculty of Musical Arts of the Federal State Budgetary Educational Institution of Higher Education “Moscow Pedagogical State University” is given to the substantiation of the place of the academic discipline in the curriculum of the educational program 44.03.01 Pedagogical Education, profile “Music Education” (for foreign students), content and funds of evaluation tools.*

Keywords: *research activity, educational program, curriculum, planned results, goal, tasks, content, funds of evaluation tools.*

Considering that the complex of professional activities of a musician teacher includes research, including the curriculum for training a music teacher at the Faculty of Musical Art of the Federal State Budgetary Educational Institution of Higher Education “Moscow Pedagogical State University” under the educational program 44.03.01 “Pedagogical Education”, profile “Music education” (for for-

oreign students) include the academic discipline “Research in the field of music education”. The purpose of this discipline is the formation of students’ competencies in the field of research activities of a teacher-musician.

The academic discipline “Research in the field of music education” is based on the study of other disciplines of the subject-methodological module: “Theory of music education”, “Methods of music education”, “Musical psychology and psychology of music education” and, in turn, is the basis for training to the state final certification, and in particular, the implementation by students and the defense of final qualifying work.

The discipline is aimed at the formation of the following competencies: UK-1, PK-11, PK-14; PK -15.

UK-1. Able to search, critically analyze and synthesize information, apply a systematic approach to solve tasks

PK-11 Able to use theoretical and practical knowledge for setting and solving research and artistic and creative tasks in the subject area (in accordance with the profile and level of education) and in the field of education.

PK-11 Able to use theoretical and practical knowledge for setting and solving research and artistic and creative tasks in the subject area (in accordance with the profile and level of education) and in the field of education.

PK-14. Able to establish meaningful, methodological and ideological connections of the subject area (in accordance with the profile and level of education) with related scientific fields.

PK-15. Able to determine his own position regarding the debatable problems of the subject area (in accordance with the profile and level of education).

The content blocks of the academic discipline “Research activity in the field of music education” are considered:

Table 1.
The content of the discipline “Research activity in the field of music education”

No.	Name of the topic (section) of the discipline
1	Introduction to the research activity of the teacher-musician
2	Main methodological characteristics of musical pedagogical research
3	The connection of the pedagogy of music education with philosophy, musicology, psychology, theory and history of musical performance
4	The structure and design of the course and final qualification work of the bachelor in the direction of «Pedagogical education», profile «Music education» (for foreign students)
5	Theoretical methods of musical and pedagogical research
6	Empirical Methods of Musical Pedagogical Research

Funds of evaluation tools are correlated with each of the content blocks:

Table 2.
The fund of assessment tools

No.	Name of the topic (section) of the discipline (module)	Monitoring tools for progress	List of competencies
1	Introduction to the research activity of the teacher-musician	Writing an annotation / review / generalization of the pedagogical experience of a music teacher in a basic educational institution. Task No. 1	Intermediate stage UK-1 PK-11 PK-14 PK-15
2	Main methodological characteristics of musical pedagogical research	Development of the methodological apparatus of course work on the problems of pedagogy of music education (at the student's choice). Task No.2	Intermediate stage UK-1 PK-11 PK-14 PK-15
3	The connection of the pedagogy of music education with philosophy, musicology, psychology, theory and history of musical performance	Development of a list of references for course work, including works in the field of philosophy, musicology, psychology, theory and history of musical performance. Task No.3.	Intermediate stage UK-1 PK-11 PK-14 PK-15
4	The structure and design of the course and final qualification work of the bachelor in the direction of «Pedagogical education», profile «Music education» (for foreign students)	Development of the structure of the student's course work on the problems of pedagogy of music education (at the student's choice). Task No. 4.	Final stage PK-11 PK-14 PK-15
5	Theoretical methods of musical and pedagogical research	Development of implementation in the course work of the interaction of methods of analysis and synthesis, generalization of musical and pedagogical experience,	Final stage PK-11 PK-14 PK-15

		extrapolation and interpretation of knowledge and methods of activity used in related sciences. Task No. 5.	
6	Empirical Methods of Musical Pedagogical Research	Development of conversation questions, tasks of questionnaires, tests, interviews for conducting experimental and search work on the problem of a student's term paper. Task No. 6.	Final stage PK-14 PK-15

As a result of this approach to the study of the academic discipline, students acquire:

knowledge:

- the nature of the relationship between musical and pedagogical science and practice;

- conceptual guidelines in the field of methodology, history and theory of music, musical psychology and methodology for solving actual problems of music education;

- the essence of the methodological links between the pedagogy of music education and philosophy,

- musicology, psychology;

- technologies for analyzing problems and trends in the field of musical art;

- methods of organizing the stages of experimental and search work; techniques, methods and ways of processing the results of the ascertaining and verification stages, requirements for the design of the formative stage of experimental and search work.

skills:

- apply the acquired methodological knowledge when writing a research paper;

- prepare an annotation, review, report in accordance with the requirements for educational and

- research activities of the future teacher-musician;

- to carry out musical and pedagogical

- analysis of philosophical, general scientific and particular scientific literature related to the pedagogy of music education;

- to show their own position regarding the debatable problems of the subject area «Music»;

- to formulate the tasks of work at each stage of experimental and search work.

practices:

- a methodology for planning and implementing experimental work on a research problem; a methodology for planning and implementing experimental work on a research problem;
- skills of complex search, analysis and systematization of information on the studied problems of musical art using scientific and textual sources, scientific and educational literature, information databases;
- methodology for working with scientific and educational literature on the research problem;
- worldview reflection and analysis of problems and trends in the field of musical art;
- research methods: theoretical and empirical in accordance with the purpose and objectives of each stage of experimental and search work.

Educational program 44.03.01 «Pedagogical education», profile «Music education» (for foreign students) was created in view of the demand for professional training in the universities of the Russian Federation (and in particular, Moscow State Pedagogical University) of Chinese citizens. In this regard, an important pedagogical condition for the implementation of a competency-based approach to the development by Chinese students of the research activities of a teacher-musician at the Faculty of Musical Art of the Moscow State Pedagogical University is the recognition of equivalent in the professional training of foreign students of Russian universities «Guidance programs in academic disciplines for the preparation of bachelors at the faculties of music in higher educational institutions of China» [1] and FSES of HE [2] in the direction 44.03.01 Pedagogical education, which determines the organization of the educational process in the Russian Federation.

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关于新的音乐协同哲学
ABOUT THE NEW SYNERGETIC PHILOSOPHY OF MUSIC

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抽象的。这篇论文介绍了作者的音乐哲学模型，他称之为新协同音乐哲学。需要强调的是，该模型之所以获得这个名称，是因为它依赖于古典 - 旧 - 协同学和正统协同主义 - hesychasm 的综合。注意到协同概念在模型形成中的作用。

它表明，结合旧的协同学和 hesychasm，可以说：世界是物质到精神的非线性、系统进化的上升——物质的精神化。

建议这种上升的不同构造是可能的。在提议的模型中，它表现为系统在以下方向的进化运动：自然-社会-文化-艺术-音乐。因此，音乐最终成为物质上升到精神、物质消融为精神的体现。

关键词：新协同学、协同学、协同作用、哲学、音乐、物质、精神。

Abstract. *The paper presents the author's model of the philosophy of music, which he called the New Synergetic Philosophy of Music.*

It is emphasized that the model received this name due to its reliance on the synthesis of classical – old – synergetics and Orthodox synergism – hesychasm. The role of the concept of synergy in the formation of the model is noted.

It is indicated that combining the old synergetics and hesychasm, it can be stated: the world is a nonlinear, systemic-evolutionary ascent of Matter to Spirit – the Spiritualization of Matter.

It is suggested that different construction of this ascent is possible. In the proposed model, it appears as an evolutionary movement of systems in the direction: nature – society – culture – art – music. Thus, music turns out to be the embodiment of the ascent of Matter to Spirit, the Dissolution of Matter into Spirit.

Keywords: *New synergetics, synergetics, synergy, philosophy, music, Matter, Spirit.*

The New synergetic philosophy of music is our proposed model of the philosophy of music. We called it so because it is based on the synthesis of classical (old) synergetics and Orthodox synergism – hesychasm. Let's explain what has been said.

As you know, classical (old) synergetics (which emerged in the 70s of the XX century) was an interdisciplinary direction in science, within which the features of self-organization of systems were studied. It was found that systems evolve in the direction of: from less organized: orderly, stable, reliable – to more organized: orderly, stable, etc.

However, interestingly, as noted by the founder of synergetics, German physicist Herman Haken, the word “synergy” lies at the heart of the name of the new scientific branch proposed by him – “synergetics” (“I chose the word ‘synergetics’ then (from the word ‘synergy’. – *A.K.*), – Haken admits, – because Greek words were assigned to many disciplines in science. I was looking for a word that would express... the general energy to do something” [10, p. 209].).

Having chosen the concept of “synergy” for the name of the scientific field created by him, the scientist has never returned to it in his works, and yet this concept is extremely capacious.

The essence of the concept of “synergy” is revealed with special depth in Orthodoxy, its focus is hesychasm, where it means the unity of the energies of man and the energies of God.

The nature of this unity is explained by the systematizer and substantiator of the practice of hesychasm, St. Gregory Palamas (XIII – XIV centuries). As the saint points out, there is light – “the spirit poured out upon us by God according to His promise from the Spirit of God,... the action of the essence of the Spirit” [3, p. 307]. This action is “a gift ... of the all-holy Spirit (embodied by His energies. – *A.K.*) ... The Holy Spirit surpasses his energies not only because He is their cause, but also because what is accepted always turns out to be only an insignificant fraction of His gift” [3, p. 307, 309].

An important distinguishing feature of the interpretation of the unity of the energies of man and the energies of God by the interpreters of the practice of hesychasm was that in this unity they emphasized the participation of the energies of the “whole” person. The famous Byzantine theologian Maxim the Confessor (VI – VII centuries) already testifies to this: “People all participate in God entirely,.. so that the whole man may become God...”[16, p. 71-72]. (By the way, the above thought of Maxim the Confessor is reproduced by Gregory Palama [3, p. 327].) Thus, the unity of the energies of man and the energies of God presupposes the increase of the energies of the created to the energies of the Divine (1).

The combination of old-style synergetics and synergism allows us to talk about the birth of a new type of synergetics – a New synergetics. Our model of the philosophy of music is built on the basis of New synergetics. Let’s turn to this model.

First of all, let us state the position: there is no doubt that, according to the New Synergetics, the world is a systemic-evolutionary ascent of Matter to Spirit.

This ascent can be built in different ways. In our version, it appears as an evolutionary movement of systems: nature – society – culture – art – music. Let’s

explain what has been said and start with a comment on the evolutionary movement: nature is society.

The fact that nature is a prerequisite of society is convincingly shown by A.G. Masleev. According to Masleev, “nature ... acts as a permanent and (obligatory. – A.K.) condition of the subject-practical existence of ... society” [12, p. 52].

At the certain stage of its own evolutionary the society does generate the culture’s arising.

There is necessary to mark, that society and culture are practically not differing traditionally in national scientific literature. With that in selective works of scientists there is persistently conforming idea about the different occurrences between society and culture, where culture is the new level of society’s development in qualitative relation. In our opinion, that idea is most distinctly described by A.K. Uledow already in 70th years of 20th century. In scientist’s opinion “the culture is not structural part of whole (like sphere, field, section etc.), but sooner certain qualitative society’s statement at each present stage of its development” [15, p. 27-28]. By what is explained such interpretation?

Obviously, the arising of society was prepared by human’s appearance. More precisely - human’s consciousness. There is evidently that evolution of society is associated with human’s development, with its psychic. There is known that supper-consciousness apart from consciousness is the evidence of more higher lever of development of human’s psychological organization. In psychological literature that occurrence is also named as up-consciousness. Being the resource of human’s creative illumination (intuition), its up-consciousness, by optimal realization does secure the effectiveness of creative human’s activity, moreover in different orientations: in art, in science, in philosophy and in others [2]. Because that spheres do forming up culture’s sphere, as it is known in general, therefore maximal identity of human’s up-consciousness does give evidence about society’s escalating in process of evolution in culture.

Art is becoming certain stage of culture’s evolution. Speaking about that stage of evolutionary world’s forming up, firstly there is important to note the exclusive connection of culture and art, since art is organic culture’s part. There is arising question: the degree of system evolutionary world’s running in our construction, subsequent after culture, while there are included also science, philosophy and other components in that plane? That is distinctive “culture’s will to art” – as the result of further human’s evolution. We will explain spoken words.

As we saw, transition from nature to society in process of evolution world’s forming-up has been secured by human’s arising – human’s consciousness. Further evolutionary movement form society to culture was connected with human’s development, its psychic. By created phenomenon of up-consciousness of human psychic’s structure.

By that way we can presuppose, that subsequent evolutional jump of culture must be connected with further improvement of human's psychical organization. In which duration it should be realized?

A fresh addressing to lows of synergetic world-conception, there might be said, that human psychic is distinctive system. Because one from the conditions of system's development is reinforcement of integration processes, occurring in its system, thus development of human psychic, as of system, must respect that principle (2).

In our opinion further evolution firming-up, improvement of human's psychic in manifested by integration in this structure of supper-consciousness, self-consciousness, supper-consciousness, that are predetermine human's consciousness forming-up (3).

We suppose that art is exactly what bringing out (reifies) the integrated merger of supper-consciousness, consciousness and up-consciousness of human – i.e. exposes human's self-consciousness in structure of his psychical activity. Therefore art is exactly what goes behind culture in process of evolution world's deployment. Understanding that art is the stage of world's development, exactly after culture – is qualitatively new level of culture's development. Popular opinion about the art in specialist literature for art as culture's code, culture's nucleus etc. especially the concept of art as culture's self-consciousness, proposed by M.S. Kagan, and does reflect it [5].

Music is being the stage of art's evolution – like all of evolving world's systems discussed above (nature, society etc.), presented by itself system forming-up. Music and art are more closely conjugate than in previous case of culture and art. If art belongs to culture, music and musical art – it is actually art's variety. Moreover as variety it is being most integrated (synthesized) i.e. – most perfect embodiment of art in whole. With what is it connected?

The reason of that situation – is the further evolution of human's psychic, caused by new stage of integration processes occurring in it. In present case – the integration of self-consciousness, leded to gaining true authentic "I" (4). In music we are meeting with that integration of consciousness – of truth "I" – due to what music renders as most completed perfect art (5). Given admission convince about, that actually music is an expression of the embodiment of the systemic-evolutionary ascent of Matter to Spirit, the Dissolution of Matter into Spirit (for more information about the model, see: [7; 8; 9; 13]).

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(1) *The commonality of synergistic and synergetic dynamics is obvious. An authoritative expert in the field of synergistic phenomena, S.S. Khoruzhiy, drew attention to this generality. The scientist writes: Synergetic dynamics is “a synergetic type of dynamics, open and well studied in physics” [6, p. 11]. V.V. Nalimov also expressed similar thoughts on this matter [14].*

(2) *In favor of present purpose the works about Central Nervous System are giving evidence. So for example A.M. Iwanitsky indicates, that developing of nervous processes, leading for forming-up higher psychological functions, does find “analogy with principles of more general order” in Iwanitsky’s point, behind what he means the rules of system processes, described in particular by I. Prigozhin and I. Stengers [4, p. 876].*

(3) *By M.K. Mamardashwili’s remark the human’s self-consciousness might be reviewing as human’s “consciousness of consciousness” [11, p. 16].*

(4) *This authentic “I”, in analogy with M.K. Mamardashwili’s remark mentioned above, can be understand already as “self-consciousness of self-consciousness” (existence of what gives evidence about exclusively human’s personality development).*

(5) *M.Sh. Bonfeld’s opinion is confirming this spoken thesis. “Musical thinking – as scientist confirms – ...is the variety of artistic continual thinking, inherent in all types of art. However there exist enough facts that give evidence about music’s special position in this sphere. Abstractness from realities of non-artistic world, underlined meaningful non-discreteness of musical tissue... are forming up from music, from some have continuity’s quintessence. They are lifting the music on continuity-mental level, unattainable for other art’s types” [1, p. 573].*

E.M.雷马克小说中的情态范畴：比较和翻译方面

**THE CATEGORY OF MODALITY IN E.M. REMARQUE'S
FICTION: COMPARATIVE AND TRANSLATION ASPECTS**

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抽象的。在这项工作中，以 E.M. Remarque 的散文及其俄语翻译为例，考虑了通过语言实现模态关系的功能可能性。 本研究的目的是确定和描述文学文本中情态手段的使用细节，并分析它们的语用和翻译方面。 在处理文本材料时，使用了复杂的方法，包括成分、上下文和比较类型的分析。 事实证明，原文和译文之间的明显差异往往是由于文本作者和译者对世界的形象存在差异。 这项工作的科学和实践意义取决于它的创新性，因为基于 E.M. Remarque 文学文本材料的翻译的特殊性仍然很少被研究。 得出的结论是，对等词的个别比喻可能重合，但在原文和译文中几乎找不到比喻构成完全相同的词。

关键词：小说，情态范畴，翻译，情态动词，情态词，情态助词，作者的情态。

Abstract. *In the work, on examples from the prose of E.M. Remarque and its translations into Russian, the functional possibilities of implementing modal relations by means of the language are considered. The purpose of the study is to determine and describe the specifics of the use of modal means in a literary text, as well as to analyze their pragmatic and translational aspects. When processing textual material, a complex methodology was used, including component, contextual and comparative types of analysis. It turns out that the obvious differences between the texts of the original and the translation are often due to the discrepancy between the images of the world of the author of the text and his translator. The scientific and practical significance of this work is determined by its innovative nature, due to the fact that the specificity of translations based on the material of literary texts by E.M. Remarque remains as yet little studied. It is concluded that individual figurative meanings of equivalent words may coincide, but words with absolutely the same composition of figurative meanings are practically never found in the original and translations.*

Keywords: *fiction, category of modality, translation, modal verbs, modal words, modal particles, author's modality.*

Fictional prose of E.M. Remarque is characterized by bright and expressive manifestations of the German language of the common people. The very style of presentation is restrained, but extremely expressive, and the works are imbued with deep lyricism, subtle irony and hardships of rainy times. It is in them that the use of various ways of expressing modality allows the reader to better understand the text and feel the mood of the writer.

The category of modality is known to be a linguistic universal and belongs to the main categories of natural language [1]. The category of modality, according to E.I. Belyaeva, is realized in the utterance by units belonging to different language levels: morphological, syntactic, lexical, prosodic, as well as combinations of these units [2].

The syntactic means of expressing modality in German is moods: indicative or indicative (der Indikativ), imperative or imperative (der Imperativ) and subjunctive or conjunctive (der Konjunktiv). In the indicative mood (der Indikativ), the German verb has six tense forms indicating an action in the present, past or future tense. It denotes an assessment of what is happening as something real, taking place in reality, for example: *Der Tag ist wirklich gut heute. Sogar Post ist da, fast jeder hat ein paar Briefe und Zeitungen* [Remarque. Im Westen nichts Neues]. / *День сегодня и в самом деле выдался хороший. Даже почта пришла; почти каждый получил по несколько писем и газет* [Trans. by Yu. Afonkin]. In this example, Yu. Afonkin conveys the modality, expressed in German with the help of the indicative, with the indicative mood of the Russian language, without losing the author's style.

The subjunctive mood or subjunctive is a verbal category of the German language that has wide functions. Unlike the indicative, the main grammatical meaning of the subjunctive is that the action is thought of only as potentially possible, desirable (but doubtful in terms of its feasibility) or even unrealistic, for example: *Es ist das andere gewesen, diese hellsichtige Witterung in uns, die uns niedergeworfen und gerettet hat, ohne daß man weiß, wie. Wenn sie nicht wäre, gäbe es von Flandern bis zu den Vogesen schon längst keine Menschen mehr* [Remarque. Im Westen nichts Neues]. / *Нет, это было другое, то, похожее на ясновидение, чутье, которое есть у всех нас; это оно вдруг заставляет солдата падать ничком и спасает его от смерти, хотя он и не знает, как это происходит. Если бы не это чутье, от Фландрии до Вогезов давно бы уже не было ни одного живого человека* [Trans. by Yu. Afonkin]. In this example, using the subjunctive mood E.M. Remarque talks about a potential action in the past. From an expressive point of view, this once again emphasizes the importance of the “flair” about which the author writes. Yu. Afonkin managed to convey this manifestation of modality in the text using the conditional mood in Russian.

The writer uses quite widely such means as modal verbs, modal words and particles. We note right away that in the texts of his novels and their Russian transla-

tions, a significant role is given to modal verbs, which, in comparison with moods, more accurately convey the shades of modal meanings. With their help, the author expresses this or that action as possible or impossible, obligatory or unnecessary, probable or improbable, for example: „Ich glaube, wir können das jetzt ausmachen“, sagte er und drehte den Schalter um [Remarque. Arc de Triomphe]. / «Я думаю, теперь уже можно погасить», – сказал он и повернул выключатель [Trans. by Schreiber and B. Kremnev]. We noted the presence of almost the entire range of modal verbs: können / мочь, быть в состоянии, иметь возможность, wollen / хотеть, желать, намереваться, mögen / любить, чувствовать расположение к кому-либо, müssen / быть должным, быть вынужденным что-либо делать, dürfen / мочь, сметь, иметь право, sollen / быть должным, быть обязанным, следовать, надлежать, lassen / позволять, давать (возможность), разрешать, велеть, заставлять, for example: „Wer rechnet heute noch mit Zukunft! Wozu soll man sich darüber jetzt schon Gedanken machen!“ [Remarque. Drei Kameraden]. / «Кто сегодня говорит о будущем! Зачем ломать себе голову над этим!» [Trans. by Yu. Afonkin].

In this example, the modal imperative verb “sollen” serves to reinforce the modality of the utterance. In the translation, I. Schreiber omits this verb, however, he adequately conveys the author’s thought with the help of the phraseological unit “ломать голову.” It should be noted that in Russian modal verbs are usually used in combination with the infinitive. Among the constructions expressing modal relations, three groups are distinguished: can, to dare, to be able + infinitive; want, desire + infinitive; might, should, need + infinitive, for example: Vor mir klafft der Trichter. Ich fasse ihn mit den Augen wie mit Fäusten, ich muss mit einem Satz hinein [Remarque. Im Westen nichts Neues]. / Передо мной зияет воронка. Я пожираю ее глазами, мне нужно добраться до нее одним прыжком [Trans. by Yu. Afonkin]. In this case, the modal verb cannot be used without the infinitive, so Y. Afonkin’s translation can be considered adequate, because the author’s modality has been preserved.

So, the role of modal verbs is to demonstrate the attitude of the person to the action and the attitude of the author of the work to the stated fact. Moreover, their presence also clarifies the different degree of conviction in the interpretation of a certain fact. For example, the highest degree of confidence is explicated using the verb müssen: „Robby, sagte er, mir ist da was eingefallen. Wir müssen uns mal um das Mädchen von dem Binding kümmern“ [Remarque. Drei Kameraden]. / «Робби, – сказал он. – Знаешь, что мне пришло в голову? Нам нужно хоть разок побеспокоиться о той девушке, что была с Биндингом» [Trans. by Yu. Afonkin]. The modal verb “müssen” indicates that the hero has firm intentions, he is confident in his decision. The translator presents this with the help of the “нужно побеспокоиться” construction, adequately realizing the author’s modality.

The smallest degree of confidence can be realized using the modal verb *mögen*: „In eine Bar? Gibt es denn Bars, die am hellen Tage offen sind?“ „Ich weiß eine“, sagte ich. „Sie ist allerdings sehr ruhig. Wenn Sie das mögen...“ „Manchmal schon...“ [Remarque. Drei Kameraden]. / «Бар? Разве бывают бары, открытые средь бела дня?» «Я знаю один, – ответил я. – И там вполне спокойно. Если вы не возражаете...» «Ну что ж, для разнообразия...» [Trans. by Yu. Afonkin]. With the help of the verb “*mögen*”, the writer managed to convey the hero’s doubt, and the translator achieves adequacy by using the expression “если вы не возражаете”.

The verb *lassen* also has a significant semantic spectrum, which has the following semantics:

– «побуждать кого-либо действовать», for example: „Lass den Quatsch“, fluchte ich, „wir brauchen dich hier. Wozu willst du schon vorher ins Lazarett!“ [Remarque. Drei Kameraden]. / «Брось эту ерунду, – зашипел я. – Ты нам нужен здесь. Зачем раньше времени попадать в больницу!» [Trans. by Yu. Afonkin]. His presence in the form of an imperative is able to induce the hero to action. The translator managed to convey the modality of this sentence by using the verb “брось” also in the imperative mood.

– «не препятствовать действию», for example: „Rot wäre schöner gewesen, Puppi! Aber du musstest natürlich deinen Kopf durchsetzen.“ „Nu lass mal“, sagte Puppi verdrossen [Remarque. Drei Kameraden]. / «Красный цвет был лучше, пупсик! Но ты, конечно, всегда должен настоять на своем!» «Да отстань ты!» – раздраженно бросил пупсик [Trans. by Yu. Afonkin]. The phrase «lass mal» expresses a dismissive attitude towards a companion, not a desire to interfere with her remarks and enter into a dialogue with her. Yu. Afonkin uses an exclamatory sentence instead of an affirmative one and conveys the modality of this situation with the help of a colloquial expression.

– «велесть, заставлять, поручать», например: „Lass uns mal allein“, sagte er schließlich grob [Remarque. Drei Kameraden]. / «Оставь-ка нас одних», – сказал он, наконец, грубо [Trans. by Yu. Afonkin]. The writer, using the imperative mood and the verb «lassen» as a requirement, expresses his dislike through the lips of the hero. The Russian translation adequately illustrates the author’s modality with the same imperative mood.

– «позволять, разрешать, допускать, давать (возможность)», for example: Ich öffnete eine Tür des Wagens und ließ den Motor an. Dann schwieg ich, um Blumenthal Zeit zur Besichtigung zu lassen [Remarque. Drei Kameraden]. / Я открыл дверцу и запустил мотор. Потом я помолчал, предоставляя Блюменталю время для осмотра [Trans. by Yu. Afonkin]. The verb «lassen» in this example illustrates permission, permission. The translators were able to adequately convey it with the help of the adverbial participle «предоставляя».

Modal words also play an important role in the texts of novels, allowing in many cases to briefly but capaciously convey various semantic shades. It should be noted that both in the works of linguists and in the linguistic terminological dictionaries themselves, a single concept of the term “modal word” has not yet been identified. For example, «Dictionary of Linguistic Terms» edited by O.S. Akhmanova defines a modal word as a term that has lost its specific lexical meaning and functions as a means of descriptive expression of modality [1]. This applies to modal words, both in Russian and in German.

In the writer’s texts there are many examples of this category of words, which can be, for example, the answer: „Wissen Sie nicht, dass das städtische Anlagen sind?“ knurrte er dann empört. Ich lachte. „Natürlich weiß ich das! Oder glauben Sie, ich hielt das hier für die Kanarischen Inseln?“ [Remarque. Drei Kameraden]. / «Известно ли вам, что это городские парки?» – гневно спросил он. Я рассмеялся: «Конечно, известно; или, по-вашему, я принял это место за Канарские острова?» [Trans. by Yu. Afonkin]. The presence of the modal word «natürlich» illustrates the hero’s ironic response, while also explicating the modality of the sentence, which is adequately conveyed in the Russian translation or exclamation/reaction: Lenz riss mir den Scheck aus der Hand. „Unmöglich! Wird bestimmt ungedeckt sein!“ [Remarque. Drei Kameraden]. / Ленц выхватил у меня чек: «Это невозможно! Чек наверняка останется неоплаченным!» [Trans. by Yu. Afonkin]. In the example, the modal word implements the emotional reaction of the characters to what is happening, also determining the modality of the entire statement.

Modal particles are also lexical means of expressing modality, which, according to the German linguist G. Helbig, due to their elusive meaning, cannot be described either syntactically or semantically. They act mainly as illocutionary indicators, i.e. indicators of speech actions [7]. In German-language studies devoted to this category of words, the term «die Abtönungspartikel» (shading particles) is also widely used, that is, unchangeable words with which the speaker expresses his attitude to the statement, tries to influence his interlocutor, express agreement, his assessment, point out the consequence, etc. The same modal particle can perform different functions in different contexts [13]. The most commonly used ones are: aber, auch, bloß, denn, doch, eben, eigentlich, etwa, halt, ja, mal, nur, schon, vielleicht, wohl, for example: „Ich habe nichts gegen die Beschlagnahme der Zigarre“, sage ich. „Es ist rohe Gewalt, und mehr kennst du ehemaliger Unteroffizier ja nicht vom Leben. Aber wozu die Zigarrenspitze?“ [Remarque. Der schwarze Obelisk]. / «Ничего не имею против конфискации сигары, – заявляю я. – Хотя это грубое насилие, но ты, как бывший унтер-офицер, ничего другого в жизни не знаешь. Все же зачем тебе мундштук?» [Trans. V. Stanevich]. Here Bodmer jokingly mocks Georg’s habit of using a mouthpiece when smoking. The use of

the particle «aber» contributes to a more vivid transmission of a sense of surprise. In the Russian translation, V. Stanevich shows this with the help of an intensifying particle «же».

The following example illustrates the use of the particle «denn» as a means of conveying a hint of additional surprise, layered on top of the main connotation: „Er wollte, du hattest nicht verkauft“, sagt Georg Kroll. „Was? Was soll denn das nun wieder heißen?“ [Remarque. Der schwarze Obelisk]. / «Он жалеет, что ты продал крест», – поясняет Георг Кроль. «Жалеет? Как прикажешь это понимать?» [Trans. V. Stanevich].

A number of modal particles are used in specific types of sentences: doch, eben, halt, ja, schon – in narrative; denn, eigentlich, wohl – in interrogative; doch mal, schon – in imperative sentences; bloß, doch, nur, vielleicht – in statements expressing desire and exclamatory sentences. According to G. Schroeder, modal particles bring a wide variety of emotions into the utterance. For example, the modal particle «denn» can express a whole range of emotions in interrogative sentences: helplessness, curiosity, hostility, doubt, impatience and irritation, etc. [13]: Ravic ließ die Augen nicht von den gleitenden Wagen. „Was denn? Was denn, Ravic?“ [Remarque. Arc de Triomphe]. / Равик не сводил глаз с машин, пронесивших мимо. «Так что же случилось? Что случилось, Равик?» [Trans. I. Schreiber and B. Kremnev]. In this case, the particle “denn” used in the interrogative sentence expresses sincere interest in getting an answer to the question asked. Translators I. Schreiber and B. Kremnev use lexical repetition to achieve a more accurate translation of the author’s modality.

The modal particle «doch» in declarative utterances has a wide range of functions, including the correlation of the utterance in which it is used with the preceding one; establishing an argumentative connection between statements; rejection of misunderstood or false positions; influence on the development of interpersonal relationships. The particle can also give the statement various communicative shades: an answer, a request, an order, a ban, a censure, etc., for example: „Ich muss doch sehr bitten, sagt er schließlich, in meinem Lokal kann man nicht solchen Larm machen“ [Remarque. Der schwarze Obelisk]. / «Я попрошу... – заявляет он, наконец – в моем ресторане не полагается так шуметь» [Trans. V. Stanevich]. With its help, the author expresses a demand, a convincing request. In the Russian version of the translation, the shade of the demand is reinforced by the verb “заявлять”, which gives the hero’s speech a more official style.

In Russian, particles, since their semantics reflects the variety of shades of the speaker’s relationship to the reported, are mainly related to the means of expressing subjective modality. They give additional modal-semantic shades to sentences and individual words, for example, the modal meaning of uncertainty, ambiguity can be transmitted in Russian through the particle “что ли”: Ich stand meiner

Wirtin gegenüber. „Wo brennt's?“ fragte Frau Zalewski. „Nirgendwo“, erwiderte ich. „Ich will nur meine Miete bezahlen“ [Remarque. Drei Kameraden]. / Я стоял перед своей хозяйкой. «Пожар, что ли, случился?» – спросила фрау Залевски. «Никакого пожара, – ответил я. – Просто хочу уплатить за квартиру» [Trans. by Yu. Afonkin]. The combination of particles “что ли” introduces a certain doubt into the statement, ambiguity with a touch of irony, since the tenant usually paid much later.

To emphasize the optimality of the feature, its compliance with the desired goal, the combination of particles “как раз” can also be used: Köster und Lenz saßen im Büro. „Du kommst gerade recht“, sagte Gottfried [Remarque. Drei Kameraden]. / В конторе я застал Кестера и Ленца. «Ты пришел как раз вовремя», – сказал Готтфрид [Trans. by Yu. Afonkin]. The particle «как раз» expresses the timeliness of action, satisfaction. It emphasizes the good timing of the visit and is used to illustrate the modality of the situation.

Thus, the German language, along with Russian, has a fairly wide system of modal meanings and ways of explicating them directly in speech. The lexical means of expressing modality include, among others, modal verbs, modal words, and particles that express various shades of modality and emotions without naming them. Various lexical means and techniques for creating the expressiveness of a literary text can often interact. Concentrating them in one context, E.M. Remarque creates a special updated artistic world of the work, forms its greatest expressive potential. In the texts of novels, linguistic possibilities do not always coincide. Separate figurative meanings of equivalent words can have an adequate translation, but words with absolutely the same composition of figurative meanings are practically never found in the original and translations.

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论俄汉对政治话语翻译的特殊性问题
ON THE ISSUE OF THE PECULIARITIES OF THE TRANSLATION
OF POLITICAL DISCOURSE IN THE RUSSIAN-CHINESE
LANGUAGE PAIR

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抽象的。文章提出了理解和正确翻译俄罗斯和中国的政治声明和学说的重要性的问题，这是两国成功开展国际合作的主要组成部分之一。政治话语作为解决国际冲突的一种方式，被视为调节国家间关系的特殊工具。

关键词：政治话语，翻译，语言特征。

Abstract. *The article raises the question of the importance of understanding and correct translation of the political statements and doctrines of Russia and China, which is one of the main components of successful international cooperation between the two countries. Political discourse, which serves as a way to resolve international conflicts, is considered as a special tool for regulating relations between countries.*

Keywords: *political discourse, translation, linguistic features.*

The concept of “discourse” causes certain difficulties for linguists, since it is a complex multicomponent process. In modern linguistics, there are many approaches to the definition of this concept. Discourse as a whole is associated with pragmatic, sociocultural, psychological and other factors. Its main feature is the obligatory functioning of the text in a certain context, time and space. For example, a functional approach: “discourse” is interpreted as a type of dialogical utterance; structural–syntactic approach: “discourse” – two or more sentences connect-

ed by a single meaning; structural–stylistic approach: “discourse” is understood to have stylistic specificity and high contextuality of the organization of colloquial speech; social–pragmatic approach: “discourse” – a text placed in life, in a situation of communication and presented as a special social reality. Having considered several approaches to its definition and based on the scientific work of A.K. Khurmatullin “The concept of discourse in modern linguistics”, it is possible to single out the social–pragmatic approach as the most relevant at the present time [2].

Based on the approach to understanding discourse as a whole, political discourse is characterized as texts and speeches uttered under certain conditions to express political ideology. Political linguistics studies political discourse. Such linguists as B. Palek, V. Dresler, E. Landovsky, M.M. Bakhtin, E. Shcheglov, A.N. Baranov, O.L. Mikhaleva explored various aspects of discourse in their works. There are relatively few studies devoted to China’s political discourse abroad. Among Chinese linguists, Cheng Changwen, Wang Handong, Hu Huatao, Hu Yayuan made the greatest contribution to the study of this linguistic phenomenon.

Political discourse covers many aspects related to speech activity. As a linguistic phenomenon, political discourse is an activity that creates and reproduces meanings organized by specific historical and socio-cultural codes, creating, maintaining and transforming relations of power and subordination in society [3]. According to Cheng Changwen, every political discourse has its own rules, which are repeated in texts, works and dialectical situations [4].

Since the main purpose of political discourse is to influence the audience in order to achieve political influence, this determines the stylistic, syntactic, grammatical and lexical features of the political language. Having analyzed the main linguistic features of political texts, it is worth noting at the vocabulary level the widespread use of professional political terminology, vocabulary of solemn and official business styles, as well as words with emotional coloring and political metaphors that help political leaders maintain their positive image. In addition, in the speeches of politicians of the Russian Federation and the People’s Republic of China, it is often possible to find nouns with abstract meanings.

Political discourse in Chinese is characterized by the widespread use of common vocabulary, terms of the social–political sphere, toponyms and anthroponyms. From the point of view of stylistic design of political texts, the use of such means of expression as *chengyu*, epithets, comparisons, political metaphors are characteristic. At the syntactic level, we can note the predominance of complex common sentences designed to have an effect on the audience. Syntactic and grammatical transformations in the translation of texts of political discourse in Chinese and Russian correspond to the general stylistics of the text. Using one or another translation technique, it is necessary to focus not only on the maximum adequate reflection of the meaning, but also on preserving the degree of emotional impact that is inherent in the source text.

After analyzing the approaches of various researchers, it becomes possible to classify political texts by genre and identify their most characteristic features. Based on a variety of parameters and criteria, the classification according to the principle of goal-setting, by spheres of activity, by the nature of the leading intention, by the type of subject-address relations, by the volume of information, as well as by the monologue or dialogical of forms seems to be the most complete.

The texts of political discourse in both Chinese and Russian are distinguished by the wide use of social-political terminology, clichéd formulas, lexical units with a positive connotation, various means of artistic expression, which are a means of emotional impact on the audience. The vocabulary of political texts is saturated with emotionally colored units, which are translated using words of a high archaic style. Social-political terms and clichéd constructions of political discourse most often have a direct equivalent or several functional analogues in the language into which the translation is carried out. This is due to the frequency of use, the need to diversify speech, the different origin of terms.

One of the difficulties in translating a political text is the appeal of political leaders in their speeches to historical and cultural features. Russian translation does not cause any serious difficulties, but the translation from Chinese into Russian may require the use of descriptive translation techniques. This is due to the fact that these elements in the speech of Russian politicians are universally known facts (for example: the mention of the Great Patriotic War or the allusive phraseology “sink into oblivion”), while Chinese politicians resort to mentioning narrowly known cultural realities that are not always understandable to a listener ignorant of Chinese culture (for example: speaking about the origins of the Chinese nation, the mention of the first ancestor Fu-xi, guessing by hexagrams, or the patron god Shennong, trying medicinal herbs).

The peculiarities of political discourse are also manifested at the grammatical and syntactic levels. The texts of political communication are designed for the mass reader and listener; therefore, they are saturated with special grammatical constructions, slogans, appeals, precedent statements and quotations. The syntactic and grammatical structure of political discourse is characterized by the predominance of complex common sentences. A commonly used construction technique is syntactic parallelism. When translating, various syntactic transformation techniques can be used, such as syntactic division, changing the type of subordinate clause, inversion of sentence members, changing the grammatical form and sentence member. At the syntactic level, it is possible to note the presence of complex common sentences with different types of connections, rows of homogeneous terms. When translating, it is often necessary to change the type of connection from a complex to a simple sentence division. In addition, inversion and emphases are used, which is due to the stable word order in the Chinese language [1].

Having considered the stylistic features, it becomes possible to identify a predisposition to the construction of texts of political discourse in accordance with the canons, adding a wide use of means of expression. When translating the speeches of Xi Jinping and Vladimir Vladimirovich Putin, one should focus not only on an adequate reflection of the meaning of the statement, but also on maintaining the degree of emotional impact on the addressee. For the translator, the greatest difficulty is the politicians' appeals to historical and cultural peculiarities, to well-known realities (for example, the phenomena that are narrowly focused, understandable only to the recipient who is knowledgeable in this culture (for example, the phenomena). When translating, techniques such as literal translation, explication and demetaphorization are widely used.

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俄语表达否定的形态学方法

MORPHOLOGICAL WAYS OF EXPRESSING NEGATION IN THE RUSSIAN LANGUAGE

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抽象的。本文介绍了用俄语表达否定的形态学方法。提供了几种用于实现句法否定的选项。在这方面，本文考察了否定词缀和前缀。我们注意到否定词缀与不同词类基础的相容性在不同的语言和同一种语言中都是不同的；通常，动词词根不与否定词缀结合，因为这种语言中的动词否定是通过动词的分析形式传递的。

关键词：否定，倒装，否定句，否定助词，否定词缀，否定代词和副词。

Abstract. *The paper presents morphological ways of expressing negation in the Russian language. Several options for implementing syntactic negation are made. In this regard, this paper examines negative affixes and prefixes. We note that the compatibility of negative affixes with the basics of different parts of speech varies both from language to language and within the same language; verb bases, as a rule, do not combine with negative affixes, because verbal negation is transmitted in this language by the analytical form of the verb.*

Keywords: *negation, inversion, negative sentences, negative particle, negative affixes, negative pronouns and adverbs.*

In Russian, there are several options for the implementation of syntactic negation. Of particular interest is the modality of double negation. Double negation is

characterized by the presence of two materialized negations with one member of the sentence. For example: Второе письмо было, видимо, не неприятно, потому что граф улыбнулся, читая его. Это - нелегкая, однако **не невозможная** задача.

The negation of negation is created by placing a particle not before a negative pronominal word or adverb, before a negative predicate it is **нельзя, невозможно**, or before a word form that already has a negative particle **не** with it. The negation of negation is closely related to context and is usually used to express objection and opposition. The general modal negation can be expressed a) formally-grammatically and b) lexically-syntactically. A particular, or optional, modal negation with one (and also not with one) sentence member is observed when the negation refers to the bearer of the attribute, but the action itself is not negated.

Negation can be expressed by inversion, however, this does not exclude intonation, since inversion outside intonation can predetermine logical stress and only intonation realize negation.

Sentences like: «Есть чему радоваться», «Есть из-за чего страдать» and the like need intonational certainty, which we use in situational conditions. As E.M. Kubarev notes, in oral speech, a vivid means of expressing denial is intonation, which introduces expressive shades of irony, doubt, impossibility, prohibition, etc.

The author calls sentences where negation is expressed only by intonation intonation-negative. They do not have negative particles **не** and **ни**, but they have a bright, expressive negative meaning, which is expressed by a special intonation, or rather, a group of intonations close to each other.

Negation can also be expressed by intonation (expressive expression of negation in an affirmative sentence).

However, the most successful is the following definition of ways to convey negation:

«..Negation in Russian can be expressed by a negative word, a negative affix (not complete, not equal), or it may not have a separate expression, but be a component of the meaning of the whole word (He refused = «он не согласился»; he missed = «он не попал») or the whole sentence.

Negative sentences in Russian are divided into general negative and partial negative.

Structural features of generally negative sentences in the Russian language are the presence of a particle **не** in the predicate, the word is **нет** in the role of the predicate of impersonal sentences, the particle is **ни** in sentences like «На небе **ни** облачка», negative pronouns and adverbs in one-part sentences like: «**Не с кем** поговорить»; «**Некуда** пойти» etc.

In partial negative sentences, negation is associated with all the other members of the sentence.

The presence of a negative particle is not always a sign of a negative sentence. So, the particle is **не** part of the union **не только, но и** also does not indicate the negative nature of the connections and relationships between the members of the proposal.

And in sentences like: «Да кто тебе поверит!»; «Много ты понимаешь»; «Чтобы я еще стала с ним связываться!» we, in our opinion, are dealing with implied denial, while not having materially expressed components of denial.

In Russian, negation in all parts of speech can be expressed using a prefix. As for the verb, it can form a negative form with the help of a negative particle.

The category of negation in Russian can be expressed:

- the particle **не**, capable of being in front of any word form: **не дом, не раз, не беспокоя** etc.;

- the prefix **не-**, which is attached to almost all word forms: **несчастье, ненадежный, нелегко, неопнятно** etc.;

- prefixes **без/бес, дез, дис** etc., which can be attached to nominal and verbal bases: **бездействие - бездействовать, дезорганизация - дезорганизовать**;

- a particle **ни** (in sentences like: «**Ни** огонька», «**Ни** копейки», «**Ни** одного вопроса» etc.);

- negative pronouns and adverbs with the prefix are **не-**;

- pronouns and pronominal words with the prefix **ни-**: **никто, ничто, никакой** etc.;

- predicatives **нет, нельзя, невозможно, немислимо**;

- in a word **нет** equivalent of a negative sentence or its main member, used in response remarks or in opposition.

They can:

1) express negation yourself,

2) using negation to express a statement;

3) to be used for amplification together with already known modal words or modal particles, modal phrases (**видимо не..., конечно нет, безусловно, невозможно** etc.). In these cases, traditional modal means act as amplifiers of the modality of negation.

By the nature of the attitude to reality expressed in the sentence, they are divided into affirmative and negative. Usually negation is expressed using negative particles or negative pronouns (don't, not, no, etc.)

It is possible to convey negation by intonation means, however, there are unconditional differences between the ways of constructing negation in different languages. So, in Russian, negation can be conveyed by combining several ways, for example, a negative particle and a negative pronoun, which is impossible in English:

«Мне никто сокровенней не был,

Так меня никто не томил»

Let's compare the English sentence "Nobody ever knows anything" and its Russian translation: «**Никто никогда ничего не** знает». In English, negation is expressed once - using the negative pronoun somebody, and in Russian - four times.

According to the assessment of the content of the utterance, sentences can be affirmative and negative, and also contain the meaning of confirmation, confidence, or, on the contrary, the meaning of uncertainty, doubt and suggestion. These meanings are expressed by the use of modal words and particles, as well as by the special construction of a simple and complex sentence. So, the introduction of the words certainly - «конечно» or perhaps - «возможно» into the sentence «Ответ был правильным» - "The answer was right" introduces the meaning of confirmation (Ответ был, конечно, правильным - Certainly the answer was right) or doubt (Ответ был, возможно, правильным - Perhaps the answer was right).

The division of sentences into affirmative and negative is based on the connections and relationships between objects and their features in the real world, which are expressed using syntactic connections between the members of the sentence. Affirmative sentences affirm what is said about the subject of speech (thought).

If the structural features of generally negative sentences in the Russian language are the presence of a particle **не** in the predicate, the word is **нет** in the role of the predicate of impersonal sentences, the particle is **ни** in sentences like «На небе **ни** облачка», negative pronouns and adverbs in one-part sentences like: «**Нечем** молодость вспомнить»; «**Не с кем** поговорить»; «**Некуда** пойти» etc., then in English, generally negative sentences contain a verb in a negative form.

Negative sentences are also found in the composition of complex sentences: both in compound and compound sentences

Denial is often accompanied by a statement, both potential and expressed. Sentences that include grammatically formulated negation and affirmation are called negative-affirmative. Such proposals can be both simple and complex.

With an unconnected connection of parts of a complex sentence, a combination of affirmation/negation can be one of the means of communication that also serves to express the meaning of comparison.

Two negative particles sometimes formalize an affirmative sentence (a sentence with double negation), since negation of negation occurs in it. In addition, in one sentence, a combination of negation in the main part of the sentence and negation in the verb phrase is possible.

In infinitive, gerundial and participial constructions, negation can be expressed:
a) with the leading component - the non-predicative form:

His father, **not** liking the idea of his going on the stage, had insisted on this - «Его отец, которому **не нравилась** идея, что он пойдет на сцену, настоял на этом»

«I'm awfully sorry» I said, **not** knowing **what else to say**. - «Мне очень жаль», - сказал я, **не зная**, что еще сказать».

b) with any subordinate component:

In infinitive, gerundial and participial constructions, as in the whole sentence, in English, unlike Russian, there can be only one negation:

Not having any friends \ Having **no** friends - «**Не** имея **никаких** друзей»..

However, it is quite possible to have two negatives: in the main part of the sentence and in a construction with a non-predicative form:

Would it **not** be better **not** to tell your father? - **Не** лучше было бы **не** говорить твоему отцу?

The most commonly used negative particle is the particle **not**. The use of this particle depends on whether it appears in the predicative form of the verb or in other words and word forms.

In the predicative form of the verb, the particle not is placed after an auxiliary or service verb (a bundle to be or modal):

I **wouldn't mind** coming to you for a season - «Я бы **не возражала** против того, чтобы придти к вам на сезон».

That **couldn't have been taught**, you must have that by nature - «Этому **не могут** научить, это должно быть от природы».

You **can't know** that every gesture must mean something - «Вы **не можете знать**, что каждый жест должен что-то означать».

For other words and forms of words, including non-predicative forms of the verb, the **not** particle is placed before the word to which it refers.

He was **not** a quick thinker and needed a little time to let a notion sink into his mind - «Он был **не особенно сообразителен** и нуждался во времени, чтобы осознать идею»

“ V.N. Bondarenko in his monograph “Negation as a logical and grammatical category” identifies the following six ways of expressing negation: negative affixes; negative particles; negative pronouns and adverbs; negative conjunctions; negative prepositions - postpositions in some languages; as well as an implicit way of expressing negation.

Regarding the English language, it is interesting to note that in Northern Scotland the negative forms **Present** and **Past Participle** are constructed using the negative prefix op- (=un-). Such forms as **onbeen** (=not, without being), **onhad**, **onhen** (=not, without having), **ondoin** (=without doing), **ongruten** (=without greeting), etc. are characteristic.

It should be mentioned:

- in the presence of negative affixes, prefixes prevail over suffixes;
- many researchers note that the compatibility of negative affixes with the basics of different parts of speech varies both from language to language and within the same language;

- when naming adjectives and (less often) nouns, the prefixes **un-** (homonym for the verb *un-*), **non-**, **in-** (**im-**, **il-**, **ir-**, **dis-**, **mis-** are most often used. The prefixes **un-**, **non-**, **in-** are the closest in meaning, as evidenced by the existence of doublet words that differ little from each other in their meanings: **non**professional - **un**professional, **in**acceptable - **un**acceptable (**не**приемлемый);

- the suffix **-less**, denoting the absence of something, is attached mainly to the basics of adjectives and nouns: **powerless** - **бессильный**, **useless** - **бесполезный**, **ненужный**, **негодный**, and this suffix is close in meaning to the prefix **un-**, expressing the absence of something, which is confirmed by the presence of synonymous words, for example: **endless** - **un**ending (**бес**конечный), **profitless** - **un**profitable (**не**выгодный, **не**рентабельный);

- verb bases, as a rule, do not combine with negative affixes, because verbal negation is transmitted in this language by the analytical form of the verb, formed with the help of a certain auxiliary verb and the negative particle **not**.

Negation is one of the fundamental problems of linguistics, since it is one of the functional and semantic phenomena that have a universal character. This indicates that negation is still of particular interest to linguists and provides food for new thoughts.

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否定的框架解释

FRAME INTERPRETATION OF NEGATION

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抽象的。 本文的目的是分析否定的范畴作为代表句子意义的一个成分的语言范畴,表明句子的成分之间没有既定的关系本文考虑了积极和消极的范畴,包括逻辑学——思维的科学,语言学——将语言作为思维工具和形式的科学。

关键词: 否定, 倒装, 否定句, 否定助词, 否定词缀, 否定代词和副词。

Abstract. *The purpose of this paper is to analyze the category of negation as a linguistic category representing an element of the meaning of the sentence, indicating that there is no established relationship between the components of the sentence The paper considers the categories of positive and negative, including logic – the science of thinking, and linguistics – the science of language as an instrument and form of thinking.*

Keywords: *negation, inversion, negative sentences, negative particle, negative affixes, negative pronouns and adverbs.*

In science, negation has been and remains the object of research in philosophy, formal logic and linguistics. In the philosophical understanding, the category of negation is interpreted as a necessary moment of development processes, as a category expressing a certain type of relationship between two successive stages, states of a developing object. The linguistic interpretation of negation is of par-

particular interest to us. In linguistics, negation is the expression by means of lexical, phraseological, syntactic and other means of language that the connection established between the elements of a statement does not really exist (thought in speech as not really existing)” [4, C, 133].

Thus, negation as a linguistic category is an element of the meaning of a sentence, indicating that the connection established between the components of the sentence, in the opinion of the speaker, does not really exist (A.M. Peshkovsky). In other cases, the corresponding affirmative sentence is rejected by the speaker as false [1]. In most cases, a negative statement is used when the corresponding affirmative was made earlier or is included in the general presumption of the speakers.

Negation, of course, is one of the original, semantically indecomposable semantic categories peculiar to all languages of the world, which cannot be defined through simpler semantic elements.

Negation can be expressed by negative words, negative prefixes, for example: Russian. “indecisive, insignificant”, German “unbekant”, English “impossible”. In addition, negation can be expressed in verb form, for example:

“I don’t mind” - I don’t mind; analytical negative form.

Sometimes denial may not have a separate expression, being a component of the meaning of the word, as, for example, in the Russian verb “refuse”, which means “disagree”, in English “fail” - “not succeed”, “miss” - “not to have time, to miss, i.e. not to hit the target”. In this case, we are talking about intra-family negation. In sentences like: “Yes, who will believe you!”, “You understand a lot”, “So that I can still get in touch with him!” we, in our opinion, are dealing with implied denial.

As a rule, a sentence that includes a negative word or a negative verb form is called grammatically negative. In a Negative sentence, a certain statement (predication) is always denied, which is defined as the scope of the negation. At the same time, the scope of negation can be considered all sentences (“He did not keep his promise”) or only part of it. So, in the sentence “We did not disperse for a long time because of the rain, although it was already late”, the circumstance of the reason does not fall within the scope of denial. There is an opinion that the sentence may be ambiguous due to the ambiguously vented scope of negation, i.e. different interpretations of this sentence are possible. So, the sentence “She did not want to return to the city of her youth because of painful memories” can be interpreted in different ways:

- 1) Painful memories were the reason that she did not want to return to the city of her youth;
- 2) She did not want to return to the city of her youth just because of painful memories.

As a rule, in oral speech, ambiguity can be partially eliminated by intonation.

Depending on the scope or boundaries of the scope of negation, sentences are classified in a certain way. A sentence that entirely constitutes the scope of negation is called a sentence with complete negation or semantically generally negative; in a sentence with incomplete negation, only one of the semantic components of the sentence is negated. Any sentence can include semantic components that are not subject to negation – presupposition. So, in the generally negative sentence “I am not upset that she did not get married”, the component “she got married” falls within the scope of negation, but is not denied.

If we consider negation from the point of view of the role of the elements expressing it in the syntactic structure of the sentence, then it is necessary to distinguish phrasal, i.e. expressed by a negative word as part of the predicate or the negative form of the predicate, and verbatim – not with the predicate. O. Jespersen . [3] and A.M. Peshkovsky note that most often phrasal

However, the opposite relationship is also possible: in the sentence “Few have waited for this happy day”, the literal denial is complete (“It is not true that many ...”), and in the sentence “They will not forget all the hardships that have fallen to their lot for a long time”, the denial is incomplete (“For a long time, the hardships will not be forgotten”).

In some cases, the negation is attached not to the word to which it refers in meaning, but to another, syntactically subordinating the first. At the same time, it is called displaced. For example: My observations didn’t help me much – “My observations didn’t help me much.” As a rule, a displaced negation is a negation with a predicate, as in the above sentence. However, it is also likely to shift the negation to a preposition, for example, “not in your sleigh” = “not in your sleigh”: negation in meaning refers to a pronoun, and is syntactically related to a preposition subordinating (through the medium of a noun) it’s a pronoun.

In our opinion, such a kind of displacement as the rise of negation is of particular interest. Its essence consists in the fact that the negation is transferred from the subordinate clause to the main one (or from the subordinate infinitive to the subordinate verb or modal word); cf. I don’t believe it is true – “I think it’s wrong.” In Russian, predicates that are allowed to be negated include such predicates as “I think”, “I believe”, “expected”, “it seems to me”, “I want”, “I advise”, “intend”, “should”. In English, this category includes “suppose”, “imagine”, “reckon”, “guess”, “anticipate”, “it appears”, “sounds like”, etc.

The interpretation of negation proposed by Ch.Fillmore is especially interesting [5]. He explores such varieties of negation as intraframe, contextually-free, contextually-connected, interframe and frame negation. We would like to dwell on some of the judgments proposed by this linguist.

“Intraframe negation can be both context-free and context-related; by context we mean the preceding part of the discourse; interframe negation is necessarily

context-related” [5, p. 76]. In order to illustrate context-free intra-frame negation, the author considers the following sentence: Her father doesn't have any teeth. – Her father has no teeth.

This denial, according to the author, is “context-free”, because this discourse does not need to form any expectations about a person's face. Negation in such a sentence does not require establishing a connection with something preceding the discourse. The frame of the representation of the human face is always at our disposal, and there is no need to involve context data. In other words, the proposal under discussion can be considered as an indication to the interpreter to use the frame of a human face and to modify this frame so that there are no teeth in the resulting representation.

The use of the singular noun in the sentence “During our entire vacation, we did not catch a singlefish” functions perfectly normally in a negative sentence. However, this sentence is in no way understood as a denial, which is based on the expectation of catching only one fish.

“A frame is a set of assumptions about the structure of a formal language for expressing knowledge, as an alternative for semantic networks, or for predicate calculus; a set of entities, according to the researcher's assumption, existing in the described world (metaphysical interpretation of the concept); a frame gives an idea of what kind of knowledge is essential for such a description; the organization of representations stored in memory (human and/or computer) plus the organization of processing and logical inference processes operating on this storage (heuristic or implementation interpretation). A frame is a data structure for representing stereotypical situations, especially when organizing large amounts of data” [Kubryakova, Demyankov 1996:184].

It should be noted that the correlation of such categories as affirmation and negation is of particular interest. Unfortunately, it is impossible to investigate this problem in detail within the framework of one article. However, affirmation and negation as paired categories cannot fully reflect the ontological essence of negation, because there are many examples in language when negation is paired with doubt, with negation itself. And in this case it is quite appropriate to pay attention to the point of view of Fr. Jespersen n, who tries to prove the threefold nature of these categories, considering them as opposite concepts contrary to logic, which considers them to be opposite, excluding the possibility of an intermediate. Contrary to logic, but proceeding from it, O. Jespersen establishes a threefold division: A - statement, B - doubt, C - denial [3, C, 24]. According to this, B expresses uncertainty and opposes to the same degree A and C. consequently, negation presupposes under the statement everything that is denied, including doubt and denial. However, since everything that precedes negation is already a statement, even if it is doubt or denial, O. Jespersen's theory cannot be accepted as a threefold variant.

That is why the doubts opposite to denial are optional concepts that logic does not take into account.

In the conclusion we emphasize that the relativity of the category of positive and negative is inherently in every science, including logic – the science of thinking, and linguistics – the science of language as an instrument and form of thinking. The forms of positive and negative judgments in the language correspond to positive and negative positions.

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体育领域公共行政管理的国外经验

**FOREIGN EXPERIENCE OF PUBLIC ADMINISTRATION IN THE
FIELD OF PHYSICAL EDUCATION AND SPORT**

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注解。 本文考虑了体育文化和体育领域公共管理的国外经验问题，这些问题也可以应用于俄罗斯联邦的公共管理问题。 为了在管理流程的改进上做出新的假设，为俄罗斯联邦的体育文化和体育部门开发更有效的管理模式，似乎有必要分析国外现有的机制和管理工具，包括外国同事的经验 以及国外研究人员的成果。

关键词：体育教育、运动、体育治理、公共政策、国外经验。

Annotation. *The article considers the issues of foreign experience of public administration in the sphere of physical culture and sports, which can be applied to the issues of public administration in the Russian Federation as well. In order to make new assumptions in the improvement of management processes and develop more effective management models for the sector of physical culture and sports in the Russian Federation, it seems necessary to analyze the existing mechanisms and management tools abroad, including the experience of foreign colleagues and the results of foreign researchers.*

Keywords: *physical education, sport, governance in sport, public policy, foreign experience.*

In the Russian Federation, interest in the sports, health and fitness movement is constantly growing and its management structure and organisational forms of sports institutions are being transformed. In Soviet times, the entire sports system was built on a state basis. In Russia, for a long time sport was seen as a spectacle rather than a business. The sports industry covered exclusively the market for sports goods. However, the development of market relations is beginning to advance in the sports sector, which is already being positioned as a complex relationship within sports events, management of sports organizations, provision of sports

and health services to the population, funding and sponsorship, training in sports and physical education, organization of scientific research, sports psychology and pharmacology [3].

At present, the situation in the field of sport and physical education in the country is characterised by the following factors.

All-Russian sports federations - commercial sports (leagues) and non-commercial ones - were separated from the system of state management of sports and physical education in the form of public organisations, and there are now 114 in total.

The Russian Federation develops and promotes its sports, participates in the training of sports teams as part of a unified calendar of inter-regional, all-Russian and international physical education and sporting events, has the right to cover the country's regular season games, earn income from the sale of broadcasting rights and from creating comfortable conditions in stadiums.

The constant streamlining of processes in the markets for new sports facilities encourages the public sector to necessarily adopt the principles of technical efficiency. Municipalities with more direct management are mostly able to manage efficiency through public expenditure policies; however, this is indirectly dependent on the solvency of the private company managing the service.

The defence of this governance model is to reduce the cost of municipal governance, to use innovation and in private sector structures that operate in a competitive environment. In the case of Spain, following the economic downturn process, municipalities have focused on finding governance options that guarantee better economic efficiency in order to guarantee budgetary stability. As a result, turning to service-outsourced management models has become a trend in municipal governance [5].

Under these circumstances, in Greece, as in most European countries, municipal sports organisations have been promoting "Sport for All" for the past 30 years, which has had a beneficial effect on the physical and mental health of citizens.

Developing sport through local government, while important, there is a paucity of research on the subject. A study published in the United Kingdom emphasises the need to develop sport at local level with a long-term perspective and people who know the subject thoroughly.

In addition, the availability of budgets for local sports development is an important step in this direction, as it will be implemented with a balanced, fair and rational distribution of funding, and local government structures will be strengthened through these processes.

Locally organised sport with significant citizen participation is widespread in many European countries, such as France, the UK, the Netherlands and Spain. Over the last few years, it has shown a growing trend at the international level.

In Greece, all municipalities provide sports programmes for citizens without, or at an extremely low cost. To this end, the municipalities have set up organisations and hired a significant number of physical education instructors. These organisations use municipal and public sports facilities for recreation and sport for all citizens. The main activities of these organisations, according to their websites, are related to the whole spectrum of sports management: they support the Sport for All programme, sports activities in schools or clubs, and recreational, cultural, scientific and conference activities [6].

Finally, these organisations are trying to develop sports centres, gyms and fitness programmes to meet the increased needs of citizens of all ages, as well as sports programmes to connect citizens with nature (mountaineering, trekking, skiing, etc.).

Public administrations need to make profound changes to both their organisation and planning in order to be more effective, as citizens demand more transparency. In response, the so-called New Public Management is being applied, management systems that focus on responsible leadership and continuous improvement based on the three pillars of financial stability, quality and transparency. The assumption is that modernisation will lay the foundation for a new, sustainable, efficient and open public administration, which will reshape the new model of society. Consequently, the premise of increasing the value of society, and that public service delivery has its costs, must be a constant in the new administrative culture. In these times of cuts, every organisation must minimise costs, and even more so those that are fully or partially funded by public funds [2].

One of the city of Vienna's key objectives is to provide an optimal environment for sport in all its diverse aspects. In this age of networks and media coverage, any modern municipal administration will have an interest in keeping up with international sports trends.

Table 1

Ratio of resource expenditure on the development of physical activity and sport in European countries between the different actors of governance

Country	Government share, %	Share of local authorities, %
Germany	2	98
UK	5	95
Switzerland	8	92
Sweden	10	90
Finland	15	85
Denmark	16	84
France	23	77
Spain	24	76

Italy	43	57
Portugal	46	54
Hungary	65	35
Russia	82	18

Although expenditure on sport accounts for 0.2-2 per cent of GNP (or about \$2 billion) in developed European countries, a much higher proportion of it is financed from other sources. Thus, the share of the state sports budget in Great Britain, Germany, Denmark, Finland, Sweden is less than 20% of the amount of local sports budgets. For Italy and France the difference is 30%, and for Spain and Portugal it is 40%. The share of regional, municipal and local authorities in the total sports budget is 95% in the UK, 98% in Germany, 76% in Spain, 85% in Finland, 77% in France, 90% in Sweden and 57% in Italy, but only 18% in Russia. A characteristic feature of the development of the network of physical education and sports organisations abroad is the predominance of publicly owned enterprises and non-profit organisations. Thus, the role of local authorities can play a particularly decisive role in the promotion of sport [4].

In line with this aspect, in every modern country, the central government cooperates with regional, municipal and local authorities to promote sport among citizens. In this way, through local government, citizens can benefit from the positive effects of sport.

A system of programme measures is used as an effective and efficient mechanism in the Russian Federation aimed at a fundamental change in the development of physical culture and sport. It balances out federal and regional activities on the one hand and creates the conditions for the development of mass physical education and sport in the territory of the municipalities on the other. Certainly, further development and attention to mass sport can only contribute to its fruitful modernisation and smooth change in relation to the external and internal changes taking place in the Russian Federation.

The involvement and influence of the state in the field of sport is to some extent essential to the existence of the system as a whole at the present time. Thus, public administration in the field of sport is characterised by features that distinguish it from public administration in other spheres. This specificity is in no small measure determined by the autonomy of the field of sport.

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急性肾功能衰竭无尿期幼儿心肌需氧量的昼夜节律
**CIRCADIAN RHYTHM OF MYOCARDIAL OXYGEN DEMAND
IN YOUNG CHILDREN IN THE PHASE OF ANURIA OF ACUTE
RENAL FAILURE**

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抽象的。根据对 36 名 3 岁以下儿童的调查数据的研究,在第一天,所有患者的心肌需氧量 (MOD) 昼夜节律均显示出增加的趋势。在第 1 组无尿的重症监护期间(在 ICU 重症监护长达 10 天),研究指标未检测到显著变化,而在第 2 组(恢复超过 11 天)和第 3 组(不利结果)组,发现 MOD 有显著的渐进增加。白天和晚上,第 3 组的昼夜节律平均水平明显高于第 1 组,超过正常数据 50-57%。MOD 的每日波动在第 3 组儿童中也是最显著的,并且在以后(第 19-30 天)有增加的趋势,表明心肌代谢不稳定的进展具有不利的结果。长达 3 年的急性肾功能衰竭 MOD 昼夜节律反转的持续时间、昼夜波动幅度的增加与患者病情的严重程度相对应。

关键词: 心肌需氧量的昼夜节律, 儿童, 急性肾功能衰竭。

Abstract. *Based on the study of survey data of 36 children under the age of 3 years, on the first day, a tendency to an increase in the mesor of the circadian rhythm of myocardial oxygen demand (MOD) was revealed in all patients. During the intensive care period of anuria in group 1 (up to 10 days of intensive care in the ICU), no significant changes in the studied indicator were detected, while in 2 (more than 11 days with recovery) and 3 (unfavorable outcome) groups, a significantly significant progressive increase was found MOD. The average level in the circadian rhythm was significantly higher in group 3 than in group 1 both in the daytime and at night, exceeding the normative data by 50-57%.*

Daily fluctuations in MOD were also the most significant in children of the 3rd group with a tendency to increase at a later date (on days 19–30), characterizing the progression of myocardial metabolism instability with an unfavorable outcome. The duration of the inversion, the increase in the amplitude of diurnal fluctuations) of the circadian rhythm of the MOD in acute renal failure up to 3 years corresponded to the severity of the patients' condition.

Keywords: *circadian rhythm of myocardial oxygen demand, children, acute renal failure.*

Relevance. Interorgan structural and functional connections between the kidneys and other systems, such as the cardiovascular system, are more pronounced in childhood due to limited reserve capabilities, which is especially pronounced in pathological conditions. At present, it is not enough to study individual parameters of kidney function in patients with uronephrological pathology. It is advisable to use an integrated approach with the use of methods to create an idea of the work of the heart in these patients, deviations of its parameters from the norm. Normally, myocardial oxygen demand is the most important factor determining the amount of coronary blood flow. The structure of myocardial oxygen demand: basal needs (20%), electrical activity (1%), work against volume load (15%), work against pressure load (64%). Normally, the myocardium extracts 65% of the oxygen contained in arterial blood, while most other tissues extract only 25%. The saturation of hemoglobin with oxygen in the coronary sinus is normally 30%. Consequently, the myocardium (unlike other tissues) is unable to compensate for reduced blood flow by extracting more oxygen from hemoglobin. Any increase in myocardial metabolic demand must be accompanied by an increase in coronary blood flow. Factors affecting the ratio of O₂ delivery to myocardial O₂ demand are: heart rate, diastole duration, coronary perfusion pressure, blood pressure (in the aorta), left ventricular end-diastolic pressure (LVEDP), arterial oxygen content, arterial oxygen tension, hemoglobin concentration, diameter of coronary vessels. Myocardial oxygen demand is determined by the following main factors: heart rate, contractility of the heart muscle, tension of the walls of the left ventricle during systole. With an increase in the values of these indicators, the demand of the myocardium for oxygen increases [1-6]. Due to the lack of data on the change in MOD during the period of anuria in children under 3 years of age, we tried to identify and evaluate the features of changes in the indicator in acute renal failure.

Goal of the work. To study and evaluate changes in the circadian rhythm of myocardial oxygen demand in the phase of anuria in infants.

Material and research methods. The data of hourly monitoring of MOD in 36 children with acute renal failure admitted to the ICU of RSC EMC with anuria from 1 to 5 days at the age of 10 months to 3 years 4 months from the ICU

of regional children’s hospitals and branches of RSC EMC was studied. Prior to admission to the clinic, all patients received anti-inflammatory therapy aimed at the treatment of ARI-2, pneumonia 25, glomerulonephritis - 6, AII-4 patients. According to the indications, due to severe progressive respiratory failure, patients were provided with invasive mechanical respiratory support from the first day. All patients underwent hemodialysis, 4 patients underwent hemodialysis in combination with plasmapheresis under the control of hemodynamics, acid-base state (ABS), respiratory system, maintenance, antibacterial, anti-inflammatory, syndromic corrective intensive therapy according to the recommendations in the literature. A favorable outcome with the restoration of full functional activity of the kidneys and discharge from the hospital was observed in 26 children (groups 1 and 2), an unfavorable outcome in 10 children (group 3). The first group consisted of patients who received intensive care in the ICU for up to 10 days (11), the second - children (15) with a favorable outcome after intensive care for 11 - 90 days.

As shown in Table 1, the duration of intensive care in children of groups 2 and 3 significantly exceeded the duration of treatment in the ICU in group 1 by 20 or more days ($p < 0.05$, respectively). In group 2, the duration of mechanical respiratory support (MRS) was 18.6 ± 8 days, in group 3, a longer MRS did not improve the outcome of the disease. The following formula for calculating MVP = $HR * SBP / 100$ in % was used, where HR is heart rate, SBP is systolic blood pressure.

Table 1.
Characteristics of patients

Groups	Age, mont.	Start of IVL, days	Duration of MCI, days	In ICU, days
1	$29 \pm 2,8$	0	0	$7,8 \pm 1,5$
2	$19 \pm 7,7$	$4,3 \pm 3,5$	$18,6 \pm 7,6$	$27,8 \pm 4,3^*$
3	$30,5 \pm 6,5$	$5,5 \pm 0,5$	$25,5 \pm 6,7$	$30,7 \pm 6,8^*$

*-the difference is significant relative to the indicator in group 1.

Table 2.
Dynamics of the mesor of the circadian rhythm of the MVP

Days	1 group	2 group	3 group
1	$134,3 \pm 8,9$	$119,2 \pm 11,1$	$129,1 \pm 12,3$
2	$127,3 \pm 5,7$	$137,4 \pm 2,8^*$	$144,8 \pm 4,6$
3	$134,3 \pm 3,2$	$134,8 \pm 4,2$	$150,6 \pm 4,0^*$
4	$136,8 \pm 6,2$	$136,4 \pm 4,3$	$155,9 \pm 5,2^*$
5	$124,1 \pm 4,9$	$133,3 \pm 3,9$	$155,2 \pm 6,4^*$
6	$124,7 \pm 5,8$	$131,5 \pm 4,2$	$154,8 \pm 5,5^*$
7	$133,5 \pm 5,6$	$130,2 \pm 2,8$	$161,0 \pm 4,1^*$

8	138,6±3,0	130,6±2,9	164,3±7,1*
9	131,7±7,8	133,2±7,1	175,2±7,1*
10	120,7±17,4	138,0±4,0*	168,5±6,1*
11		139,4±3,5*	159,2±6,7*
12		148,1±3,9*	156,2±6,4*
13		140,6±3,5*	158,4±10,5*
14		143,1±3,3*	165,5±6,2*
15		134,6±4,4	151,6±6,9*
16		144,1±3,1*	149,5±6,1*
17		137,1±4,3*	156,0±5,6*
18		139,3±4,0*	160,6±6,7*
19		139,7±5,0*	151,2±7,6*
20		147,5±5,3*	161,0±7,4*
21		142,3±7,7*	142,9±7,0
22		143,4±5,1*	142,4±4,9
23		137,6±5,6*	152,1±5,8*
24		142,1±5,8*	158,4±4,3*
25		147,8±7,0*	155,6±5,9*
26		146,2±7,1*	143,9±6,8
27		142,9±8,3*	151,0±9,8
28		129,3±8,4	159,9±6,7*
29		150,2±7,5*	150,5±10,4
30		154,4±5,3*	143,6±7,4

Table 3.

Average indicators of the MVP in the circadian rhythm

Hours	1 group	2 group	3 group
8	136,7±5,3	139,8±7,0	157,2±10,3 ^{'''}
9	133,8±6,5	138,5±8,3	156,7±9,1 ^{'''}
10	134,1±8,4	139,6±8,7	156,9±10,0 ^{'''}
11	130,9±5,8	140,5±7,7	157,7±8,1 ^{'''}
12	134,3±7,0	140,5±7,7	152,9±10,7
13	133,6±8,7	139,2±9,0	154,9±11,1 ^{'''}
14	132,5±8,5	140,8±7,6	157,8±10,7 ^{'''}
15	130,1±9,9	140,1±7,0	157,5±8,5 ^{'''}
16	127,3±9,6	140,2±7,2	157,1±11,1 ^{'''}
17	130,2±8,8	141,2±8,7	155,2±10,3 ^{'''}
18	136,1±7,3	143,1±7,1	153,1±11,5
19	136,2±6,3	141,2±7,1	155,7±9,6 ^{'''}
20	137,2±4,9	138,9±7,2	154,4±8,7 ^{'''}

21	136,2±7,1	139,0±5,4	153,7±10,4
22	135,2±6,6	137,5±6,8	152,8±8,2
23	129,0±5,0	138,0±7,9	153,7±9,2 ^{***}
24	125,6±7,1	137,1±7,6	152,8±9,2 ^{***}
1	123,1±8,1	136,9±7,7	151,5±9,6 ^{***}
2	121,4±7,9	137,3±8,0	149,8±9,3 ^{***}
3	124,1±7,5	135,8±7,1	151,3±7,5 ^{***}
4	122,4±8,0	137,3±7,2	153,3±10,0 ^{***}
5	123,1±6,8	138,5±6,9	151,4±6,9 ^{***}
6	130,0±6,6	140,1±6,3	154,5±7,7 ^{***}
7	131,5±5,7	138,3±5,3	155,2±8,0 ^{***}

*-significant relative to the indicator on the first day

^{***}-the difference is significant relative to the indicator in group 1.

On the first day, there was a tendency to increase the mesor of the circadian rhythm of the MVP in all patients (Table 2). In the dynamics during the period of anuria in group 1, no significant changes in the studied indicator were detected. While in groups 2 and 3 a significantly significant progressive increase in MVP was found in group 2 on day 2 - 15%, 10 - 16%, 11 - 17%, 12-24%, 13-10%, 14-20%, 16-21%, 17-15%, 18-17%, 19-17%, 20-23%, 21-18%, 22-19%, 23-15%, 24-18%, 25-23%, 26-22%, 27-18%, 29-26%, 30 days -28%. In the group with an unfavorable outcome, myocardial oxygen demand increased relative to that in groups 1 and 2 most significantly throughout the entire period of intensive therapy (Table 2). So, already on the 3rd day there was an increase in oxygen demand by 16%, 4-5 days by 20%, 6-19%, 7-24%, 8-27%, 9-35%, 10-30%, 11- 23%, 12 - 20%, 13 - 22%, 14 - 27%, 15 - 11%, 16 - 15%, 17 - 20%, 18 - 24%, 19 - 16%, 20 - 24%, 23 - 17%, 24-22%, 25 - 20%, 28 - 24% (Fig. 1). The data obtained indicate that the myocardial oxygen demand corresponds to the general severity of the condition, despite the ongoing stress-limiting therapy, which is most likely due not only to an increase in general intoxication due to progressive decompensation of the function of organs and systems, but also to an increase in the mechanical load on the myocardium, an increase in the functional load on heart muscle in connection with infusion-transfusion therapy against the background of an ongoing systemic inflammatory response of the body due to multiple organ systems dysfunction.

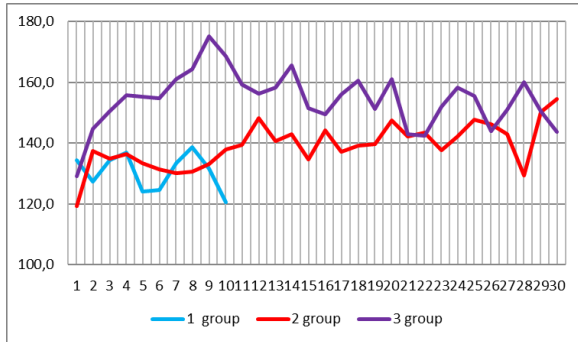


Figure 1. Dynamics of the mesor of the circadian rhythm of the MVP (%) in acute renal failure in infancy

Attention was drawn to the oscillatory nature of the change in the average daily level of MVP, when in group 2 there was a tendency to decrease in MVP on days 7-8, in group 3 there was an increase in MVP to a maximum value on day 9 by 78% relative to the norm, remaining significantly higher than in group 2 in subsequent days of intensive care (Table 1, Fig. 1). The average level in the circadian rhythm also turned out to be significantly higher in group 3 than in group 1 (Table 2) during the day, both in the daytime and at night, exceeding the normative data by 50-57%.

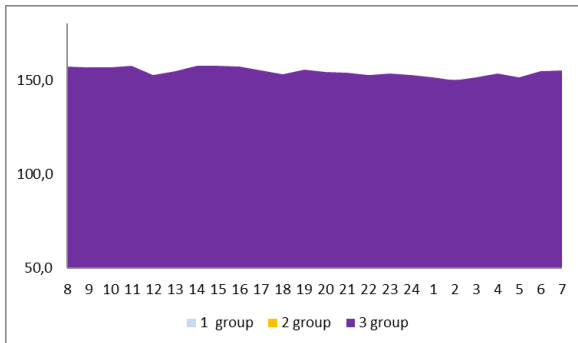


Figure 2. Average indicators of MVP in the circadian rhythm, in%.

Thus, the average level of MVP in the circadian rhythm in group 1 was increased by an average of 21-36%, in group 2 - by 37-40%, in group 3 - by 50-57% with acute renal failure in children under 3 years of age (**Fig. 2**).

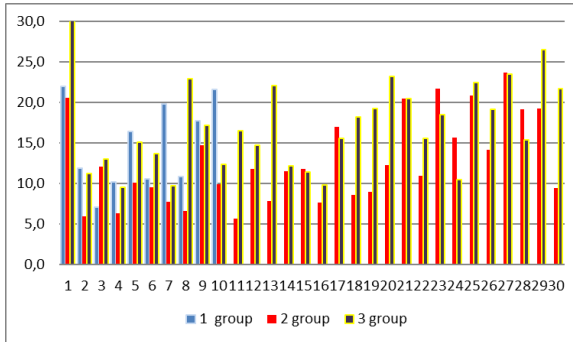


Figure 3. Dynamics of the amplitude of the circadian rhythm of the MVP up to 3 years, %

Daily fluctuations in MVP were also the most significant in children of the 3rd group with a tendency to increase at a later date (on days 19–30), characterizing the progression of myocardial metabolism instability with an unfavorable outcome. Apparently, the observed greatest value of the amplitude of the circadian rhythm up to 30% (changes in myocardial oxygen demand during the first day by 30%) can be taken as a sign of an unfavorable outcome in acute renal failure in children under 3 years of age. While fluctuations in MVP during the first day in group 1 amounted to 22%, in group 2 - 20%.

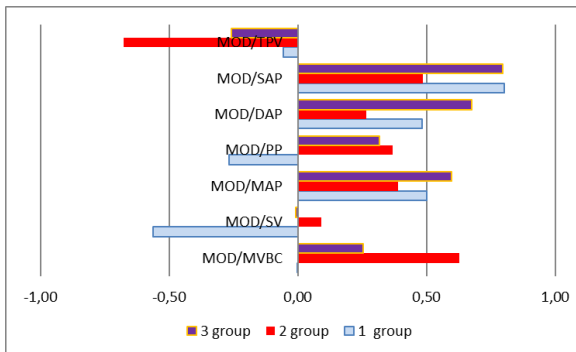


Figure 4. Correlations of myocardial oxygen demand with hemodynamic parameters

A significantly significant direct correlation of the indicator with SBP indicated a direct dependence of MVP on the level of SBP in groups 1 and 3 of patients, to a lesser extent in group 2. That is, an increase in SBP corresponds to an increase

in MVP, which leads to the expediency of preventing arterial hypertension, especially characteristic of acute renal failure. An upward trend in MVP was found with a tendency to increase DBP, the most pronounced in group 3, somewhat less in group 1 and insignificant in children of group 2, which can be taken as the basis for determining the advisability of more intensive vasodilator therapy. A direct significant trend of a direct relationship between MVP and IOC is apparently due to more volumetric infusion therapy aimed at restoring the perfusion properties of the damaged kidney parenchyma. In general, the obtained results indicate in general a stimulating effect on the MVP growth of most hemodynamic parameters (SBP, DBP, PBP, MAP, IOC) (Fig. 4).

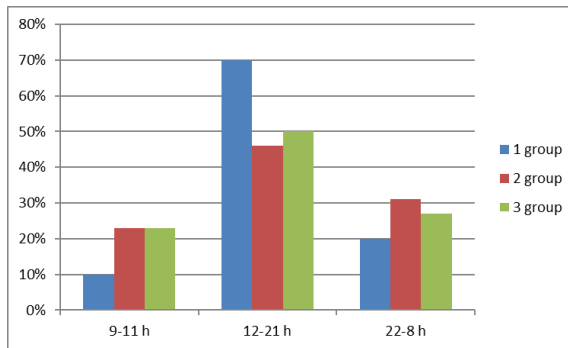


Figure 5. Duration of shifts in the acrophase of the circadian rhythm of the MVP

In percentage terms, the inversion of the circadian rhythm of the MVP was 20% in group 1, 31% in group 2, and 27% in group 3. However, in absolute numbers, the longest inversion of the MVP was in the 2nd group - 9 days, in the 3rd group for 8 days and in the 1st group for 2 days. That is, the duration of the inversion of the circadian rhythm of the MVP in acute renal failure up to 3 years corresponded to the severity of the patients' condition.

Conclusion. On the first day, a tendency to an increase in the mesor of the circadian rhythm of the MVP was revealed in all patients. During the intensive therapy of the period of anuria in group 1, no significant changes in the studied indicator were detected, while in groups 2 and 3, a significantly significant progressive increase in MVP was found. The average level in the circadian rhythm was significantly higher in group 3 than in group 1 both in the daytime and at night, exceeding the normative data by 50-57%. Daily fluctuations in MVP were also the most significant in children of the 3rd group with a tendency to increase at a later date (on days 19–30), characterizing the progression of myocardial metabolism instability with an unfavorable outcome. The duration of the inversion of

the circadian rhythm of the MVP in acute renal failure up to 3 years corresponded to the severity of the patients' condition.

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COVID-19 大流行后患有冠心病的第二成熟年龄妇女的身体工作能力, 从显性 A.A. 的位置来看 使用撑杆行走时的 UKHTOMSKY

PHYSICAL WORKABILITY OF WOMEN OF THE SECOND MATURE AGE SUFFERING WITH CORONARY HEART DISEASE AFTER THE COVID-19 PANDEMIC, FROM THE POSITION OF DOMINANT A.A. UKHTOMSKY WHEN WORKING WITH POLE WALKING

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抽象的。在心脏病学领域,首次给出了评估 29 名生活在西西伯利亚南部、正处于冠心病 (CHD) 康复治疗门诊阶段的成年女性身体表现 (PP) 的指标, 在使用撑杆行走 (PW) 遭受 Covid-19 大流行之后。人类个体发生的第九个时期首次被划分为相等的 5 年时期。为了确定 PP 的水平,使用了阶梯测试 PWC 170, 由此可以持续监测中枢血流动力学的功能状态,并通过理疗练习及时调整正在进行的康复治疗。作者发现 PP 和最大耗氧量 (MOC) 的显著降低取决于女性的护照年龄。

关键词: 第二个成年期的女性, 缺血性心脏病, 身体表现, Covid-19 的后果, 越野行走, Ukhtomsky 的优势。

Abstract. *For the first time in cardiology, indicators are given for assessing physical performance (PP) in 29 women of the second adulthood, living in the south of Western Siberia, who are at the outpatient stage of rehabilitation treatment for coronary heart disease (CHD), after suffering a Covid-19 pandemic using pole walking (PW). For the first time, the ninth period of human ontogenesis was divided into equal 5-year periods. To determine the level of PP, the step test PWC 170 was used, thanks to which it is possible to constantly monitor the functional state of central hemodynamics and make timely adjustments to the ongoing rehabilitation treatment by means of physiotherapy exercises. The authors found a significant decrease in PP and maximum oxygen consumption (MOC) depending on the passport age of women.*

Keywords: *women of the second adulthood, ischemic heart disease, physical performance, the consequences of Covid-19, Nordic walking, Ukhtomsky's dominant.*

Relevance. To date, quite a lot of actual experience has been accumulated regarding the Covid-19 pandemic, which has made significant and so far not completely studied changes in the state of human health. Preserving and restoring the health of people who have had Covid-19 is one of the most important state tasks.

Currently, the rehabilitation of patients with coronavirus infection is carried out using medications and physical medicine technologies [2, 3]. During its implementation, especially in women with CHD, it is important to exercise competent medical control of the functional state of the body at various stages of rehabilitation [1], which will significantly reduce mortality. As for the assessment of physical performance in women of the second adulthood with coronary artery disease, using regular dosed physical exercises during pole walking (PW) as a rehabilitation, there are no such studies in the available literature.

Purpose of the study: in women of the second adulthood with coronary artery disease, after undergoing Covid-19, according to the step test PWC 170, to determine the values of PP during regular PW classes.

Material and methods. We examined 29 women (MG - the main group) of the second adulthood (47.4 ± 1.7 years) undergoing rehabilitation treatment using regular dosed physical activity during PW for chronic CAD without signs of heart failure, who had Covid-19. As a control (CG - control group), 18 women of the same age (46.9 ± 1.6 years) who do not have diseases of the cardiovascular system (CVS) were examined. All women permanently resided in the south of Western Siberia. Considering that the period of the second mature age lasts from 36 to 55 years, i.e. is 20 years, we consider it not correct to judge the RF of women, for example, 36 years old, and compare it with a woman aged 55 years. In this regard, we divided the period of the second adulthood into equal 5-year intervals. MG:

from 36 to 40 years (38.4 ± 1.4 ; $n = 6$), from 41 to 45 years (43.1 ± 1.2 ; $n = 8$), from 46 to 50 years (48.2 ± 1.3 ; $n = 10$) and from 51 to 55 years (52.7 ± 1.4 ; $n = 5$). D: from 36 to 40 years old (37.8 ± 1.4 ; $n=4$), from 41 to 45 years old (42.7 ± 1.5 ; $n=3$), from 46 to 50 years old (48.0 ± 1.5 ; $n = 5$) and from 51 to 55 years (52.3 ± 1.4 ; $n = 6$). PP was studied using the PWC 170 step test recognized by WHO. The indicator of maximum oxygen consumption (MOC) was calculated by the formula: $MIC = 2.2 \times PWC170 + 1070$ Body weight measured on a balance scale with an accuracy of 50 g.

Training sessions and training of PW were held in the park 3 times a week for one hour. A prerequisite for each lesson, firstly, we consider the briefing on the methodology and technique of SH. Secondly, about the benefits for the cardiovascular system of regular dosed physical activity in the form of health-improving PW. Thirdly, carrying out verbal suggestion to create a dominant Academician A.A. Ukhtomsky, which not only increases the interest of women in SH, but also motivates them to maintain a sufficient level of PP.

The results of the study were processed on a personal computer using modern electronic programs (Statistika). The study was conducted in compliance with the ethical standards set forth in the Declaration of Helsinki and the Directives of the European Community (8/609EC) and the oral consent of the women.

Results and discussion. Important for the study of the PP of women, we consider the observance of the following provisions. Firstly, the creation of a good emotional and psychological attitude of a woman for testing, which consists in comprehensive information for her about the upcoming dosed physical activity and its importance for subsequent treatment, not only with the use of drugs, but also with physical activity during pole walking. Secondly, a preliminary clinical and instrumental examination of women, which allows assessing the functional state of central hemodynamics and identifying possible contraindications to the step test. Thirdly, the relationship of trust between the instructor and the trainee.

Using the dominant proposed by Academician A.A. Ukhtomsky, we explained and instilled to each woman that the physical activity that is given to them when climbing steps of different heights is short-term and very far from the maximum load, so its implementation does not present any particular difficulties and does not affect the course of coronary artery disease.

The results of the study of body weight indicated that due to the increase in the passport age, it increases. In women MG at the age of 36-40 years, body weight was 62.26 ± 2.30 kg, at 41-45 years old - 66.83 ± 2.39 kg, at 46-50 years old - 67.74 ± 2.33 kg, at 51-55 years old - 69.61 ± 2.26 kg. In women of the CG - at the age of 36-40 years, body weight was 61.39 ± 2.47 kg, at 41-45 years old - 65.46 ± 2.53 kg, at 46-50 years old - 67.22 ± 2.24 kg, at 51-55 years old - 68.85 ± 2.73 kg. Thus, for the period from 36 to 55 years, the age-related increase in the body weight of women in the MG was 7.35 kg., CG - 7.46 kg.

Assessing the results of the study of PP, we note, firstly, that in all women of the MG, despite the previous infection with Covid-19 and the presence of a chronic course of coronary artery disease, the PP was at the level of average values. PWC 170 at the age of 36-40 years was equal to 593.84 ± 16.3 kgm/min, at the age of 41-45 years - 526.92 ± 15.4 kgm/min, at the age of 46-50 years - 462.36 ± 16.1 kgm/min, aged 51 to 55 years - 374.17 ± 15.5 kgm/min.

Secondly, a significant dependence ($p < 0.05$) of a decrease in the level of PP due to an increase in passport age was revealed. Thirdly, if the values of PP (in kgm/min) in women under the age of 50 years were at almost the same level ($p > 0.05$), then after reaching the age of 50 years, the PP significantly ($p < 0.05$) became less (Fig. 2).

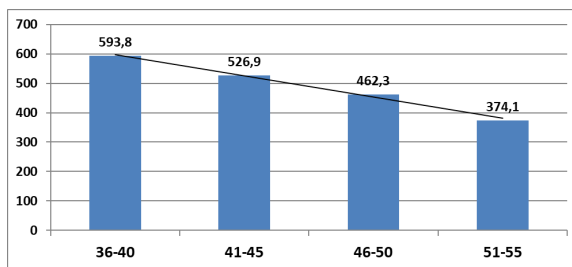


Figure 2. Dynamics of age-related values of physical performance of women of the second mature age, suffering from coronary heart disease, during pole walking.

As for women from the CG, their PP indicators in absolute values were significantly ($p < 0.05$) higher than those of their peers from the CG. PWC 170 kgm/min at the age of 36-40 years was equal to 629.57 ± 17.1 kgm/min, at the age of 41-45 years - 569.18 ± 16.7 kgm/min, at the age of 46-50 years - 497.43 ± 17.6 kgm/min, at the age of 51 to 55 years - 414.29 ± 15.5 kgm/min (Fig. 3).

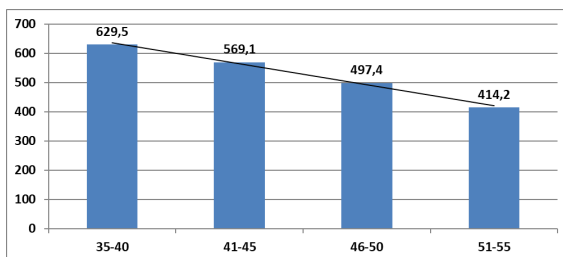


Figure 3. Dynamics of age-related values of physical performance in women of the period of the second mature age of the control group during pole walking.

PP in kgm/min/kg in women MG at the age of 36-40 years was 9.53 ± 0.47 kgm/min/kg, at the age of 41-45 years - 7.88 ± 0.41 kgm/min/kg, at the age of 46-50 years - 6.82 ± 0.36 kgm/min/kg, at the age of 51-55 years - 5.37 ± 0.29 kgm/min/kg.

Studies have shown that the MOC in ml/min/kg in CG women in absolute terms is higher than in their MG peers. In CG women at the age of 36-40 years, the MOC was 39.99 ± 1.07 ml/min/kg, at the age of 41-45 years - 35.47 ± 1.02 ml/min/kg, at the age of 46-50 years - 32.19 ± 0.96 ml/min/kg, at the age of 51-55 years - 28.78 ± 0.94 ml/min/kg (Fig. 4).

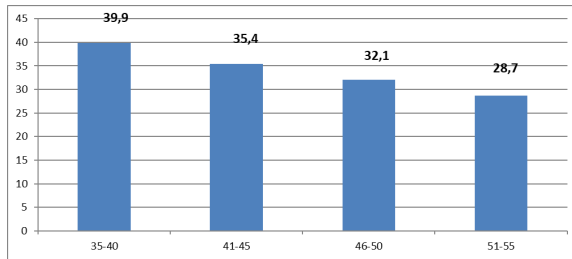


Figure 4. Dynamics of age-related values of maximum oxygen consumption in women of the period of the second mature age of the control group during pole walking.

In women, MG MOC in ml/min/kg, respectively, was: 38.16 ± 1.19 , 32.91 ± 1.12 , 30.80 ± 0.98 , 27.19 ± 0.92 ml/min/kg (Fig. 5).

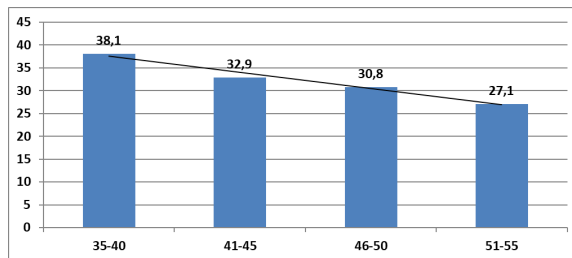


Figure 5. Dynamics of age-related values of maximum oxygen consumption in women of the period of the second mature age of the main group during pole walking.

Due to the increase in the passport age, the MOC has a significant ($p < 0.05$) downward trend. So, for the period from 36 to 55 years, the MOC in women of MG in absolute terms decreased by 10.97 ml/min/kg, and in women of the CG by 11.21 ml/min/kg.

Thus, the above indicates, firstly, the high practical value of the PWC 170 step test. Secondly, such an important fact as a short time for its implementation should not be discounted. It took us 15 to 17 minutes to complete the PWC 170 step test for women. Thirdly, during the step test, a positive emotional impact was carried out according to the type of dominant A.A. Ukhtomsky. We noticed that the creation of a dominant had a positive effect on the functional state of women.

Based on the study carried out, the following conclusions can be drawn:

1. To assess the level of PP, it is possible and necessary to use an easy-to-perform and valid step test PWC 170, which allows you to quickly and reliably monitor the functional state of the human body, especially after a previous Covid-19 pandemic.

2. In clinical practice, the 9th age period of human ontogeny should be considered not as a single period (36-55 years), but divided into equal time intervals, which will allow not only to individualize PW classes, but also to carry out medical control taking into account the passport age.

3. PP and MOC in women of the second period of mature age, suffering from CHD, after the Covid-19 pandemic, significantly depends on their passport age. When conducting rehabilitation treatment using PW, the physician should keep in mind that as the biological age of women increases, their PP and MOC values decrease.

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秋明州青少年学生中枢血流动力学的自主调节 c。 有龋齿
**AUTONOMIC REGULATION OF CENTRAL HEMODYNAMICS
IN ADOLESCENT STUDENTS IN TYUMEN C. WITH DENTAL
CARIES**

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客观的。 研究秋明市青少年学生在龋齿手术治疗期间平均动态压力 (ADP) 的变异性,它是最重要的中枢血流动力学指标之一。

材料与方法。 在 28 名青少年学生中,在牙科椅上以坐姿进行 5 分钟的生理休息,然后在进行龋齿手术治疗的过程中,研究了中枢血流动力学指标,包括收缩压 (SBP, mm Hg), 舒张压 (DBP, 毫米汞柱)、脉搏 (PP, 毫米汞柱) 和平均动态 (ADP, 毫米汞柱) 动脉压。 ADP根据Hickam和Wetzler-Boger公式的计算方法确定。

结果与讨论。 已经确定的是,研究的患有龋齿的年轻男性中枢血液动力学指标首先没有超出生理学规范值。 其次,ADP 仅随着龋齿的麻醉和牙科预备而增加,但其值是由生理决定的,并与情绪和心理压力有关。

结论。 Hickam 和 Wetzler-Boger 计算 ADP 的公式可以客观评估中枢血流动力学的状态,应该在临床牙科实践中广泛使用。

关键词: 年轻男性, 龋齿, 平均动态压力。

Objective. *To study the variability of the average dynamic pressure (ADP) as one of the most important indicators of central hemodynamics in adolescent students in the city of Tyumen during the surgical treatment of dental caries.*

Material and methods. *In 28 adolescent students in a state of 5 minutes of physiological rest in a sitting position in a dental chair, and then during*

the procedure for surgical treatment of dental caries, indicators of central hemodynamics were studied, including systolic (SBP, mm Hg), diastolic (DBP, mm Hg), pulse (PP, mm Hg) and average dynamic (ADP, mm Hg) arterial pressure. ADP was determined by the calculation method according to the Hickam and Wetzler-Boger formulas.

Results and discussion. *It has been established that the studied indicators of central hemodynamics in young men suffering from caries, firstly, do not go beyond the physiologically normative values. Secondly, ADP increases only with anesthesia and odontopreparation of a carious tooth, but its values are physiologically determined and are associated with emotional and psychological stress.*

Conclusions. *Hickam's and Wetzler-Boger's formulas for calculating ADP allow for an objective assessment of the state of central hemodynamics and should be widely used in clinical dental practice.*

Keywords: *young men, caries, average dynamic pressure.*

Relevance. For many decades in various countries of the world, despite the undoubted achievements in treatment and prevention, the most common disease is dental caries, which affects up to 95–97% of the world's population [2, 12, 14, 15, 23, 25, 27, 31, 32, 34]. It is impossible not to take into account the fact that the prevalence of dental caries among various contingents of the population in Russia is growing [1], especially due to the increase in passport age.

For many years, close attention has been paid to the issues of dental service in the Tyumen region. For example, the Tyumen State Medical University has been actively developing for many years the issues of the physiological approach in assessing the mechanisms of dental caries [4, 5], the mechanisms of tooth resistance to caries [6, 18], and the general resistance to periodontal diseases [3]. Methods for assessing changes in the hard tissues of the tooth are analyzed [21], issues of systemic prevention and treatment of dental caries [7, 17], and high-quality dental care are to be discussed [9].

For almost any patient, being in a dental chair and surgical treatment of dental caries is a kind of stressful situation that affects central hemodynamics [10, 29, 33].

In the medical literature available to us, we did not find studies related to the functional state of central hemodynamics, including ADP in adolescent men directly during the surgical treatment of dental caries, despite the fact that an extensive literature of domestic and foreign researchers is devoted to the physiology and pathology of blood circulation in humans [13, 26, 36, 37].

Objective: to study the variability of blood pressure as one of the most important indicators of central hemodynamics in men of adolescence in the city of Tyumen during the surgical treatment of dental caries.

Material and methods. The study was conducted on the basis of the Tyumen medical center «Astra-Med». In 19 men of adolescence with different degrees of clinical manifestations of dental caries before and during treatment, the indicators of central hemodynamics were studied while sitting in a dental chair. The anterior pressure was determined by the Korotkov method. To assess ADP, we used the Hickam formulas: $ADP = (PP : 3) + DBP$ and Wetzler–Boger: $ADP = 0.42 SBP + 0.58 DBP$ [8, 38], where: ADP – average dynamic arterial pressure (mm Hg); 3 - coefficient. Pulse arterial pressure was determined by the formula: $PAP = (SBP - DBP)$.

When assessing the degree of damage to the teeth by caries, we used the indicators recommended by the World Health Organization. The results of the study were processed on a personal computer by the methods of mathematical statistics using Student's t-criterion [11]. Differences were considered significant at a significance level of $p < 0.05$, adopted in biomedical studies.

The performed study complied with the Order of the Ministry of Health of the Russian Federation No. 226 dated June 19, 2003 «Rules of Clinical Practice in the Russian Federation». The principles of voluntariness, the rights and freedoms of the individual, guaranteed by Articles 21.2 and 22.1 of the Constitution of the Russian Federation, are observed.

Results and discussion. The work of the heart and the movement of blood through the vessels are determined by two combined factors: rhythmic changes in the volume of arterial vessels and the level of blood pressure. Therefore, knowledge of the level of blood pressure, its pulse fluctuations is very important for assessing the functional state of the circulatory system. It is known that the arterial system has conducting and damping functions [29, 35]. Violation of the conduction function occurs with narrowing or spasm of the arterial vessel, which is rare in adolescents. The damping function of an arterial vessel contributes to smoothing out pressure oscillations in it that occur during cyclic ejections of blood from the left ventricle and the transformation of a pulsating arterial blood flow into a continuous blood flow. This ability depends on the elastic properties of the arterial vessel wall itself [28, 30]. It is impossible not to take into account these functions of the arterial system, because in the dental chair we have not just a person with a toothache, but also individual characteristics of central hemodynamics and psychosomatics, which is reflected in clinical practice [19, 20].

It is known [24] that the level of blood pressure depends on a number of cumulative factors and their relationships: a) the amount of blood entering the vascular system per unit time; b) intensity of outflow to the periphery; c) the capacity of the arterial segment of the vascular bed (the ratio of the increase in volume to the increase in pressure); d) elastic resistance of vessel walls; e) the rate of blood flow during systole; e) blood viscosity; g) the ratio of the time of systole and diastole; h) heart rate.

ADP is a reflection of the energy of the continuous movement of blood and characterizes the degree of elasticity of the arterial vessel. ADP, unlike SBP and DBP, is relatively constant. It is known that the SBP value reflects the functionality of the heart muscle, while the DBP level determines the distribution of coronary blood flow and coronary perfusion [16, 24].

Academician I.P. Pavlov in his lectures on blood circulation [22] noted: “... *the average blood pressure in the arteries is a constant value, and this constancy is greatly protected by the body. This is of great importance, because fluctuations in this value are unsafe for the body. Extremely strong walls are needed, otherwise the vessels may not withstand, which happens with old people, whose vessels no longer have such extensibility or such strength as those of young people. Therefore, normally this value should not change abruptly, and the fact that the mean blood pressure value is kept at a constant level must be remembered. It should not rise much, because then there will not be enough receptacle for blood and the vessels may not withstand the pressure, but it should not fall too much, because the pressure difference in the arterial and venous systems will decrease and normal blood circulation will be disturbed, which, as you understand, is also very dangerous for the body. This means that the blood pressure in the arteries is characterized, on the one hand, by its constant fluctuations, on the other hand, by the constancy, invariability of the mean blood pressure. Mean blood pressure is stubbornly guarded by the body at a constant level ...* «.

To date, there is no doubt [24] that: “... *the average dynamic arterial pressure is the result of all those variable pressure values that occur during one involution of the heart. Mathematically, it is the integral, or the average of the infinitesimal changes in pressure from the minimum to the lateral systolic pressure over the time of one cardiac cycle.*

Normally, ADP is 80-90 mm Hg and depends on the age of the person. ADP in a person under the age of 45 is on average 80 mm Hg, with fluctuation limits of 75-92 mm Hg; in persons over 45 years old - 85-95 mm Hg, and in old age can reach 100-110 mm Hg [24].

Indicators of central hemodynamics in young men with dental caries at various stages of treatment (Table 1) indicated that they depended on the procedure being performed.

Table 1

Indicators of central hemodynamics in adolescents during physical (physiological) rest and surgical treatment of dental caries (M±m)

Indicator	Stages of the caries treatment procedure				
	Physiological rest	Anesthesia	Odonto-preparation	Filling	Polishing
SBP	119,4±2,7	128,2±3,1	132,6±3,0	124,5±2,3	120,8±2,5
	P _{1-2, 1-3, 2-3, 2-4} <0,05; P _{1-5, 3-4} – нет				
DBP	71,5±2,3	73,8±2,4	72,5±2,5	71,9±2,2	71,4±2,3
	P – нет				
PP	47,9±1,4	54,4±1,1	60,1±1,5	52,6±1,6	49,3±1,3
	P _{1-2, 1-3, 1-4, 2-3, 3-4, 3-5} <0,05; P ₁₋₅ – нет				
Calculations using the Hickam formula					
ADP	87,46±	91,93±	92,53±	89,43±	87,93±
	P ₁₋₃ <0,05; P _{1-2, 1-4, 2-3, 3-4, 3-5} – нет				
Calculations using the Wetzler–Boger formula					
ADP	91,61±2,3	96,68±3,0	97,74±2,6	93,99±2,9	92,20±2,8
	P _{1-2, 1-3, 1-4, 1-5, 2-3, 3-4, 3-5} – нет				

The dynamics of SBP values (Fig. 1) in the treatment of caries highlighted several points regarding changes in hemodynamics occurring within a few minutes. Firstly, SBP in the state of physical rest was statistically significant ($p < 0.05$) within the physiological norm typical for adolescents. Secondly, SBP in absolute terms increased by 8.8 mm Hg during anesthesia and 13.2 mm Hg during odonto-preparation of the tooth, which is statistically significant ($p < 0.05$) in comparison with the state of physical rest. Thirdly, during tooth filling and polishing, SBP did not significantly differ ($p > 0.05$) from the values of physical rest.

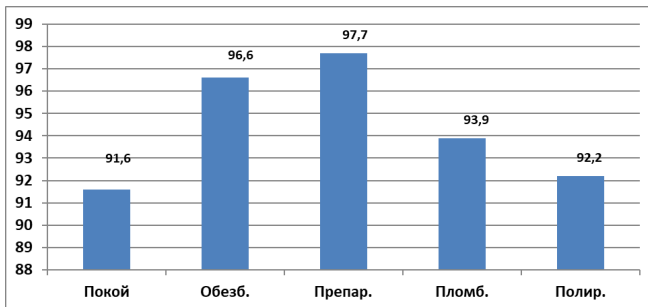


Figure 1. The value of systolic blood pressure at the stages of treatment of dental caries.

It is generally accepted that the DBP height is mainly determined by the degree of permeability of the precapillary system. The greater the resistance of the precapillaries, the higher the DBP. According to N.N. Savitsky [24], a persistent increase in DBP is more unfavorable than an increase in SBP. In this case, the DBP values will be the higher, the greater the resistance of the precapillaries, the lower the elastic resistance of large vessels and the higher the heart rate. Normally, in healthy people, the level of DBP can fluctuate within 65 ± 10 mm Hg. Between the ages of 19 and 50 years, DBP is most often 70-79 mm Hg. Art., and at 50-70 years old - 80-89 mm Hg.

Giving an assessment of the dynamics of DBP values at the stages of treatment of dental caries (Fig. 2), we note that there were no significant differences ($p < 0.05$), and it corresponded to the standard values.

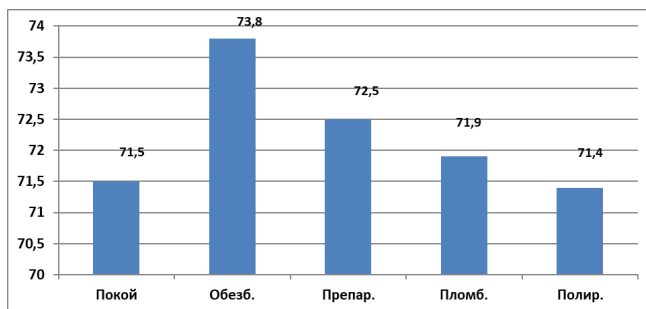


Figure 2. The value of diastolic blood pressure at the stages of treatment of dental caries.

In a healthy adult, PP is on average 35 ± 10 mm Hg. Our studies have shown that the PP values during anesthesia and odontopreparation (Fig. 3) were significantly ($p < 0.05$) higher than in the state of physiological rest.

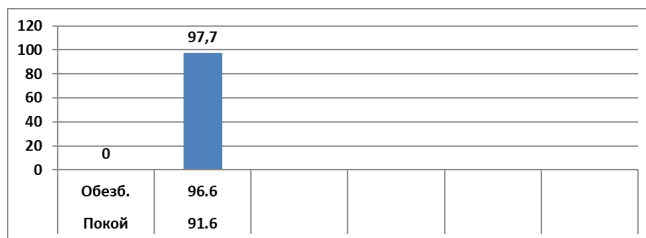


Figure 3. The value of pulse arterial pressure at the stages of treatment of dental caries.

We associate this, first of all, with the psycho-emotional stress induced by the stress of the patient in the dental chair. Nevertheless, we were alarmed by the fact that the increase in PP in males of adolescence, which occurred at the stage of anesthesia and odontopreparation, went beyond the normative physiological values. This led us to the idea of whether young men have a pathology of the cardiovascular system (CVS). Comparison of PP with the dynamics of changes in SBP during the surgical treatment of caries convinced that SBP did not go beyond the physiological norm. We concluded that in adolescents, a gradual increase in SBP correlates with a transient increase in SBP, especially during anesthesia and odontopreparation, which, apparently, is due to the excessive influence of the sympathetic division of the autonomic nervous system on the activity of the cardiovascular system during treatment.

The calculated ADP values according to the Hickam and Wetzler-Boger formulas differ in absolute values, and at all stages of surgical treatment. So, for example, ADP in a state of physiological rest, calculated according to the Hickam formula, was 4.15 mm Hg, than calculated by the Wetzler-Boger formula.

During anesthesia and odontopreparation, ADP, calculated according to the Hickam and Wetzler-Boger formula, had not only absolutely large, but also statistically significant ($p < 0.05$) indicators in comparison with other stages of treatment (Fig. 4, where 1, 2, 3, 4, 5 - stages of treatment).

We regard the ADP indicators obtained by us not as an expression of pathology in the activity of the cardiovascular system in men of adolescence, but as a consequence of their individual setting in the neuro-reflex regulation of blood circulation. It is impossible not to take into account the fact that SBP also increased during anesthesia and odontopreparation, which could not but affect the values of ADP.

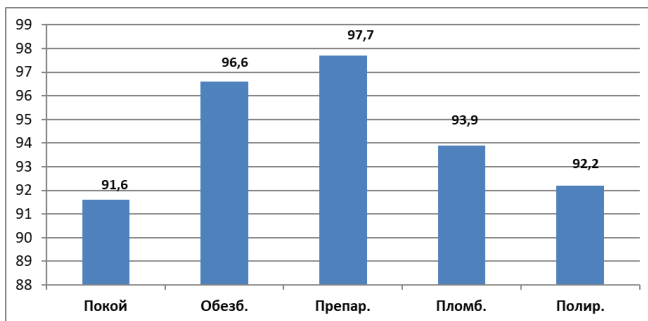


Figure 4. Estimated values of ADP according to the Hickam formula in men of the first period of adulthood.

Based on the study carried out, the following conclusions can be drawn:

1. Indicators of central hemodynamics in men of the period of youthful age in Tyumen c., suffering from dental caries, do not go beyond the physiologically normative values.
2. It should always be remembered that during anesthesia and odontopreparation, SBP and ADP increase for a short time, are physiologically determined in nature and quickly normalize.
3. The Hickam and Wetzler-Boger formulas for calculating ADP give an objective idea of the state of human central hemodynamics, therefore, due to their simplicity, they can be widely used in dental practice.

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在 All-on-4 种植牙手术中使用手术模板的优势
THE ADVANTAGES OF USING SURGICAL TEMPLATES IN ALL-ON-4 DENTAL IMPLANT PROCEDURES

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抽象的。近年来，在口腔种植学和矫形牙科中，手术模板的使用越来越流行。手术模板是一种定制指南，可帮助牙医将牙科植入物和矫形假体精确地放入患者口腔中。该模板提供了患者口腔的三维（3D）表示，使手术侵入性更小、效率更高。本文讨论了在牙种植学和骨科牙科中使用手术模板的优势，以及它们如何改善患者的治疗效果。

关键词：手术模板、牙种植学、矫形牙科、3D 表示、患者结果。

Abstract. *In dental implantology and orthopedic dentistry, the use of surgical templates has become increasingly popular in recent years. A surgical template is a custom-made guide that helps dentists precisely place dental implants and orthopedic prostheses in the patient's mouth. The template provides a three-dimensional (3D) representation of the patient's oral cavity, making the procedure less invasive and more efficient. This article discusses the advantages of using surgical templates in dental implantology and orthopedic dentistry and how they can improve patient outcomes.*

Keywords: *surgical templates, dental implantology, orthopedic dentistry, 3D representation, patient outcomes.*

All-on-4 dental implant procedures have become a popular alternative to traditional dentures or implant-supported bridges. The procedure involves placing four dental implants in the jawbone, which then support a full set of teeth. To ensure the accuracy and precision of the implant placement, many dentists are now using surgical templates. A surgical template is a custom-made guide that provides dentists with a three-dimensional representation of the patient's oral cavity, making the procedure less invasive and more efficient. In this article, we will discuss the advantages of using surgical templates in All-on-4 dental implant procedures and how they can benefit both the dentist and the patient.

Advantages of Using Surgical Templates in All-on-4 Dental Implant Procedures:

Improved Accuracy: A surgical template provides a precise guide for the placement of the dental implants, reducing the risk of implant malposition or prosthesis misfit. This accuracy leads to a more successful outcome and can improve the longevity of the implants.

Efficient Procedure: The use of surgical templates streamlines the All-on-4 dental implant procedure, reducing the surgical time and making the process less invasive. This leads to a faster recovery time for the patient.

Reduced Radiation Exposure: The use of surgical templates reduces the need for radiographs during the procedure, which reduces the patient's radiation exposure. This is especially important for patients who may require multiple procedures or those who are sensitive to radiation.

Improved Patient Outcomes: The precision and accuracy provided by surgical templates lead to improved patient outcomes, such as better aesthetics, function, and comfort. Patients experience less discomfort, and the prosthesis feels more natural in the mouth.

Implementation of Surgical Templates in All-on-4 Dental Implant Procedures:

The implementation of surgical templates in All-on-4 dental implant procedures requires a combination of specialized training and technology. Dentists must first create a detailed 3D model of the patient's oral cavity using digital impressions, cone beam computed tomography (CBCT), or other imaging techniques. This model is then used to create a custom surgical template that fits precisely over the patient's teeth and gums.

The surgical template is designed using computer-aided design (CAD) software, which allows the dentist to make precise adjustments to the template's shape and size. The final template is typically fabricated using a 3D printer or a milling machine. Once the surgical template is complete, the dentist can use it to guide the placement of the dental implants with greater accuracy and precision.

Limitations of Surgical Templates in All-on-4 Dental Implant Procedures:

Although the use of surgical templates in All-on-4 dental implant procedures has many advantages, there are some limitations to their use. One significant limitation is the cost of creating custom surgical templates, which can be expensive for patients. Additionally, some patients may not be candidates for surgical template-guided procedures due to anatomical limitations or severe bone loss.

Conclusion:

The use of surgical templates in All-on-4 dental implant procedures is a valuable tool for improving the accuracy and predictability of implant placement. The use of surgical templates can lead to more efficient procedures, reduced radiation exposure, and improved patient outcomes. By providing a precise guide for im-

plant placement, surgical templates help to reduce the risk of implant malposition or prosthesis misfit, improving the longevity of the implants. Implementation of surgical templates requires specialized training and technology, but the benefits can be significant for both the dentist and the patient.

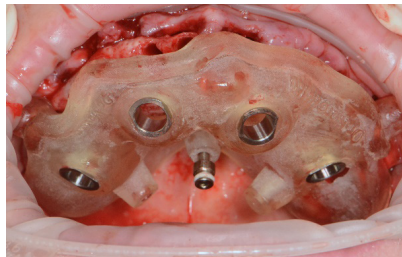
Despite the limitations of surgical templates, such as their cost and patient eligibility, they remain a valuable tool in All-on-4 dental implant procedures. Dentists who are trained in their use can provide patients with a more accurate and predictable procedure, resulting in improved patient outcomes and overall satisfaction.

In conclusion, the use of surgical templates in All-on-4 dental implant procedures is a significant advancement in implant dentistry. As technology continues to evolve, it is likely that surgical templates will become even more accurate and affordable, making them an increasingly important tool for dentists and patients alike.

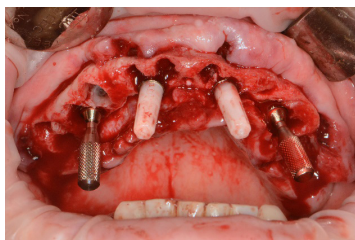
An example of a surgical template for all on 4 implantation



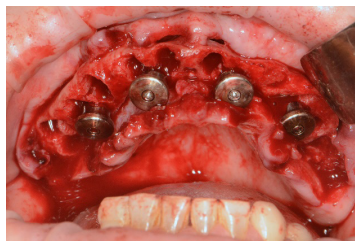
The situation before in the oral cavity



A surgical template is installed, the template is designed in the program 3 Diagnosis and Plasticad



Implants and multiunits are installed



Installed healing caps

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2型糖尿病患者梗死后心脏重构过程的评价

**EVALUATION OF THE PROCESSES OF POSTINFARCTION
HEART REMODELING IN PATIENTS WITH TYPE 2 DIABETES
MELLITUS**

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Introduction. Cardiac remodeling is the result of a complex interaction between neurohormonal and cytokine signaling cascades, which, by a positive feedback mechanism, stimulate the processes of cell structural rearrangement leading to ventricular remodeling [1,2]. These include infiltration by inflammatory mononuclear cells and proliferation of fibroblasts, some of which can differentiate into contractile myofibroblasts, stimulation of myocyte hypertrophy and an increase in the rate of myocyte apoptosis. This complex of cellular changes ultimately leads to characteristic morphological changes in the left ventricle, including dilatation and progressive LV dysfunction. LVH occurs as a result of exposure to pathological factors, and it is aimed at maintaining the normal function of the organ - at maintaining cardiac output (CO), which is determined by the efficiency of its systolic and diastolic functions. It is well known that the fall in CO with a decrease in myocardial contractile function is compensated by two mechanisms: Frank-Starling and activation of neurohumoral systems: activation of the SAS, RAAS and the arginine-vasopressin system leads to an increase in vascular tone, sodium and water retention with an increase in circulating blood volume, which triggers a long-term compensation mechanism, the main component of which is remodeling [2,3]. In type 2 diabetes mellitus (DM2), it is the heart that is recognized as the most important target of damage. The combination of insulin resistance, hyperinsulinemia and hyperglycemia accelerates the development and progression of diseases associated with atherosclerosis, increasing the risk of cardiovascular complications [4]. Left ventricle (LV) diastolic dysfunction is considered an early marker of myocardial damage in T2DM, noting the pathogenetic relationship be-

tween LV diastolic dysfunction and LV hypertrophy (LVH) in the development and progression of chronic heart failure (CHF) [5]. Despite the available material on the pathogenesis of remodeling, the results of the work do not reflect a complete picture of the processes of formation of structural and functional disorders of the heart in patients with type 2 diabetes in CHF. The question of the severity of heart changes in electrophysiological remodeling in T2DM remains unresolved.

Objective: To evaluate the processes of cardiac remodeling in patients with type 2 diabetes mellitus (DM) after myocardial infarction (MI).

Patients and Methods: The study included 97 male patients with MI at the age of 40 to 60 years (mean age 51.3 ± 5.7 years). The survey included patients with a history of MI from 6 months to 3 years. To compare the data obtained, a group of healthy individuals (control group) was examined in the amount of 31 people comparable in sex and age with the main group. The structural and functional state of the myocardium and the process of LV remodeling was assessed by Doppler echocardiography. Echocardiography was carried out on the MEDISON ACCUVIX V20 device (Korea), using a 3.25 MHz probe in standard echocardiographic positions, by the transthoracic method in the supine position and on the left side by EchoCG in M- and B-modes in accordance with the recommendations of the American Association of Echocardiography (ASE). During echocardiography, the structural parameters of the heart were assessed: LV end-diastolic volume (EDV), LV end-systolic volume (ESV), thickness of left ventricular posterior wall (TLVPPW), interventricular septal thickness (IST), fraction of shortening of the anteroposterior LV size in systole (Fs), the size of the left atrium (LA), the longitudinal size of the left ventricle, defined as the distance from the base of the papillary muscles to the apex of the heart in systole and diastole (Ls and Ld). The value of the mean hemodynamic BP (AP_{mean}) was calculated using the HiKem formula. End systolic volume (ESV), end diastolic volume (EDV), ejection fraction (EF) were calculated based on the obtained data using the Simpson formula. Evaluation of LV diastolic function by determining indicators: the maximum rate of early filling of the left ventricle (E), the maximum rate of late filling of the atria (A), the ratio of E / A, DT is the time of slowing down the flow rate in the early LV filling phase (ms), isovolumetric relaxation time left ventricle (IRTLV, ms).

Results: When evaluating the parameters of postinfarction left ventricular (LV) remodeling in the examined patients, the following types of remodeling were identified: 28 (29.5%) had a concentric type of remodeling, 36 (37.9%) had concentric LV hypertrophy and an eccentric type of remodeling - in 31 (32.6%) patients. Disorders of LV diastolic function were observed in 86 (90.5%) patients, of which relaxation disorders were determined in 41 (47.7%) cases, pseudonormalization - in 27 (31.4%) and restrictive changes in 18 (20.9%) cases.

Table 1
Structural-geometric parameters and indicators of LV diastolic function in patients with CHF

Indicators	Type 2 SD + PICS	Type 2 SD + PICS	p
EDV, ml	147,7±31,9	159,1±36,3	p>0,05
ESV, ml	74,7±24,8	85,3±30,7	p<0,05
EF, %	54,4±5,8	44,8±6,5	p<0,05
LA, sm	3,8±0,6	4,1±0,4	p<0,05
E, sm/s	63,2±12,3	57,7±16,3	p<0,05
A, sm/s	69,1±14,5	74,5±15,8	p>0,05
E/A	0,91±0,35	0,78±0,38	p>0,05
IVRT, ms	104,6±14,3	91,13±16,4	p>0,05
DT, ms	184,4±21,91	175,3±29,54	p>0,05

To assess the relationship between violations of the contractile function of the left ventricle and diastolic dysfunction of the left ventricle, patients were divided into 3 groups: a group with preserved systolic function of the left ventricle (ejection fraction (EF) $\geq 50\%$), a group with reduced EF ($<40\%$) and EF = 40-49%. Patients with EF $\geq 50\%$ were 32 (33.7%), EF = 40-49% - 40 (42.1%) and EF $<40\%$ - 24 (25.3%). Undoubtedly, LV dysfunction is a serious consequence of coronary artery disease and hypertension, but in patients with type 2 diabetes, diastolic heart dysfunction can outpace the violation of LV systolic function and, moreover, lead to the development of CHF symptoms in isolation [6]. In our own study, echocardiographic signs of impaired diastolic function with preserved LV EF were detected in all patients with DM2, however, with a combination of DM2 and previous MI, the severity of diastolic disorders increased, which manifested itself in an increase in the incidence of pseudonormal and restrictive types of diastolic dysfunction [7]. An analysis of the prevalence of various types of left ventricular diastolic dysfunction showed that severe disorders of left ventricular diastolic dysfunction - pseudonormal and restrictive types were significantly more common in the group of patients with reduced left ventricular systolic function. The formation of LV dysfunction and CHF is based on processes associated with structural changes in cardiomyocytes against the background of chronic hypoperfusion, increased diastolic stiffness and impaired active relaxation of the myocardium, reactive changes in the musculoskeletal skeleton, decreased diastolic filling and remodeling with segmental disorders of the heart structure [8]. The data obtained allow us to state that the severity of LV diastolic dysfunction in T2D is a prognostically significant factor in the formation of CHF:

Conclusion: In patients with type 2 diabetes who have had myocardial infarction, post-infarction remodeling leads not only to structural restructuring of the

left ventricle, characterized by a decrease in myocardial contractility, a change in the structural and geometric parameters of the heart, but also to severe LV diastolic dysfunction, which is a prognostically significant factor in the formation of heart failure.

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培养的真皮成纤维细胞和肺表面活性物质移植后第19天再生皮肤缺损的结构成分
STRUCTURAL COMPONENTS OF A REGENERATING SKIN DEFECT ON THE 19TH DAY AFTER TRANSPLANTATION OF CULTURED DERMAL FIBROBLASTS AND PULMONARY SURFACTANT

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抽象的。影响全球 20% 以上人口的慢性静脉功能不全是由静脉淤滞引起的，导致周围组织在分子、细胞和组织水平上发生一系列病理变化 [1]。该研究的目的是研究移植肺表面活性物质和真皮成纤维细胞组织工程构建体后第 19 天小鼠愈合缺血性皮肤缺损活检标本的形态学特征。将 16 只 4-6 月龄的 C57/B1 系白色实验室小鼠分为对照组和实验组。各组均在腹腔注射 2.5%阿佛汀溶液 0.3-0.4 ml 后进行肩胛区皮肤缺血创面模拟手术，手术过程中实验组小鼠移植由以下组成的二维结构 表面应用肺表面活性物质，伤口的边缘和底部用 0.4 ml 异种成纤维细胞在生长培养基 DMEM F12 (Lonza) 中的悬浮液切碎，数量为 133 万个细胞。基于肺表面活性物质和真皮异成纤维细胞的组织工程结构可加速缺血性皮肤缺损的愈合。创面造模后第19天，创面活检标本表皮较对照组增厚2倍，

分化程度更高。在实验组中,观察到表皮衍生生物的铺设 - 毛发。肉芽组织处于纤维化初期,胶原纤维面积较对照组增加 $20.20 \pm 0.01\%$,血管面积较对照组减少 $19.13 \pm 0.01\%$,肉芽组织出现形态学征象 伤口过程的第二阶段 - 增殖阶段。

关键词: 缺血性皮肤缺损,真皮成纤维细胞,表面活性剂,修复性组织发生,小鼠。

Abstract. *Chronic venous insufficiency, which affects more than 20% of the world's population, is caused by venous stasis, leading to a cascade of pathological changes in surrounding tissues at the molecular, cellular, and tissue levels [1]. The aim of the study was to study the morphological features of biopsy specimens of a healing ischemic skin defect in mice on the 19th day after transplantation of a tissue-engineered construct from pulmonary surfactant and dermal fibroblasts. 16 white laboratory mice of the C57/B1 line, which had reached the age of 4-6 months, were divided into control and experimental groups. In all groups, an operation to simulate a skin ischemic wound in the scapular region was performed after intraperitoneal injection of a 2.5% solution of Avertin 0.3-0.4 ml, and during the operation, mice of the experimental group were transplanted with a 2D construct consisting of a superficially applied pulmonary surfactant, and the edges and the bottom of the wound was chipped with 0.4 ml of a suspension of alofibroblasts in the growth medium DMEM F12 (Lonza) in the amount of 1.33 million cells. A tissue-engineered construct based on pulmonary surfactant and dermal heterofibroblasts accelerates the healing of an ischemic skin defect. On the 19th day after the wound modeling, the epidermis of the wound biopsy specimens is 2 times thicker and more differentiated compared to the control. In the experimental group, the laying of derivatives of the epidermis - hairs is observed. The granulation tissue is at the beginning of the fibrosis stage, when the area of collagen fibers is $20.20 \pm 0.01\%$ larger, and the area of blood vessels is $19.13 \pm 0.01\%$ less compared to the control group, where the granulation tissue demonstrates morphological signs of the second stages of the wound process - the stage of proliferation.*

Keywords: *ischemic skin defect, dermal fibroblasts, surfactant, reparative histogenesis, mice.*

Chronic venous insufficiency, which affects more than 20% of the world's population, is caused by venous stasis, leading to a cascade of pathological changes in surrounding tissues at the molecular, cellular, and tissue levels [1]. A complication of CVI is a trophic ulcer. One of the approaches to the therapy of such a pathology was the delivery of viable allogeneic cells, including fibroblasts, to a trophic ulcer [2]. The treatment of skin defects using in vitro cultured cells has been widely recognized worldwide as a safe and effective method [3]. Among the many types of cells that can have a clinical effect, dermal fibroblasts are of particular interest.

The ability of fibroblasts to form an intercellular matrix, synthesize cytokines, and induce migration and proliferation of different types of cells in skin lesions makes them promising for wide clinical use [4]. They have the ability to actively divide and participate in wound healing [5]. Tissue-engineered skin grafts with dermal fibroblasts have proven to be effective in closing deep skin wounds, including in violation of venous circulation [3]. In a healthy lung, type 2 alveolocytes secrete surfactant proteins, which are important for protecting the lungs from pathogens [6]. Surfactant has been successfully used in the treatment of uncomplicated skin defects [7]. In this regard, the aim of the study was to study the morphological features of biopsies of a healing ischemic skin defect in mice on the 19th day after transplantation of a tissue-engineered construct from pulmonary surfactant and dermal fibroblasts.

Material and methods. We used 16 white laboratory mice of the C57/B1 line, which reached the age of 4–6 months. All animals were divided into control and experimental groups of 8 animals each. The experiments were carried out following all the principles of humanity contained in the directive of the European Community (86/609/EC) and in accordance with the “Rules for the performance of work involving experimental animals”. In all groups, an operation to simulate a skin wound in the scapular region was performed after intraperitoneal injection of a 2.5% solution of Avertin 0.3–0.4 ml. The skin was excised in the form of a circle with a diameter of 12 mm, a silicone ring with an outer diameter of 12 mm was fixed to the edges of the wound with fascial interrupted sutures with atraumatic suture material “Polypropylene” 5-0 to exclude the possibility of epithelialization of the wound and closing it with mobile skin in the back region. The technique of forming a model wound is described in the work of Baranovsky Yu. G. et al., 2016 [8]. The EG (8 specimens) included mice in which a 2D construct consisting of a superficially applied pulmonary surfactant was transplanted onto a model wound during the operation, and the edges and bottom of the wound were chipped with 0.4 ml of a suspension of allofibroblasts of the 2nd or 3rd passage Cells of the third passage with phenotype CD44+CD90+CD105+CD73+CD45+CD31-CD34-CD45- in DMEM F12 growth medium (Lonza) in the amount of 1.33 million cells. The technique for obtaining and cultivating dermal fibroblasts is described in detail in the article by Shapovalov E.Yu., et al., 2017 [9].

Commercially available preparations of lung surfactants contain a lipophilic fraction after lavage or extraction from the lungs of animals. Among the surface emulsifying properties of phospholipids and hydrophobic surfactant proteins SP-B and SP-C that facilitate absorption and spread of the surfactant film, phosphatidylglycerol [10], DPPC18, SP-B31 and SP-C32 present have anti-inflammatory and antibacterial properties [11]. In EG mice, a solution of a natural surfactant preparation, poractant alpha (commercial name Curosulf, manufactured by Chiesi

Farmaceutici (Italy), was used, which is a complex complex that includes hydrophobic low molecular weight proteins, polar phospholipids, and polysaccharides obtained from crushed lungs of calves and piglets. Above the wound closed with an aseptic bandage “Voscopran” with levomikol.

After 19 days, the recovering ischemic skin defect was excised during repeated surgical intervention after intraperitoneal injection of a 2.5% solution of Avertin 0.3-0.4 ml. The biopsy was placed in 10% buffered neutral formalin solution. The surgical wound was sutured and, after its healing, the mice were returned to the vivarium. According to the generally accepted method, the material was impregnated with paraffin. The overview staining of the sections was carried out with the first dye - Mayer's hematoxylin, and then with the second - eosin. The thickness of the epidermis, the area occupied by collagen fibers and microvessels in the granulation tissue of the biopsy samples were measured using the ImageJ program at a total magnification of 400 times with an Olympus CX40 light microscope, 50 measurements per section. The area of collagen fibers and blood vessels was calculated as a percentage of the area of granulation tissue in sections. Comparisons of statistical samples of the thickness of the epidermis, the area of collagen fibers and blood vessels were made in percentage with respect to CG in each healing period, using MS Office Excel 2007 and STATISTICA 10.0 Enterprise (StatSoft Inc., USA), using the Mann-Whitney test (U-test) with a degree of significance of differences $p=0.05$.

Results of the study and their discussion. In sections of biopsy specimens of a healing model ischemic wound in the control group, there is a stratified squamous partially keratinized epithelium covering the wound from the outside (Figure 1A). Its thickness is $59.38 \pm 1.04 \mu\text{m}$ (Table 1). The epidermis contains a basal layer, consisting of a single row of prismatic cells lying on the basement membrane. Above them, two or three rows of polygonal epidermocytes are visible, forming a prickly layer. The granular layer is fragmented into groups of epidermocytes with basophilic granules of keratohyalin in the cytoplasm. The most superficial stratum corneum is very thin with single flattened keratinocytes with nuclei in the initial stage of specialization. The basis of biopsy specimens is granulation tissue, consisting of collagen fibers, cells, mainly fibroblastic differon, and numerous blood vessels. Collagen fibers are thick, tortuous, lie loosely, intertwined in the form of a network. The free spaces between them are filled with edematous fluid, blood vessels, and there are a few cells with basophilic nuclei in the center. The area occupied by collagen fibers is $50.25 \pm 0.01\%$ of the area of the dermis. Relatively numerous blood capillaries and venules are dilated. The vessel wall consists of a single row of endothelial cells. The area occupied by blood vessels is $1.15 \pm 0.01\%$ of the area of the dermis.

During the same period of healing of the model wound in mice of the experimental group after application of a surfactant and injection of xenofibroblasts, biopsy specimens are covered with stratified squamous partially keratinized epithelium, the thickness of which is $49.17 \pm 0.01\%$ greater than in the control group (see Table 1). This epithelium also contains four layers of epidermocytes. The increase in the thickness of the epidermis occurred due to an increase in the rows of polygonal epidermocytes in the spiny layer and the full formation of the granular layer (Figure 1B). The stratum corneum is still not completely formed. The process of keratinization is not completed, flat cells lie in one row and have flattened nuclei. In the marginal zone of biopsy specimens along the perimeter of the wound, there are single bookmarks of hairs. The granulation tissue under the biopsy epidermis demonstrates the beginning of transformation into the third stage of the wound process, when the architectonics of the location of collagen fibers changes. It contains both longitudinally lying bundles of collagen fibers characteristic of the fibrosis stage and intertwining collagen fibers characteristic of the proliferation stage (see Fig. 1B). The area occupied by collagen fibers is $20.20 \pm 0.01\%$ more than in the control group. The free spaces between the fiber bundles were noticeably reduced, as was the number of blood vessels. The area occupied by blood vessels decreased by $19.13 \pm 0.01\%$ compared to the group of mice without treatment, which also indicates fibrosis of the granulation tissue.

Table 1
Quantitative characteristics of the components of biopsy specimens of the control (CG) and experimental (EG) groups on the 19th day of regenerative histogenesis

Skin scars	The thickness of the epidermis in microns	The area of vessels in the dermis in%	The area of collagen fibers in the dermis in%
Skin scars in CG	59,38±1,04	1,15±0,01	50,25±0,01
Skin scars in EG	116,81±0,15	0,93±0,01	62,97±0,01

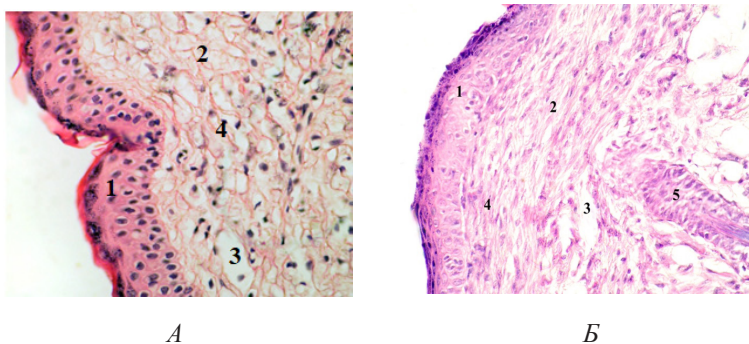


Figure 1. Epidermis and dermis of biopsy specimens of ischemic skin wounds in mice of the control and experimental groups on the 19th day of reparative histogenesis. Stained with hematoxylin and eosin. A - Control group. Magnification: x400. B - Experimental group. Magnification: x200. 1 - epidermis; 2 - granulation tissue; 3 - vessel; 4 - collagen fibers; 5 - bookmark wool.

Conclusions. A tissue-engineered construct based on pulmonary surfactant and dermal heterofibroblasts accelerates the healing of an ischemic skin defect. On the 19th day after the wound modeling, the epidermis of the wound biopsy specimens is 2 times thicker and more differentiated compared to the control. In the experimental group, the laying of derivatives of the epidermis - hairs is observed. The granulation tissue is at the beginning of the fibrosis stage, when the area of collagen fibers is $20.20 \pm 0.01\%$ larger, and the area of blood vessels is $19.13 \pm 0.01\%$ less compared to the control group, where the granulation tissue demonstrates morphological signs of the second stages of the wound process - the stage of proliferation.

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某体育院校学生无氧运动后肌肉工作生理成本的变化
**CHANGES IN THE PHYSIOLOGICAL COST OF MUSCULAR
WORK IN STUDENTS OF A PHYSICAL EDUCATION UNIVERSITY
AFTER ANAEROBIC EXERCISE**

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抽象的。 该文章将体育大学学生在无氧运动后肌肉工作的生理成本变化视为衡量学生运动员健康水平的系统标准。 其质变得到证实,反映了身体在运动训练过程准备阶段的当前机能状态水平。

关键词: 生理成本、无氧运动表现、速度、速度-力量能力、功能状态、大脑神经能量映射、心率变异性、运动员。

Abstract. *The article considers changes in the physiological cost of muscular work in students of a sports university after anaerobic exercise as a systemic criterion for the achieved level of student-athlete fitness. Its qualitative shifts are proved, reflecting the level of the current functional state of the body in the preparatory stage of the process of sports training.*

Keywords: *physiological cost, anaerobic performance, speed, speed-strength abilities, functional state, neuroenergy mapping of the brain, heart rate variability, athletes.*

Intensification of training effects leads to disruption of neuronal metabolism, disruption of adaptation processes, development of pathology, in particular the

cardiovascular system, its microcirculatory link, which largely ensure physical performance. Moreover, excessive systematic selected loads, and then for their abrupt cessation, the athlete's body spends its biological price, which can be reflected in the development of obesity, atherosclerosis, obesity, a decrease in cellular and tissue immunoresistance to adverse environmental influences and an increase in the overall level of morbidity. Therefore, at the present stage of sports development, it is necessary not only to take into account the special performance of athletes, but also modern methods of assessing the current functional state of their body.

The purpose of the study: to compare the physiological cost of muscular work in students of a sports university after anaerobic exercise during the study.

Materials and research methods. Analysis of heart rate variability was carried out using a hardware-software multi-channel complex (7 cardiorecorders) "Omega-Sport" (Russia). The activity of various brain structures was assessed using a 5-channel APC for topographic mapping of the electrical activity of the brain "Neuro-KM", scientific and medical company "Statokin" (Moscow, Russia). To assess the anaerobic endurance of student-athletes, a mechanical bicycle ergometer "Ergomedic 894E Peak Bike" manufactured by "Monark Exercise AB" (Sweden) was used. To assess the physiological cost of muscular work, the generally recognized formula for its calculation according to S.Ya. Klassina (2017) in a modernized version. The essence of the update was to include as an analysis of the "load value" for the body of the leading prognostic parameters based on the results of this study. The obtained results were quantified by the methods of nonparametric statistics using statistical analysis by the IBM SPSS Statistics 19 system for Windows (StatSoft, Inc., USA).

The experimental part of the study took place in the autumn period (September-October, 8 weeks) 2022 at the beginning of the pull-in and at the end of the basic developmental general preparatory stage of the preparatory period. The contingent of the subjects: 30 young athletes of the Federal State Budgetary Educational Institution of Higher Education "SGUS". For the representativeness of the sample (by groups, $n=10$) of the surveyed, anthropometric data, specialization (football, wrestling), age (18-20 years), qualification (II-III sports category) and students studying in the direction of training "Physical culture" were taken into account, profile "sports and health technologies" (FOT), involved in sports as part of the curriculum.

Research results. It was established (Table 1) that at the beginning of the study, the greatest manifestations of speed and speed-strength abilities were achieved in wrestlers. So, in them, the maximum frequency in the first trial of the 6-second test was 207.35 ± 1.25 rpm, which is 2.4% ($p < 0.05$) more than that of football players, by 4.4% ($p < 0.05$) than the representatives of "FOT". The time

to achieve it, equal to 70% of the maximum possible in group II, was noted at the level of 1.867 ± 0.011 s, which is 5.1% ($p < 0.05$) less than in group I, and by 8.2% ($p < 0.01$) than in group III. The absolute power of wrestlers during testing reached 389.31 ± 2.54 W, which is 2.3% ($p < 0.05$) higher than that of football players, by 6.3% ($p < 0.01$) than the students of specialization (FOT).

It was established (Table 2) that according to the 15-second test, the greatest manifestations of anaerobic performance were noted in football players. So at the beginning of the study, the values of the volume of work performed by them were noted at the level of 10967.45 ± 44.1 J, which is 2.4% ($p < 0.05$) more than that of the wrestlers, by 9.3% ($p < 0.01$) than the students of the specialization “Physical Faculty”. Absolute power parameters in athletes of group I were 737.16 ± 3.30 W, which is 2.6% ($p < 0.05$) more than in group II, 10% ($p < 0.01$) than in group III. The values of relative power in football players reached 9.42 ± 0.07 W/kg, which is 5.1% ($p < 0.05$) higher than in wrestlers, 9% ($p < 0.01$) than in “FOT”. The number of revolutions of the bicycle ergometer wheel during the test in athletes of group I reached 36.20 ± 0.21 , which is 6% ($p < 0.05$) faster than in group III.

Table 1
Comparative characteristics of speed-strength abilities of student-athletes of various specializations during bicycle ergometric testing, $M \pm m$

Group / Markers		Football (I), (n=10)	Wrestling (II), (n=10)	FOT (III), (n=10)	p
6 second test (1 trial, load 2% of body weight)					
Frequency, rpm	n.	202,56±1,10	207,35±1,25	198,67±0,90	*1-2;*1-3;*2-3.
	to.	208,34±1,45	213,82±1,67	203,67±1,34	*1-2;*1-3;*2-3.
	%	+2,81*	+3,12*	+2,52*	
Time1, With	n.	1,967±0,014	1,867±0,011	2,034±0,016	*1-2;*1-3;**2-3.
	to.	1,884±0,012	1,761±0,008	1,970±0,015	*1-2;*1-3;*2-3.
	%	-4,21*	-5,67**	-3,14*	
Power1, Tue	n.	380,42±2,28	389,31±2,54	366,25±1,91	*1-2;*1-3;**2-3.
	to.	392,61±2,32	403,35±2,77	374,63±2,74	*1-2;*1-3;*2-3.
	%	+3,20*	+3,61**	+2,28	
6-second test (2 trials, load 7% of body weight)					
Frequency2, rpm	n.	165,35±0,57	170,56±0,82	161,53±0,42	*1-2;*1-3;**2-3.
	to.	169,67±0,64	175,42±0,96	165,12±0,51	*1-2;*1-3;*2-3.
	%	+2,61*	+2,84*	+2,22*	
Time2, With	n.	2,025±0,017	1,985±0,014	2,112±0,021	*1-2;*1-3;**2-3.
	to.	1,953±0,014	1,902±0,010	2,081±0,018	*1-3;*2-3.
	%	-3,55*	-4,18*	-1,46	

Power2, Tue	n.	1027,12±2,74	1051,45±3,34	1019,85±2,25	*1-2;*1-3;*2-3.
	to.	1050,82±2,85	1077,82±3,93	1037,24±2,41	*1-2;*1-3;*2-3.
	%	+2,31*	+2,51*	+1,71*	
Gradient, W/s	n.	347,45±2,73	358,32±3,12	329,45±2,15	*1-2;*1-3;**2-3.
	to.	360,74±3,10	373,56±3,56	338,52±2,64	*1-2;*1-3;*2-3.
	%	+3,82*	+4,53**	+2,75*	

Note: n. - at the beginning of the study; to. - at the end of the study;

* - differences are statistically significant at $p < 0.05$;

** - differences are statistically significant at $p < 0.01$.

Thus, in general, according to the results of the study, an average level of anaerobic performance of student-athletes was revealed in comparison with the data obtained by other researchers (V.N. Seluyanov, 2010; S.K. Grigoriev, 2013), corresponding to their sports qualification and the direction of training educational programs. At the same time, the indicators of their speed, speed-strength abilities, maximum anaerobic power and glycolytic endurance increased significantly at the end of the study according to the bicycle ergometric study.

At the end of the work, for a more effective assessment of the current functional state of the organism of student-athletes and effective management of the training process, it is advisable to present not quantitative changes in the studied markers, but qualitative changes in the physiological value of the achieved result ($\Delta \rho$, %) in the dynamics of observations over the entire time of the experiment. The results are presented in tables 3-4.

Table 2

Comparative characteristics of the maximum anaerobic power in student-athletes of various specializations during bicycle ergometric testing, $M \pm m$

Group / Markers		Football (I), (n=10)	Wrestling (II), (n=10)	FOT (III), (n=10)	p
15 second test (3 trials, 5% of body weight)					
Volume, J	n.	10967,45±44,1	10712,97±31,4	10031,15±22,5	**1-3; *2-3.
	to.	11420,07±49,1	11125,23±40,5	10288,33±25,4	*1-2;*1-3;*2-3.
	%	+4,12**	+3,84*	+2,56*	
Power, W	n.	737,16±3,30	718,51±2,75	670,12±2,15	*1-2;**1-3;*2-3.
	to.	765,90±3,68	745,12±2,84	686,11±2,36	*1-2;*1-3;*2-3.
	%	+3,91**	+3,70*	+2,98*	
Power, W/kg	n.	9,42±0,07	8,96±0,05	8,64±0,05	*1-2; **1-3
	to.	9,75±0,10	9,26±0,08	8,78±0,07	*1-2;*1-3;*2-3.
	%	+3,50*	+3,34*	+1,6	

Turnovers3, times	n.	36,20±0,21	35,34±0,18	34,16±0,11	*1-3;*2-3.
	to.	38,15±0,32	37,07±0,23	35,45±0,17	*1-2;*1-3;*2-3.
	%	+5,38**	+4,75**	+3,70*	

Note: n. - at the beginning of the study; to. - at the end of the study;

* - differences are statistically significant at $p < 0.05$;

** - differences are statistically significant at $p < 0.01$.

It has been established (Table 3) that at the end of the basic developmental general preparatory stage of the preparatory period, the physiological value of a sports result achieved when performing anaerobic loads decreased only among the representatives of the sports groups of the examined, which reflected an increase in their functional capabilities of the body. Its greatest decrease according to heart rate variability was observed in football players according to the shifts in the stress index and the total spectrum power by 23.8% ($p < 0.05$). While in wrestlers, only by 19.1% ($p < 0.05$). While the representatives of the direction of training “physical culture and health technologies, on the contrary, an increase in test results, was accompanied by an increase in its price with an increase in the SI / TP delta by 15.7% ($p < 0.05$), which indicated a decrease in their adaptive capabilities, the appearance of signs of overstrain of the body and the inadequacy of the chosen training effect as a way to assess their special performance.

In the future, a comparative characteristic of the energy metabolism of cortical neurons was made using neuroenergy mapping of five areas of the brain before and after training exposure with comparison with the level of rest.

Analysis of the data showed (Table 4) that the maximum reduction in the physiological value of a sports result was also achieved in groups of athletes and testified in favor of the beneficial effect of the systematic training process on the level of their neuronal metabolism.

Table 3

Changes in the “physiological price” (shifts: SI/TP) of anaerobic load ($p < 0.05$; ** $p < 0.01$) in student-athletes of various specializations during the experiment*

Stages / Options		n., background (1)	p., background (1)	n., background (2)	p., background (2)
SI	Football	180,73±14,73	120,25±11,25	105,45±7,78	77,56±7,22
TP		2151,31±32,74	3568,45±73,12	2831,82±42,56	4223,73±80,07
Δ SI, %		50,29		35,95	
Δ TP, %		-39,71		-32,95	
Δ ρ, %		64,08		48,77 (-23,8*)	

SI	Wrestling	254,11±17,62	162,56±15,23	162,16±14,12	113,45±11,80
TP		1786,14±34,54	3126,87±70,45	2245,84±40,25	3612,61±75,12
Δ SI, %		56,31		42,93	
Δ TP, %		-42,87		-37,83	
Δ ρ, %		70,78		57,22 (-19,1*)	
SI	FOT	342,77±22,74	202,34±19,16	324,22±17,14	180,45±13,87
TP		1472,72±45,12	2813,56±63,78	1380,84±43,16	3132,14±68,77
Δ SI, %		69,40		79,78	
Δ TP, %		-47,65		-55,91	
Δ ρ, %		84,18		97,42 (+15,7*)	

Designations: n. – parameter values under load; n. - at rest; 1 - at the beginning of the retracting stage; 2 - at the end of the basic developmental general preparatory stage of the preparatory period

Table 4
*Changes in the “physiological price” (shifts: Fz/Cz) of anaerobic load (*p<0.05; **p<0.01) in student-athletes of various specializations during the experiment*

Stages / Options		n., background (1)	p., background (1)	n., background (2)	p., background (2)
Fz	Football	27,87±0,37	16,88±0,19	20,57±0,26	14,13±0,13
Cz		26,14±0,27	16,10±0,20	19,94±0,32	13,27±0,12
Δ Fz, %		65,10		45,57	
Δ Cz, %		62,36		50,26	
Δ ρ, %		90,15		67,85 (-24,7*)	
Fz	Wrestling	29,35±0,42	18,56±0,22	19,43±0,24	14,63±0,17
Cz		28,28±0,31	17,96±0,23	20,15±0,27	13,91±0,15
Δ Fz, %		57,46		32,81	
Δ Cz, %		58,14		44,57	
Δ ρ, %		81,74		55,35 (-32,2*)	
Fz	FOT	24,98±0,30	14,51±0,15	25,51±0,45	13,47±0,12
Cz		25,24±0,20	14,80±0,17	26,42±0,29	13,53±0,10
Δ Fz, %		72,15		95,27	
Δ Cz, %		70,54		89,38	
Δ ρ, %		100,90		130,64 (+29,4*)	

Designations: n. – parameter values under load; n. - at rest; 1 - at the beginning of the retracting stage; 2 - at the end of the basic developmental general preparatory stage of the preparatory period

The greatest shifts were noted in wrestlers. So their physiological price after two trials of 6-second and 15-second tests according to the data of shifts in the level of constant potential in the frontal and central regions decreased by 32.2% ($p < 0.05$). While in football players by 24.7% ($p < 0.05$). And among the representatives of the PF, on the contrary, it also had a significant increase by 29.4%, which indirectly indicated a decrease in the alkaline reserve of the buffer systems of the body.

Conclusions: the results of the study made it possible, on a strictly experimental basis, to identify the features of the dynamics of the physical price of sports results under the influence of anaerobic load under conditions of bicycle ergometric testing. We proved the universality and objectivity of this technology for a more detailed analysis of the current functional state of the body at rest and during physical exertion.

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细胞疗法：利用细胞治疗各种疾病
**CELL THERAPY: THE USE OF CELLS FOR THE TREATMENT OF
VARIOUS DISEASES**

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抽象的。这篇科学文章致力于研究细胞疗法及其在治疗各种疾病中的应用。这篇文章讨论了选择和准备用于治疗的原则，以及将它们输送到体内的方法。

主要关注应用细胞疗法的医学领域，例如血液疾病、肿瘤、神经系统疾病和心血管疾病的治疗。文章还概述了评估细胞疗法有效性和安全性的临床研究结果。

关键词：细胞疗法，干细胞，CAR T 细胞，免疫疗法，CAR 疗法，分化。

Abstract. *This scientific article is devoted to the study of cell therapy and its application in the treatment of various diseases. The article discusses the principles of selecting and preparing cells for therapy, as well as methods of delivering them into the body.*

The main focus is on the areas of medicine where cell therapy is applied, such as the treatment of blood disorders, tumors, nervous system diseases, and cardiovascular diseases. The article also provides an overview of the results of clinical studies evaluating the effectiveness and safety of cell therapy.

Keywords: *cell therapy, stem cells, CAR T-cells, immunotherapy, CAR therapy, differentiation.*

Introduction

Cell therapy is one of the most promising areas in medicine, which is based on the use of cells for the treatment of various diseases. Cell therapy can be applied

to treat a wide range of conditions, including blood disorders, tumors, nervous system diseases, and cardiovascular diseases.

Currently, research in the field of cell therapy is actively developing, and the results of clinical trials demonstrate its effectiveness and potential.

The aim of this scientific article is to examine the main aspects of cell therapy, its application in medicine, and analyze the results of clinical trials. The article will cover the basics of cell therapy, including the types of cells, principles of their selection and preparation for therapy, as well as methods of delivering cells into the body. Additionally, the article will address various areas of medicine where cell therapy is applied, and evaluate the effectiveness and safety of this treatment method based on the results of clinical trials. In conclusion, the article will provide insights into the significance of cell therapy in medicine and its future prospects.

Basics of cell therapy

Cells are the basic structural and functional units of living organisms. There are different types of cells, each with its own characteristics and functions. Cell therapy can be performed using different types of cells, which have their own features and are used depending on the nature of the disease.

One of the most widely used types of cells in cell therapy are stem cells. Stem cells can develop into various types of cells in the body, making them particularly useful for treating tissue damage-related diseases. There are several types of stem cells, including embryonic stem cells obtained from embryos and adult stem cells obtained from various tissues of the body. For example, bone marrow stem cells are used to treat leukemia and lymphoma, and umbilical cord stem cells are used to treat some genetic disorders. [1]

Immune cells, such as T lymphocytes and natural killer cells, which can kill tumor cells and protect the body from infections, are also used in cell therapy. Some studies have shown that immune cells can be used to treat various types of cancer. Currently available CAR T-cell therapies are individually tailored to each patient. They are produced by collecting T cells from the patient and reengineering them in the laboratory to produce proteins on their surface, called chimeric antigen receptors or CARs. CARs recognize and bind to specific proteins or antigens on the surface of cancer cells.

In addition, there are cells that produce proteins and growth factors that promote tissue regeneration and healing. These cells include fibroblasts and mesenchymal stem cells. They can be used to treat skin injuries, wounds, burns, and other traumatic injuries. [1]

It is important to note that each type of cell has its own characteristics and may be effective only for certain types of diseases. It is also necessary to consider possible side effects and contraindications when using cell therapy.

Mechanisms of action of cell therapy

The mechanisms of action of cell therapy involve numerous factors, including genetic modification, tissue integration, synthesis of biologically active substances, immune response, and many others.

One of the most studied mechanisms of action of cell therapy is the differentiation of transplanted cells into desired cell types. For example, in the transplantation of stem cells, such as embryonic or induced pluripotent stem cells, they can differentiate into various tissue types, such as neural, muscular, or bone tissue. Thus, they can help restore the function of damaged tissues and organs.

Another mechanism of action of cell therapy is the production of biologically active substances, such as growth factors, cytokines, and exosomes, which can stimulate tissue regeneration and healing. For example, mesenchymal stem cells, which are usually extracted from bone marrow, can secrete growth factors that stimulate the regeneration of damaged tissues. In addition, exosomes released by transplanted cells can also contain biologically active molecules that can have therapeutic effects.

It is also believed that cell therapy can promote the activation of the body's own regenerative mechanisms. For example, stem cell transplantation may activate the organism's endogenous stem cells, which can lead to an increase in the number of new cells in the damaged tissue.

To achieve the maximum effect of cell therapy, various factors must be taken into account when selecting and preparing cells, such as their potential viability and safety, as well as ethical aspects.

One of the main principles of selecting cells for therapy is their typicity. The cells used for therapy should be similar in their characteristics to the cells they replace or supplement. For example, hematopoietic stem cells, which can produce all types of blood cells, are used to treat blood diseases. Endothelial cells, which can create new blood vessels, may be used to treat cardiovascular diseases.

Another important factor is the potential viability and safety of the cells. The cells must be capable of surviving and functioning after transplantation, as well as not causing unwanted reactions or effects. When preparing cells, factors such as cryopreservation and freezing approaches should be taken into account, as they can increase long-term viability and preserve cell properties for extended periods. It is also important to consider the age and health of the donor. Cells from young and healthy donors have greater potential viability and are less susceptible to possible mutations. In addition, genetic factors, such as genetic compatibility between the donor and recipient, must also be considered.

It is also important to consider ethical aspects, such as the donor's right to confidentiality and safety. The use of embryonic stem cells can raise ethical concerns, so their use should be regulated and in accordance with the law.

Cells must be purified from possible contaminants such as bacteria, viruses, and other foreign agents. Additionally, proper conditions must be provided for the growth and development of cells during their cultivation. Thus, the selection and preparation of cells for therapy is a complex and multifaceted process that must be based on the typicality of cells, their potential viability and safety, as well as consider ethical aspects. Proper selection and preparation of cells can enhance the effectiveness of cell therapy and improve prognosis for patients.

The main methods of delivering cells into the body

There are various methods for delivering cells into the body, including systemic injection. This involves injecting cells intravenously, intramuscularly, or subcutaneously. Systemic injection is commonly used in clinical practice to treat a variety of diseases, such as myocardial infarction, stroke, Parkinson's disease, intestinal obstruction syndrome, and others.

The use of matrix - a matrix can be used to protect and support cells during delivery. For example, cells can be placed in a matrix and delivered into the body through injections or during surgical procedures. This delivery method can be particularly useful for the therapy of tissue damage.

Local injection is a method of delivering cells in which they are present to a large extent in the requested tissue. This method is often used to treat regenerative diseases such as bone marrow.

Infusion is a method of delivery of cells in which they enter the body through a catheter, in most cases intra-arterially. This method can be used for cancer treatment, trial and other diseases.

The use of implants is a method of cell delivery in which they are inserted into specially designed implants, which are then introduced into the body. This method can be used to treat bone and cartilage injuries.

Genetic modification is a method of delivering cells by naturally modifying them before being introduced into the body. It may be a method of treating mental illnesses such as cystic fibrosis. [3]

Application of cell therapy in medicine

Stem cells are a potential tool for developing innovative therapeutic strategies. There are two types of stem cells, embryonic and adult stem cells. While embryonic stem cell therapy has been riddled with allogeneic rejection and ethical issues, adult stem cells have long been used in the treatment of hematological malignancies. With the recognition of additional, potentially therapeutic characteristics, bone marrow-derived stem cells have become a tool in regenerative medicine. Bone marrow is an ideal source of stem cells because it is readily available and contains two types of stem cells. Hematopoietic stem cells give rise to all types of blood cells and have been shown to exhibit plasticity, while multipotent bone marrow stromal cells are the source of osteocytes, chondrocytes, and fat cells and have been shown to maintain and generate a large number of different cell types. [4]

In recent years, biological agents have become an important treatment option for immunological diseases. Numerous articles have been published on biologics, which complicates the decision-making process to use the most appropriate biologic for a given immune-mediated disease.

Rituximab, a highly active substance, is widely used for the effective treatment of immune diseases. Rituximab is an antitumor agent from the group of monoclonal antibodies, which are artificial synthetic chimeric cells. The safety and efficacy of rituximab is much higher than placebo, conventional treatment, or other biologics. Rituximab is safe and effective for the treatment of acquired angioedema with C1 inhibitor deficiency, ANCA-associated vasculitis, autoimmune hemolytic anemia, Castleman's disease, cryoglobulinemia, Goodpasture's disease, IgG4-associated disease, immune thrombocytopenia, juvenile idiopathic arthritis, relapsing-remitting multiple sclerosis, myasthenia gravis, nephrotic syndrome, neuromyelitis optica, pemphigus, rheumatoid arthritis, spondyloarthritis, and systemic sclerosis. Conversely, rituximab showed no effect in antiphospholipid syndrome, autoimmune hepatitis, IgA nephropathy, inflammatory myositis, primary progressive multiple sclerosis, systemic lupus erythematosus, and ulcerative colitis. Finally, mixed results have been reported for membranous nephropathy, primary Sjögren's syndrome, and Graves' disease, justifying higher quality trials with larger numbers of patients.

Heart damage remains the leading cause of morbidity and mortality worldwide. Despite significant advances, a full understanding of why the heart fails to fully recover from acute injury and why progressive heart failure often occurs remains elusive.

To date, most pharmacological interventions have focused on the modification of hemodynamics or on the modification of cardiac myocyte function. However, the important contribution of the immune system to normal cardiac function and response to injury has recently become an exciting area of research. Therapeutic interventions targeting immune cells hold promise for new avenues for treating heart disease. [5]

Cellular therapy for Parkinson's disease (PD) began in 1979 with the transplantation of fetal rat dopamine-containing neurons, which improved motor abnormalities in the PD rat model with good graft survival and axonal outgrowth. Thirty years have passed since 2 clinical trials were first registered using cell transplantation for patients with PD. Recently, cell therapy is expected to develop as a realistic treatment option for PD patients due to the development of biotechnology represented by pluripotent stem cells. Drugs using levodopa, surgery including deep brain stimulation, and rehabilitation have been established as current therapeutic strategies. These therapies have demonstrated strong therapeutic effects, but they have not been able to halt the progression of the disease. Fortunately, cell therapy may be the key to true neurorecovery. [6]

Colorectal cancer (CRC) is the third most common and second most fatal cancer worldwide. Significant efforts are currently underway to understand its molecular pathways, tumor-specific antigens (TSA) or neoantigens, in order to develop an effective treatment. Cell therapy is now gaining in importance, and more specifically chimeric antigen receptor (CAR)-T cell therapy, in which genetically modified T cells are redirected against the tumor antigen of interest. This immunotherapy has become one of the most promising advances in cancer treatment, successfully demonstrating its effectiveness. However, in colon cancer, it is difficult to achieve the same results due to the lack of TSA, targeted non-tumor effects, low CAR-T cell infiltration, and immunosuppressive microenvironment. To address these issues, CRC proposes novel approaches including, but not limited to, combination therapy, regional administration of CAR-T cells, and more complex CAR structures. This review comprehensively summarizes the current landscape of CAR-T cell therapy in CRC from potential tumor targets to preclinical studies and clinical trials, as well as the limitations and future prospects of this new anti-cancer strategy. [7]

Stem cell therapy is increasingly being used for osteoarthritis of the knee (KOA). We aimed to review the evidence for autologous stem cell therapy for pain and imaging severity in KOA. Fourteen RCTs were included. A total of 408 patients with COA were treated with MSCs derived from bone marrow, adipose tissue, or activated peripheral blood. At 1 year, 19 of 26 (73%) clinical outcome measures improved with MSCs compared with controls. In the MSC group, patients improved by 1.8-4.4 points on a scale (0-10) and 18-32 points on a knee osteoarthritis score (0-100). Four studies showed better disease severity on imaging after MSC compared with controls at 1 year. Ten of 14 (71%) RCTs were at high risk of bias for all outcomes. No serious side effects were reported after MSC therapy for a maximum of 4 years of follow-up. A beneficial effect of autologous MSC therapy compared with control treatments on patient-reported outcome measures and disease severity was found. However, the reliability of this evidence was low to very low. [8]

Conclusion. Cellular therapy is a promising approach to the treatment of many diseases. The use of various types of cells, including stem, immune and others, allows to achieve positive results in the treatment of diseases such as cancer, diabetes and cardiovascular disease. However, it must be taken into account that there are some limitations in the use of cell therapy, such as insufficient understanding of the mechanisms of action of cells and the need for additional research. In general, the development of cell therapy can lead to the creation of new, more effective methods of treatment and improve the quality of life of patients.

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纳米生物技术在药物递送和疾病诊断中的应用：考虑使用纳米颗粒进行药物递送和疾病诊断、它们的特性和优势以及潜在风险

NANOBIOTECHNOLOGY APPLICATIONS FOR DRUG DELIVERY AND DISEASE DIAGNOSIS: CONSIDERATION OF THE USE OF NANOPARTICLES FOR DRUG DELIVERY AND DISEASE DIAGNOSIS, THEIR PROPERTIES AND ADVANTAGES AS WELL AS POTENTIAL RISKS

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抽象的。 纳米生物技术是科学技术的一个新方向，它在创建用于在分子水平上分析生命系统的纳米设备方面发挥着关键作用。 纳米医学是将纳米技术引入临床的医学领域，其目的是利用分子水平的人体知识来保护和改善人类生命。 今天，在纳米医学领域，纳米粒子和纳米材料在诊断和治疗方面的应用正在扩大。 纳米技术方法和新纳米材料的使用开辟了药物和定向运输系统的创造前景。 将光学生物传感器、原子力、纳米线和纳米孔方法引入基因组学和蛋白质组学将显着提高诊断的灵敏度和准确性，减少实施时间，这无疑将提高治疗的有效性。 综述介绍了纳米生物技术在疾病诊断和新药研发领域的应用成果。

关键词：纳米粒子，纳米肿瘤学，纳米技术，乳腺癌。

Abstract. *Nanobiotechnology is a new direction in science and technology, which plays a key role in the creation of nanodevices for the analysis of living systems at the molecular level. Nanomedicine is a field of medicine dealing with the introduction of nanotechnology into the clinic, the purpose of which is to preserve and improve human life using knowledge about the human body at the molecular level. Today, the use of nanoparticles and nanomaterials for diagnostic and therapeutic purposes is expanding in the field of nanomedicine. The use of nanotechnological approaches and new nanomaterials opens up prospects in the*

creation of drugs and systems for their directional transport. The introduction of optical-biosensor, atomic-force, nanowire and nanopore approaches into genomics and proteomics will significantly increase the sensitivity and accuracy of diagnostics, reduce the time of its implementation, which will undoubtedly increase the effectiveness of treatment. The review presents the results of the application of nanobiotechnology in the field of disease diagnosis and the creation of new drugs.

Keywords: *Nanoparticles, nanooncology, nanotechnology, breast cancer.*

Introduction

Nanobiotechnology is a field of science and technology that applies nanoparticles, biological molecules and processes to create new materials, devices and systems for use in medicine, energy, electronics and other fields. In medicine, nanobiotechnology is widely used for drug delivery and disease diagnosis. One of the most promising approaches in this area is the use of nanoparticles.

Nanoparticles possess unique properties such as enhanced bioavailability, selectivity and the ability to improve the resolution and contrast in diagnostic methods. These properties make nanoparticles an ideal tool for drug delivery and disease diagnosis. However, the use of nanoparticles may also have potential risks such as toxicity, accumulation in the body, and the possibility of inducing allergic reactions.

In this article, we will examine the application of nanoparticles for drug delivery and disease diagnosis, as well as discuss their properties and advantages, as well as potential risks. We will also discuss the prospects for the development of nanobiotechnology and the need for further research in this field.

Description of the properties of nanoparticles

Nanoparticles are particles that range in size from 1 to 100 nanometers. They possess unique properties such as large surface area-to-volume ratio, high surface energy, and quantum confinement effects that can be exploited for various applications. The term ‘nanoparticle’ was coined from Greek work ‘nano’ that means ‘dwarf or small’ and when used as prefix it indicates size 10^{-9} one billionth of meter is equals to 1 nm [4]. Nanoparticles have both solute and separate particle phase properties. The surface to volume ratio of nanoparticle is 35–45% times higher as compared to large particle or atom.

The size and shape of nanoparticles are crucial factors that determine their properties and behavior. For example, nanoparticles with a smaller size have a higher surface area-to-volume ratio, which leads to greater reactivity and bioavailability. The shape of nanoparticles also affects their properties, as it can determine their surface area and surface curvature. The most common shapes of nanoparticles include spherical, rod-like, and plate-like shapes.

The surface properties of nanoparticles are also important. The surface chemistry of nanoparticles can be tailored by functionalization with specific molecules or coatings to provide stability, biocompatibility, and targeting capabilities. The surface charge of nanoparticles can also play a significant role in their biological interactions. This means that nanoparticles can more easily interact with other substances, such as gases, liquids, or solids, and have unique chemical and physical properties.

In addition to size, shape, and surface properties, the structure of nanoparticles can also affect their properties. Nanoparticles can be composed of a single material or a combination of materials, and can have crystalline or amorphous structures.

Overall, the properties of nanoparticles make them a promising tool for various applications, including drug delivery and disease diagnosis. However, the unique properties of nanoparticles also raise concerns regarding their potential toxicity and environmental impact, which must be carefully evaluated and addressed.

Nanoparticles are widely used in various fields such as catalysis, electronics, medicine, and so on. There are numerous methods for synthesizing nanoparticles, which can be classified based on the reaction mechanism or synthesis conditions.

One method is hydrothermal synthesis. This method is based on a chemical reaction that occurs in a thermostated reaction chamber under high pressure and temperature. It can be used to synthesize various types of nanoparticles, such as metal oxides, carbides, nitrides, and metallic nanoparticles.[1]

Another method for synthesizing nanoparticles is thermal decomposition. In this method, high temperature is used to convert organic or inorganic compounds into nanoparticles. This method can be used to synthesize nanoparticles of many elements, such as gold, silver, iron, and other metals.[2]

There is also the sol-gel method, which is used to synthesize nanoparticles in a liquid environment. This method allows obtaining particles of various shapes and sizes and also allows regulating their structure and properties. [3]

Nanoparticles have promising applications in medicine, especially for drug delivery to various organs and tissues.

Nanoparticles can be used to deliver drugs to target cells and tissues, which increases the effectiveness of treatment and reduces side effects. Also, nanoparticles can be functionalized with different molecular groups, which provides delivery specificity and drug release control. [4]

The researchers also demonstrated the effectiveness of using gold nanoparticles to deliver anticarcinogenic agents to tumor tissues. These nanoparticles had a high specificity for tumor cells, which ensured accurate drug delivery and reduced side effects. Gold nanoparticle-based theranostics: disease diagnostics and treatment using a single nanomaterial. [5]

The use of polymer nanoparticles can be effective for drug delivery to eye tissues. These nanoparticles can increase the bioavailability of drugs and reduce the frequency and intensity of side effects. [6]

Nanoparticles have many advantages as a drug delivery vehicle, including improved bioavailability, selectivity, and reduced side effects.

One of the main advantages of nanoparticles is their ability to increase the bioavailability of drugs. Nanoparticles can improve the bioavailability of drugs by increasing their solubility and reducing liver metabolism. [7]

Nanoparticles also have a high degree of selectivity in drug delivery. They can be targeted to specific cells or tissues, allowing drugs to be delivered directly to targeted sites and reducing negative side effects. Nanoparticles can be successfully used to deliver drugs to tumor tissues with high efficiency and no negative side effects. [8]

In addition, nanoparticles can significantly reduce the side effects of drugs. Nanoparticles can be used to reduce the toxicity of drugs and increase their effectiveness [9]

Thus, the use of nanoparticles as a drug delivery vehicle has a number of advantages, including improved bioavailability, selectivity, and reduced side effects.

In conclusion, nanobiotechnologies have great potential for drug delivery and disease diagnosis, and the use of nanoparticles in this area represents a promising practice. They may have a number of advantages, including improved stability and bioavailability of drugs, as well as increased accuracy and sensitivity in diagnosing diseases. However, there are potential risks such as toxicity and accumulation of nanoparticles in tissues that require further research and evaluation. Overall, nanobiotechnologies continue to evolve and future research and innovation in this area will be important to maximize their potential in drug delivery and disease diagnosis while minimizing potential risks and ethical concerns.

Nanoparticles for the diagnosis of diseases

In modern medical diagnostics, tomography occupies a leading position: with its help, stroke and tumors, diseases of various organs, injuries and blood flow disorders are detected. The study is deservedly popular with doctors and patients for its high data accuracy, speed and painlessness of the procedure, and affordable price. It has different types as magnetic resonance imaging, computed tomography, positron emission tomography.[10]

Computed tomography (CT) is based on scanning the human body with X-rays and fixing their absorption by various organs and tissues. The result of the study is to obtain images of cross-sections of the body with a certain step. The length of this step depends on what will be seen in the picture – if it is 0.4-1 mm, it is impossible to detect a smaller tumor.

Magnetic resonance imaging, or magnetic tomography, is based on the principle of magnetic nuclear resonance, when hydrogen atoms in the human body change their position under the influence of a powerful magnetic field. The device captures and registers changes, and then builds a three-dimensional image based on them.

Positron emission tomography is a highly accurate method of diagnosing cancers, heart diseases, nervous system, Alzheimer's disease. It makes it possible to identify a malignant formation at the earliest stage, when there are no structural changes yet.

The procedure begins with the introduction of a radiopharmaceutical. Previously, a few days before the study, the patient is prescribed a light diet and alcohol intake is limited. Immediately before the study, eating is prohibited, only drinking water is allowed. Immediately after administration of the drug for 50-60 minutes, while the substance is distributed in the body and accumulates, it is impossible to talk and move, otherwise the results of the study may be distorted.

After the distribution of the substance in the body, a scan is performed – first a computed tomography (takes about 2 minutes), then PET (about 30 minutes). Both studies are done on the same device. Sometimes, to improve the visualization of blood vessels and intestines during CT, the patient is additionally injected with a contrast agent. The patient may be asked to stay in the medical center for about an hour more so that doctors can see the quality of the images obtained and, if necessary, conduct an additional scan.[11]

A promising direction is the use of nanosystems and nanomaterials in the diagnosis of early forms of the disease, as well as therapy using targeted drug delivery. In addition, improved imaging of tumors is possible due to the use of specific anti-tumor antibodies associated with nanoparticles. The possibilities of using the obtained conductive nanocrystals as alternative fluorophores for biological visualization of tumor processes *in vivo* are being developed. [12] Angiogenesis may be one of the early markers of the tumor process. The use of nanoparticles labeled with $\alpha v\beta 3$ integrin, which is actively expressed on endothelial cells of newly formed vessels, allows visualization of tumors at the early stages of their development [13].

Promising in terms of visualization of various cells, as well as tumor tissues, is the use of quantum dots (QDs) semiconductors – nanocrystals from 1 to 10 nm in size with unique photochemical and photophysical properties, unlike conventional dyes and fluorescent proteins [14]. Depending on the particle size, QDs excited by different wavelengths are capable of emitting light in different color range. The stability of these particles, the increased ability to fluorescence, multicolored emission determine their widespread use in the diagnosis of pathological processes *in vivo*, as well as in the possible visualization of individual cells. The use of

these particles has a number of advantages over other fluorescent molecules. In particular, signal intensity, signal-to-noise ratio, and photostability are increased. In addition, QDs can be used for prolonged labeling of living cells. QDs can bind to surface cellular antigens by means of antibodies conjugated to them, as well as being incorporated into the cell by endocytosis. The stability of these particles makes it possible to track living cells for a long time [15].

An important aspect of the diagnosis and prognosis of the course of a tumor disease is to determine the degree of involvement of lymph nodes in the process. Regional lymph nodes are often the object of surgical intervention in the surgical treatment of neoplasms. Nanoparticles were created to diagnose lymph node lesions – QDs, fluorescing in the OIC range, their emission spectrum is outside of human infrared radiation. With the help of these nanoparticles, it is possible to visualize the affected lymph nodes intraoperatively in real time. Using Gds allows you to visualize tumor neoplasms in vivo. Thus, in experimental studies on mice, prostate cancer was visualized. For this purpose, the use of a polymer or magnetic nanoparticles for the visualization of more deeply located tumors eliminates the need for the use of invasive research methods [16].

Potential risks of using nanoparticles

The use of **nanoparticles** as drug carriers may reduce the **toxicity** of the incorporated drug, although discrimination between the drug and the nanoparticle toxicity cannot always be made. The structure and properties of gold nanoparticles make them useful for a wide array of biological applications. Toxicity, however, has been observed at high concentrations using these systems. Demonstrated that for 2 **nm** gold particles cationic particles were moderately **toxic**, whereas anionic particles were relatively non-toxic. Such very small sized gold nanoparticles were found to be non toxic when administered to mice for tumour therapy.

For thiol derivatized PEG - colloidal gold **nanoparticles** with tumour necrosis factor (TNF) an enhanced anti-tumour activity was reported when compared to free TNF. Topoisomerase inhibitors when formulated in lipid containing nanoparticles showed increased anti-tumour activity in an in vivo nude mouse xenograft human tumour model. Although phagocytosis by macrophages does not seem to be necessary for the uptake of nanoparticles, the **immune system** is not totally inactive when dealing with nanoparticles. For 100 **nm** polystyrene particles, an IgE adjuvant activity was observed in an animal model system of ovalbumin allergy. Antibodies against fullerenes could be induced after the intraperitoneal injection of C60 conjugated with serum **proteins**. [17]

Review existing methods for assessing the safety of nanoparticles and the need for further research in this area. The consideration of **dose** response relationships in the toxicology of **nanoparticles** poses a significant problem. In toxicology the paradigm exists that health effects are correlated to the mass of the

agent to which the individual is **exposed**, resulting in an accumulated mass as internal or organ dose/exposure. For nanoparticles the concentration number and the resulting total surface area determine the interactions with biological systems. Therefore the surface area and number concentration appear to be more reasonable parameters for **doses** in terms of **exposure**. The increase in lung **inflammation** for nanoparticles compared to fine particles was noted when doses were expressed as mass. In contrast when doses were expressed as surface area similar responses were observed for both fine and nanoparticles. Also when comparing **toxicity** differences between TiO₂ and BaSO₄, dose response relationships were similar when compared at a dose expressed as surface area burden. For TiO₂ nanoparticles, significant species differences were noted after **inhalation** exposure with rats, mice and hamsters, the rat being the most sensitive. **Pulmonary** responses and dosimetry (particle retention and overload) were considered to be responsible for these differences. Several hypotheses were proposed for the adverse health effects of nanoparticles as part of **ambient** air pollution. These hypotheses for adverse health effects of nanoparticles include:

Particle characteristics: Importance of large surface area for interactions with cells and **tissues**; Complex formation with **biomolecules**; Formation of increased level of radical species compared to larger particles; Increased induction of **oxidative stress**; Induction of **cellular DNA** damage; Induction of oxidative stress by lipid peroxidation

Distribution. Deposition characteristics dependent on size; Uptake by cells of **respiratory** epithelium; Increased access to interstitial spaces; Access to systemic circulation; Organ system effects, including effects on **immune** and **inflammatory** systems; Reduced function of macrophages, reduced phagocytosis of particles themselves, reduced macrophage mobility and cytoskeletal dysfunction; Increased pro-**inflammatory** activity and induction of cytokines and other mediators; Adverse effects on cardiac functions and vascular homeostasis

Some hypotheses raised for **ambient air nanoparticles** may be of limited or no relevance for engineered nanoparticles, such as adsorbance of **toxic** substances. Although such adsorbance cannot be ruled out, it is probably of less importance for production and handling facilities of large volumes of engineered nanoparticles compared to the particles in ambient air. Limitations of the studies cited may be the relatively high **doses** used, the short periods of time investigated, and/or artefacts occurring during sampling of the particles on filters.

In addition, the use of healthy animal models may hamper the interpretation of the results as some of the effects listed and may only be a risk for susceptible organisms and predisposed individuals, but not to healthy people. Age, co-pollutants and a compromised **respiratory tract** can modify the **pulmonary inflammation** and **oxidative stress** induced by carbonaceous **nanoparticles**. For **chron-**

ic obstructive pulmonary disease, the generation of free radicals on the surface due to high reactivity of nanoparticles, and the induction of oxidative stress, might contribute to the induction of inflammation.

In vitro observations with keratinocytes, macrophages and blood monocytes revealed the induction of **oxidative stress** in these cells after **exposure to nanoparticles**. A role for free radicals and reactive oxygen species was also suggested by *in vitro* studies in which antioxidants were able to block the particle induced release of TNF α from alveolar macrophages. Also macrophage phagocytosis was impaired by nanoparticles. For TiO₂ and ZnO nanoparticles, oxidative damage to **DNA** was demonstrated, resulting² in micronucleus formation and apoptosis. [17]

Conclusion. In conclusion, nanobiotechnologies have great potential for drug delivery and disease diagnosis, and the use of nanoparticles in this area represents a promising practice. They may have a number of advantages, including improved stability and bioavailability of drugs, as well as increased accuracy and sensitivity in diagnosing diseases. However, there are potential risks such as toxicity and accumulation of nanoparticles in tissues that require further research and evaluation. Overall, nanobiotechnologies continue to evolve and future research and innovation in this area will be important to maximize their potential in drug delivery and disease diagnosis while minimizing potential risks and ethical concerns.

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CTCS-3列控系统无线超时GSM-R无线SIM卡分析及故障解决
**CTCS-3 TRAIN CONTROL SYSTEM WIRELESS TIMEOUT GSM-R
RADIO SIM CARD ANALYSIS AND FAULT RESOLUTION**

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抽象的。CTCS-3无线通信超时故障是CTCS-3级列控系统的重点难点问题，SIM卡引起的超时问题至今未找到具体原因，重点对SIM卡表面形貌（SEM）分析、分析成分（EDS）以及对设备运行过程中SIM工作状态的研究，通过检测SIM卡表面是否存在非导电颗粒，并发现存在非导电颗粒的问题。SIM卡表面导电颗粒导致对讲机不认卡，导致无线超时。

关键词：SIM卡；SIM卡；无线通讯超时；SEM分析；EDS分析；措施。

Abstract. *CTCS-3 wireless communication timeout failure is a key and difficult problem of CTCS-3 level column control system, timeout problem caused by SIM card has not found a specific cause, focus on SIM card surface morphology (SEM) analysis, analysis composition (EDS) and the study of the working condition of the SIM during the operation of the equipment, through the detection of the existence of non-conductive particles on the surface of the SIM card, and It was found that the problem of the presence of non-conductive particles on the surface of the SIM card causes the radio to not recognize the card and leads to to the wireless timeout.*

Keywords: *SIM card; SIM card; wireless communication timeout; SEM analysis; EDS analysis; measures.*

INTRODUCTION

The CTCS-3 level train control system (abbreviations C3) is the main technical equipment and critical safety system of high-speed rail, responsible for managing train traffic, ensuring traffic safety and improving the efficiency of rail transport. After a wireless communication timeout, the ATP on-board equipment will apply normal brakes and ask the driver to acknowledge when the train speed drops to the CTCS-2 (abbreviation C2) level cleared speed and the system will switch to C2 control, which will reduce the cleared speed and affect efficiency transportation. At present, as the analysis of C3 wireless communication timeout is deepened and the monitoring of signaling processes of transport airports, base station airports

and interface monitoring services become popular, the causes of C3 wireless communication timeout caused by network communication can be accurately analyzed and points faults can be accurately identified. However, it is difficult to analyze the specific causes of problems caused by SIM cards, such as momentary disconnection from the network and failure of registration, while they are not inherent faults, and all performance subsequently returns to normal, which creates great problems for the maintenance of field equipment. This article provides a comprehensive analysis of the problem of SIM-cards and suggests measures to solve it.

1 SIM application analysis

1.1 The role of the SIM card

The GSM-R SIM card is an important part of the dedicated GSM-R mobile communication system and is required for all kinds of GSM-R based communication services. It is especially often used for communication services directly related to traffic, on which the safety of the entire train and the order of transportation depend. The SIM card used in the ATP radio belongs to the CSD service category according to the functional requirements of the communication service, and each set of ATP equipment has two radio modules, and the SIM card is installed in the radio module. While the HSR train is in motion, the two radios alternately call the RBC ground equipment to establish a CSD call. In order to prevent the train control service from interfering with other communication services, its SIM card only opens the CSD call function of the voice service. The SIM card currently adopts the maintenance method is troubleshooting, If a fault is found, check or replace it, and if there is no fault, continue to use [1].

1.2 How the SIM card works

The SIM card is a subscriber identity module that stores personal and network information about the subscriber and performs the functions of data storage, customer identity authentication and customer information encryption algorithms, the SIM card in the ATP radio station is responsible for performing network registration and CSD calls. The SIM card is a chip card with a microprocessor and has an internal structure of 5 modules, each of which corresponds to the functional microprocessor CPU, program memory ROM, working memory RAM, data memory EEPROM and serial communication unit[1].

1.3 SIM card structure

The six pins on the surface of the SIM card are its external interfaces, which are divided according to their function into supply voltage (Vcc), reset signal (RTS), clock signal (CLK), ground (GND), variable voltage supply (VPP) and input/output (I/O)[1].

2 SIM card failure analysis

2.1 SIM failure analysis

When a SIM card fails, the corresponding characteristics are as follows:

- 1) lack of network registration in the DMI interface
- 2) Abnormal GSM-R radio status indicator
- 3) Network registration is automatically restored after a momentary disconnection in transit
- 4) Network registration is restored after power off and restart
- 5) The network registration is restored after the SIM card is reinserted.

Based on the above information, the possible reasons for SIM card failure are:

- 1) Problem with module software.
- 2) The electrical characteristics of the SIM card circuit are critical, resulting in intermittent card reading failures.
- 3) Incorrect dimensions of the card holder, as a result of which there is no contact between the protrusions and the SIM card.
- 4) Oxidation of the fragments of the card holder causes high contact resistance, which affects the reading of the SIM card.
- 5) Oxidation of the shard of the SIM card contact has led to a large resistance of the contact, which affects the reading of the SIM card.
- 6) There is a foreign object between the chip of the card holder and the SIM card, which isolates the circuit and affects the reading of the SIM card.

2.2 Fault detection

2.2.1 Testing the performance of the radio module

Four 300T ATP radio modules with faulty SIM cards were selected for testing, the modules recognized the SIM cards normally, and all parameters met the standard requirements.

Data analysis of a total of eight cases of wireless communication timeout caused by SIM card failures in Hangzhou Electric Section from March 2020 to March 2021.

1) Analysis of the log data from the vehicle side: Fewer modems registered than installed 1 (Single radio). The log shows that only one radio is registered in the network, indicating that there is a problem between the radio and the network, and there are no other fault messages in the data, therefore, we can basically judge that the ATP equipment is normal.

2) Not inserted SIM card or wrong SIM card by analyzing air port monitoring data.

3) By analyzing the data of the three interfaces on the communication side, you can see MSIDETACH INDICATIO (radio network disconnection).

The reason for the disconnection of the radio network may be a normal radio shutdown. Also, a SIM card anomaly can be the cause, this type of timeout is usually caused by normal data interaction between vehicle and ground. if the radio is off, there will be one radio in the RBC handover zone, so this is essentially a SIM anomaly.

2.2.2 Testing the electrical characteristics of the SIM card circuit

As required by the 3GPP SIM interface section, the SIM circuit has six PINs that are required for power, reset, clock, data, and ground. The electrical characteristics of power, reset, clock and data of four SIM cards were chosen, the indicators met the requirements of the standard, there were no critical indicators, so the electrical characteristics of the circuit could be excluded.

2.2.3 Checking the thickness of the SIM card

According to the standard, the thickness of the SIM card is 0.76 ± 0.08 mm, and the thickness of the four failed SIM cards was measured for compliance as shown in Table 1.

Table 1
SIM Thickness Test Results

Standard	Thickness (0,76±0,08mm)
1	0,84
2	0,82
3	0,81
4	0,79

2.2.4 Determination of the resistance of the contacts of the fragments of the SIM card holder

Excessive contact resistance of the SIM card holder protrusions may affect the module’s ability to read the SIM card. According to equipment manufacturer experience, the contact resistance of cardholder interfaces typically exceeds 500 mΩ before a SIM card can be read. Two SIM cards were selected to test the contact resistance of the cardholders, and the contact resistance of the cardholders was found to be much lower than the resistance value affecting card reading, the fragments are in good condition, as shown in Table 2.

Table 2
Fragment contact resistance test

SIM- card	Fragment contact resistance values/mΩ					
	PIN1	PIN2	PIN3	PIN4	PIN5	PIN6
1	47,75	48,14	46,85	48,14	46,85	47,45
2	41,45	45,2	44,25	45,2	44,25	41,75

2.2.5 Checking the function and appearance of the SIM card

Four failed samples of the SIM card were inserted into the module, and all of them were able to read data from the SIM card normally. [2] When examining the appearance of the SIM card contacts, it was found that there are scratches of

varying severity on the surface, and the gold plating layer is covered with a layer of foreign material with a weak reflection of the metal. the presence of small worn grooves in places corresponding to the splinters of the bayonet indicates the presence of vibration wear and may also indicate that the dimensional match is in order.

2.2.6 Checking the surface of the SIM card

In order to confirm the status of the SIM card contacts, the equipment manufacturer commissioned the relevant laboratory to carry out Surface Morphology Analysis (SEM)/Compositional Analysis (EDS), which is mainly used to characterize the microscopic morphology and surface structure of the sample, and EDS for qualitative and semi-quantitative elemental analysis, as shown Figure 1. The gold plating appears white under electron radiation and black as a non-conductive foreign body centered around the contact area[2].

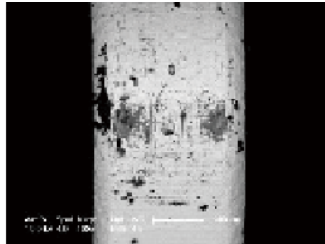


Figure 1. SEM/EDS inspection

The surface of four defective SIM cards (used for more than 5 years) was subjected to SEM/EDS examination, and the results were as follows: there were severe scratches on the contact area of the fragments, and foreign particles were present around the scratches, which were non-conductive foreign substances. It is assumed that foreign particles are a mixture of organic substances and oxides, with the main content of carbon, oxygen, nickel, chlorine, copper, calcium and other elements.

2.3 Data analysis

The analysis of the above test results basically eliminates the problem of the module software and the SIM card is functioning normally, the electrical characteristics of the SIM card circuit module, SIM card holder and SIM card related dimensions, and the SIM card holder fragments contact electropositive is normal.

A large number of non-conductive foreign particles were found in the contact area between the long-used card holder tabs and the SIM card.

The contacts are not completely flat, the gold layer is very hard, and the protrusions of the card holder and the SIM card contacts are connected by thousands of small bumps, as shown in Figure 2.

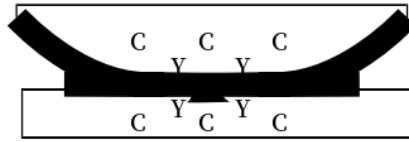


Figure 2. Schematic diagram of the contact

It is assumed that the radio is subjected to random vibration for an extended period of time and that there is friction between the card holder protrusions and the SIM card contacts, resulting in the accumulation of organic matter, oxides and wear powder around the contact area. If the accumulation of foreign objects is too large, organic matter, oxides, etc. may be pushed into the contact area of the fragments due to vibration, thereby isolating the electrical signal and causing an unrecognized failure of the card, resulting in failure of the SIM card. When you re-insert the SIM card, the fragments will push out foreign particles, restore contact, and the malfunction will disappear or foreign objects are repelled due to micro-displacement friction, i.e. automatic recovery takes place. The longer the module or SIM card is used, the more the coating wears out and the more oxides form on the surface, the higher the probability of failure.

3 Remedial measures and consequences

3.1 New maintenance measures

The analysis basically confirmed that the failure of the SIM card was caused by the station not recognizing the card due to foreign body isolation, so three measures were taken: cleaning the SIM card, fixing the SIM card, fixing and sealing the card tray.

There are 3 types of surface cleaning methods: alcohol, eraser and electronic cleaner. In order to compare the effect of the three methods, three SIM cards with a large amount of foreign matter on the surface were selected for surface morphology analysis (SEM), and it was found that the eraser was less effective, the electronic cleaner was medium, and the alcohol was more effective. After cleaning, avoid touching the SIM card[3].

Please use high temperature resistant fabric-based double-sided adhesive, the thickness of the double-sided adhesive between the SIM card and the card tray should not exceed 0.1mm to avoid excessive thickness[4].

Fixing and sealing the card tray. Copper foil tape is applied to the surface of the card tray and the surface of the radio to fix the card tray and seal the SIM card, as shown in Figure 3.



Figure 2. Fastening and sealing the card tray

3.2 The effect of rectification

From March 2020 to March 2021, a total of 8 cases of wireless disconnection due to SIM card failure were detected, after which 3 measures were taken, namely: cleaning the SIM card, fixing the SIM card, fixing and sealing the tray for cards. Between March 2021 and March 2022, there were no recorded cases of wireless disconnection due to a SIM card failure.

Take a cotton swab dipped in alcohol and wipe the SIM card contacts. After 10 wipes, a clear metallic reflection can be seen on the SIM card contacts under the SEM, and the particles can be largely removed, as shown in Fig. 4 and 5.

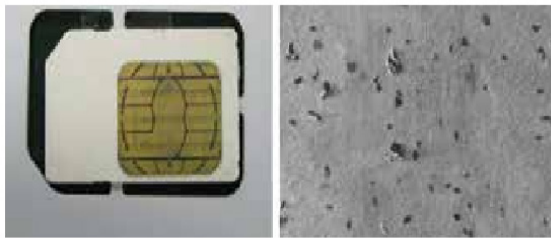


Figure 4. SIM card status before cleaning

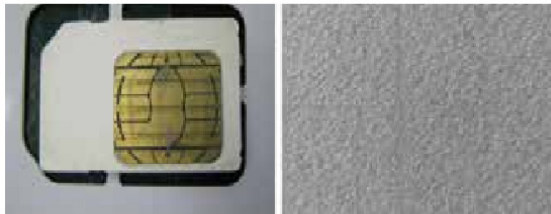


Figure 5. SIM card status after cleaning

4 Renewals and recommendations

The current repair process for ATP equipment includes primary repair, secondary repair, advanced repair and renewal, which ensures that the equipment can be used properly. There are no clear procedures and requirements for the maintenance of SIM cards, so it is recommended that they be repaired simultaneously with the repair procedures for ATP equipment. Cleaning of SIM-cards in connection with extended repair and replacement of SIM-cards in connection with the upgrade of ATP equipment[4].

According to the GSM-R Digital Mobile Network Equipment Technical Specification (CTT [2008] No. 172) Part IV, SIM cards require a contact pressure of more than 0.5N on the SIM card to ensure reliable and continuous contact between the SIM card and the card slot, and to overcome interruptions caused by oxidation and vibration. According to this requirement, equipment manufacturers must continue technical improvements, first, develop a means of testing the corresponding technical performance of the card slot and SIM card; second, improve the design process to ensure that there is no micro-vibration between the SIM card and the card tray, and no micro-vibration between the card tray and the radio. Third, we will strengthen material research and develop the design and manufacture of SIM circuits maps and contact list technology to meet the needs of railway safety [3].

Simulation results show that the resonant frequency of the onboard VTM antenna is shifted by 0.189 MHz when exposed to metallic substances such as bottom and rails, which is very close to the resonant frequency shift of the onboard VTM antenna tested in the field. The results of this work confirm the correctness and validity of the simulation model of the onboard VTM antenna for low- and medium-speed maglev, and also lay the foundation for further research and technical improvements in the future.

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列控系统信息安全风险分析与防护技术探讨
**DISCUSSION ON INFORMATION SECURITY RISK ANALYSIS
AND PROTECTION TECHNOLOGY FOR TRAIN CONTROL
SYSTEMS**

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抽象的。基于列控系统的深入发展,系统的横向设备越来越多,与其他接口设备形成更复杂的通信,导致安全系统本身的漏洞逐渐增加,一旦暴露给入侵者就会被攻击 严重威胁着铁路运输安全,因此系统安全列控信息安全显得尤为重要。以列控系统为研究对象,对当前列控系统信息安全风险进行了初步分析,阐述了我国列控系统发展所必需的信息安全防护技术思路,从而为下一代新型列控系统的装备与技术开发提供良好的研究基础。

关键词: 列控系统; 信息交互; 信息安全; 脆弱性; 技术开发

Abstract. *Based on the in-depth development of the train control system, the lateral equipment of the system more and more, and other interface equipment to form more complex communication, resulting in the security system itself the vulnerability gradually increases, if exposed to intruders will be a serious threat to the security of railway transport, so the system security train control information security is particularly important. Taking the train control system as the object of study, a preliminary analysis of the current information security risks of the train control system is carried out, the ideas of information security protection technology necessary for the development of China's train control system are described, so as to provide a promising research basis for development of equipment and technology of the next generation of the new train control system.*

Keywords: *train control system; information interaction; Information Security; vulnerability; technology development*

1 Overview

The aim of the train traffic control system is to make full use of advanced scientific information technologies and devices to ensure the movement of trains at minimum safe distances in order to achieve the maximum capacity of railway transport. In a broad sense, train traffic control systems include centralized dispatch systems (train control), computerized systems blocking (approach control), train traffic control systems (train interval control) and specialized railway information and communication equipment [1]. In the early stages of creating a column control system, each subsystem forms its own unique network, the systems are independent of each other, and the process operation and management of the railway system has perfect and strict restrictions on the implementation process, in general, it can be considered that the information security problems of the network are practically absent. With the rapid development of IT technology in recent years, the need for intelligent development and technological innovation in railway systems is becoming increasingly important. The application of general IT technology in railway train control systems is becoming more and more wide and deep, and a large amount of data and information exchange begins to occur between various subsystems and equipment in the train control process and with related external systems, resulting in a complex internal structure, in which the various devices within the system operate independently of each other and are interconnected. The increase in the number of external information interfaces between train control system equipment and the increase in the amount of common software, standard equipment and common communication protocols applied in the train control system has led to a slow growth security vulnerabilities in the system itself. For example, vulnerabilities in the core of its own system, vulnerabilities in the network communication protocol and vulnerabilities in application layer software, once potential attackers discover these security vulnerabilities, will lead to the spread of various network attacks on the information network in the train control system, a serious threat to the security of the railway transport[2].

The railway train control system is facing the increasing situation of network information security and the rapidly developing and gradually harsh external network information environment, the main equipment involved in the operation safety of the railway transport system, the train control system based on traditional functional security. Further deepen the level of network and information security, risk analysis and protection potential optimization design. As an industrial control system in a specific industry context, the network security and information security approach in the railway train control system can bring numerous insights to the industrial control sector.

The development of industrial control systems at home and abroad considers information security as an important direction of system optimization and capac-

ity building, and related research is mainly focused on four aspects□Information security system architecture, hole finding technology, situational awareness technology, active defense technology, relevant core technologies and products are also practically applied in many areas of industrial control, playing a key role in ensuring the ability of network information security[2].

Overseas railway signal manufacturers and research institutions also began to pay attention to protecting the information security of railway column control systems, researched network security and search for vulnerabilities in railway blocking systems, testing system attacks and defenses, and security boundaries of dispatch control systems. With the deepening of the CTCS system, it has been a number of studies have been carried out on the next generation of train traffic control system with main technical characteristics such as vehicle centering, satellite positioning and autonomous sensing, IP-based multi-mode communication, etc. Technical innovation, system building and application integration at the information security level are inevitable.

2 Information security risk analysis of train traffic control systems

The Cybersecurity Situation Assessment (CSSA) is an assessment of the current security situation and future trends in the development of a system's security, which can be used as a basis for further research in order to achieve rapid and accurate warning and effective protection before an information system intrusion occurs, minimizing risk for the information system and, thus, achieving the effect of proactive protection.

When implementing the information security risk analysis process, the search for system vulnerabilities at the information security level is a necessary basis for identifying sources and entry points of system risks. System vulnerabilities are inevitable for a number of reasons, such as vulnerabilities in communication protocols, improper deployment and configuration of the network architecture of the system, hardware and software, deficiencies in operating systems programs. These vulnerabilities and problems lead to vulnerabilities in the system that not only threaten various applications that use dialysis transmission, but also seriously threaten some systems that carry out transmission using authentication and authorization. Therefore, by conducting Vulnerability analysis of the railroad column management system can identify relevant existing weaknesses and facilitate the subsequent placement of protective equipment and the imposition or integration of protection methods.

The main elements of the relevant vulnerability analysis for railway train control systems include the following five areas:

- 1) Use vulnerability analysis to describe in detail the security of the train control system so that system designers, developers and managers can effectively and intelligently deploy security measures based on the state of the system and exist-

ing vulnerabilities, avoiding the possibility of new vulnerabilities resulting from additional security measures.

2) Through vulnerability analysis, it can more directly reflect the state of information security of the train control system, more convincing, so that the system design, development and management application staff more intuitive understanding of the overall state of information security of the train control system and find specific weak links to provide theoretical guidance and framework for optimizing the information security of a system to provide a reference for developing a security strategy.

3) As a result of the vulnerability analysis, attack maps are compiled, so that the application personnel of design, development and management of the system can clearly identify the security flaws of the existing system, take effective remedial measures to improve the information security status of the string control system and resilience at minimal cost.

4) Since a number of unsafe factors still persist, the trend of safety of train control systems in the coming period has become the focus of attention Vulnerability analysis can provide some theoretical basis for analyzing the safety status of train control systems.

5) In train control system risk analysis, production safety issues caused by vulnerability can threaten the equipment itself in terms of confidentiality, integrity and usability, and vulnerability analysis can serve as the basis for risk analysis; At the same time, according to the security threat caused by the vulnerability in the whole system related to the operation, can lead to different degrees of harm, different degrees of protection measures are taken for the system components, so that This provides a basis for assessing the level of protection of the column control system.

Vulnerability analysis includes both qualitative and quantitative processes, and the use of specific targeted testing and assessment tools to detect in depth, identify and evaluate the type of risk and impact level of vulnerabilities is a very important tool, such as penetration testing, which is commonly used in network analysis and mining, and is a general means of conducting a quantitative and accurate vulnerability analysis. The complete penetration testing process consists of a pre-attack phase, an attack phase, and a post-attack phase, during which an attack is carried out by collecting information about the device under test, scanning it, and conducting Port/Vulnerability/Protocol Intrusion experiments, providing clear and quantitative analysis results for system vulnerability analysis.

3 Information security protection technology for train control systems

Based on the identification of information security vulnerabilities and the corresponding risks of train control systems, effectively protecting the level of information security with specific technical strategies is a key aspect of integrating

information security functions and ideas into the development and application of real train control systems [3].

Currently, the main security technologies involved in information security in industrial control systems include: network infrastructure, data transmission, wireless network usage control, access control, intrusion prevention, malware prevention, security auditing, identity identification, resource control, fault tolerance software, data integrity, data privacy, data backup and recovery, residual information protection, and border protection.

For railroad train control systems, the focus is on top-level security architecture and key sensing and protection technologies. Based on the experience of research and development in the field of industrial control and the current situation of domestic and foreign developments in the direction of railway train control systems, the information security protection technology for train control systems can be implemented in the following four aspects.

1) Railroad information management system security system architecture: by integrating various security protection organs to achieve a single effective integrated protection barrier, this security system architecture can better reduce the intruder to the railroad information management system network disruption and damage, to ensure system information security management, to protect information, data transmission, to ensure a strong and stable foundation. The risks and pressure generated by the railway train control system network are increasing, and in order to better ensure information security, attention must be paid to improving the integrity and practicality of the system-specific security management system architecture train management.

The security architecture of systems related to the industrial control sector consists of the following main components. In terms of security management, information security is considered and controlled from four aspects: security policy and management system security policy, security management organization and personnel, construction outsourcing software development, security operation and maintenance, vulnerability management and risk management.

In terms of reliable security technology, based on the industrial automation control system, divided into various levels as a whole, considering the equipment and equipment functions contained in each level, the importance of equipment, network structure, possible risks and other factors, technology is used between levels border protection, and the communication between layers, especially between the control network and the uncontrolled network, is monitored and controlled by firewalls, network gates and other equipment. The information security of the industrial control system is ensured by security protection methods within and between different layers and by strengthening management aspects protection. As a typical example of an industrial control system in the rail industry, a railroad

train control system can be designed with the above safety system architecture in mind, and then optimized for system design, development, operation, control, and maintenance.

2) Network security vulnerabilities Mining technology: The main insecurities of a networked column control system include system application layer software, various types of security protocols for communication between application equipment, and network information leakage or vulnerabilities existing in constituent information systems. In addition to developing reliable security applications, encryption communication protocols and patching operating systems, the most effective solution to address these vulnerabilities is to use existing vulnerability scanning techniques to detect and exploit these vulnerabilities before they are exploited by attackers to damage the system. The most effective solution is to use existing methods of finding vulnerabilities to detect and exploit these vulnerabilities in information systems before they are exploited by intruders, and to conduct targeted attacks on information systems in order to update imperfect applications with appropriate security patches and create a timely system to protect against intruder attacks. [2].

3) Application of situational awareness technology: How to monitor and understand the safety situation of the train traffic control system in real time and dynamically is a prerequisite for the implementation of effective targeted measures. Situational awareness technology is an environment-based, dynamic and holistic understanding of safety risks , a way to improve the ability to detect, understand, analyze, respond to and deal with security threats from a global perspective based on big security data. The situational awareness technology based on the train control system must have the ability to constantly monitor the security of the information space, detect and analyze all kinds of threats and anomalous risk information, as well as quickly determine the sphere of influence, attack paths, targets and attack methods associated with forcing the train control system. This will effectively improve the information security of the train control system.

4) Proactive defense technology: is an intrusion into the control system before the occurrence of the behavior factor, can immediately and accurately warn, while building a defense system, proactive defense strategy, early deployment of defensive measures. Prevention, repulsion and mitigation of the risk to the information system by making it impossible for the attacker to achieve its goals, thereby protecting the attacked system. Deployment and implementation of active protection technology for train control systems must be adapted taking into account the actual characteristics of each subsystem and specific operating conditions and scenarios, and also meet the general constraints of the information security system architecture from above, to form a systematic and comprehensive protection mechanism with the advantages of local/global reinforcement.

4 Conclusion

This article briefly describes the information security environment of the network and the main problems that have arisen in the development of the train control system, as well as the main ideas and methods for implementing the information security risk analysis of the train control system [1]. The main methods and processes for analyzing the information security vulnerability of train control systems are summarized, and the information security system of industrial control systems is used as a starting point for further analysis of the information security protection technology of train control systems from four aspects, including the information security system architecture, vulnerability search technology, technology situational awareness and active protection technology. The analysis carried out in this article, is a further understanding of the rapid development of train control systems at the level of information security, and related system and technical ideas are relevant to promote the development of technologies, equipment and systems of train control systems to include information security functions and in-depth capacity building.

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注水增产技术的多种方法
**VARIOUS METHODS OF WATER INJECTION AS THE OIL
PRODUCTION INCREASE TECHNIQUE**

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注解。 难采 (HTR) 油气储量的特点是石油开采的地质储存条件及其物理条件不利。 它们的开发可以通过使用与传统方法相比需要大量成本的特殊手段和技术来实现。 由于主要开发易于采收的石油储量, 因此 HTR 率显著增加, 因此高粘度石油矿床占总储量的百分比显著增加。 因此, 目前在此类油藏上实施增产新方法存在一定困难, 开发需要新技术、新设备。

应用于高粘度油藏的传统方法有时不够有效, 因此有必要根据岩土条件选择合适的技术 [1]。 本研究考虑了一种涉及流体动力、热和物理化学处理的地层增产技术。 这些技术的正确组合使高粘度油藏的强化开发成为可能。 所考虑的方法包括注入一定含量的表面活性剂的热水。 使用伴生气作为水加热燃料可以解决其处理问题。 应用技术降低了对环境产生负面影响的排放量。

关键词: 难采储量 (HTR)、表面活性剂、热水、开发集约化、高粘度油、注入率、流体动力学模型。

***Annotation.** Hard to recover (HTR) oil and gas reserves are characterized by unfavorable geological storage conditions for oil extraction, as well as its physical conditions. Their development can be occurred with the use of special means and techniques which require significant costs in comparison with traditional methods. The rate of HTR significantly increases as the result of predominant development of easily recoverable oil reserves and as the result the percentage of high viscosity oil deposits from the total reserves noticeably increases. So, nowadays there are some difficulties which are connected with implementing new methods of oil production increase on such kind of oil deposits, as well as their development which requires new technologies and equipment.*

Traditional approaches applied to high-viscosity oil reserves sometimes are nor effective enough and therefore it is necessary to choose the right technique according to geotechnical conditions [1]. A formation stimulation technique which involves hydrodynamic, thermal and physicochemical treatments is considered in this research. The right combination of such techniques made it possible to

intensify development of high-viscosity oil reserves. The considered method includes hot water injection with a certain content of surfactants. The appliance of associated gas as the fuel for water heating allowed to cope with the problem of its disposal. The volume of emissions which negatively impacts on environment has been lowered with the applied technology.

Keywords: *hard to recover reserves (HTR), surfactants, hot water, development intensification, high viscosity oil, injection rate, hydrodynamic modelling.*

Recently it has become relevant to create and implement new technologies and formation stimulation techniques in oil production industry due to the decrease of easily recoverable oil reserves ratio in order to increase oil recovery and increase technological and economic development parameters [2,3]. Traditional methods of oil stimulation don't always assist in achievement of the desired result and that is way the effectiveness of activities conducted on oil deposits directly depend on the right chose and combination formation stimulation techniques [4].

The Becket-Kluchevskoe oil deposit is located on the territory of Cheresman-skoe and Almetevskoe regions of Republic of Tatarstan. Tectonically, the deposit is located on the western slope of the South-Tatar arch.

The sedimentary complex of deposit's primary rocks is presented by deposits of Precambrian, Devonian, Carboniferous, Permian, Neogene and Quaternary age.

Filtration characteristics according to the core data vary within $102,5 - 2841 \times 10^{-3} \mu\text{m}^2$, according to well logging data – from 398,3 to $3124,8 \times 10^{-3} \mu\text{m}^2$. Considering the volume of the information, well logging data was used in the design. The porosity according to the core data varies from 0,05 to 0,305, according to the well logging results from 0,19 to 0,30, on average according to the estimation method the porosity is 0,22 и 0,245 respectively. Considering the slight difference in the average values and for the purpose of the representative information use, both samples were used to justify the average porosity value adopted during the development program and as the result the average porosity was 0,23. The oil saturation ratio was 0,87 on average. Considering the reservoir properties of the Bobrikovky horizon it may be concluded that the development object has high-density and high porosity properties. One of the peculiarities of Bobrikovsky horizon is high oil viscosity which varies from 55 to 75 mPa·s.

It was decided to inject hot water in one of the fields of the Bobrikovsky horizon. Its development started in 2004 with the well №2138, the dynamics of the development characteristics is shown in Figure 1.

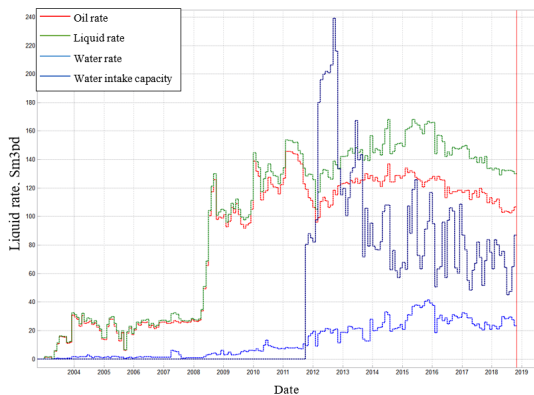


Figure 1. Dynamics of the Bobrikovsky horizon field development indicators

During the period from 2008 till 2012 active drilling works have been conducted of the field. The initial oil flow rates were 10-25 t/day, but soon the production declined in 2 times. Such declined also was accompanied with reservoir pressure decrease.

Formation stimulation techniques, which include hydrodynamic, thermal and physical-chemical treatments, were applied in order to stabilize oil production decrease [5]. The following parameters were considered in order to determine the most effective variant of complex treatment:

- 2 different temperatures of injected water (10 °C and 50 °C);
- water injection without surfactants appliance;
- 2 types of surfactants appliance with concentration ratio of 0,05%.

Hot water injection with the surfactant appliance which was conducted from September 2013. In order to heat water associated gas was applied.

For the analysis of injection effectiveness within 5 years of project realization it is preferable to analyse production wells' dynamics in the area of well №3118. In order to assess the dynamics, it is recommended to select well №3118 (Fig.2) area and make a diagram of wells №2138 (Fig.3) and №3115 (Fig.4) performance. As an analysis tool the geological and hydrodynamic model of the deposit constructed in tNavigator software will be used.

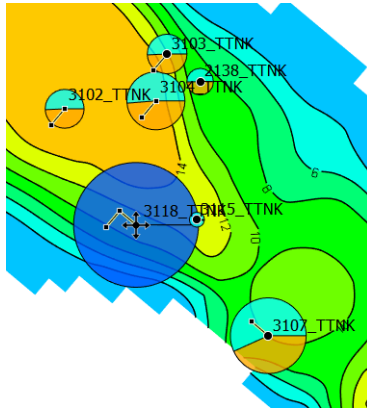


Figure 2. Well area №3118.

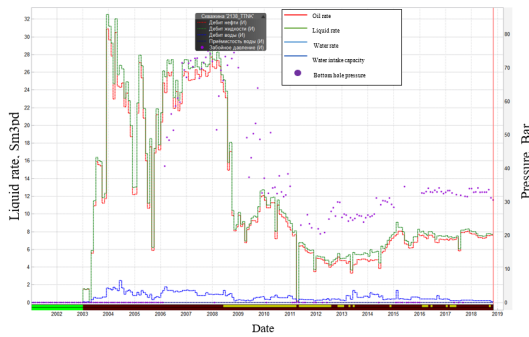


Figure 3. Well №2138 performance dynamics.

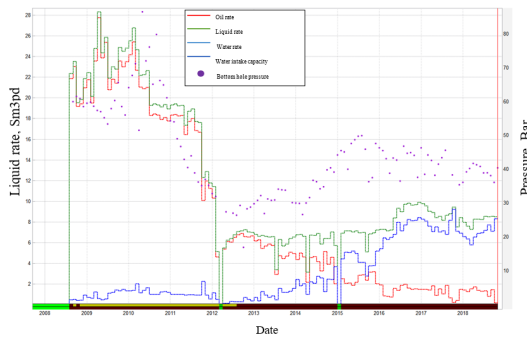


Figure 4. Well №3115 performance dynamics.

After graphs analyse it becomes clear that oil production increases as well as reservoir pressure stabilizes and increases.

Despite the noticeable effect of hot water injection, it is difficult to separate the effect of traditional injection and injection of hot water directly with surfactants. The estimates with the use of options for hot water injection combined with surfactants on hydrodynamic model are required in order to carry out the assessment.

Data, describing the interaction of reservoir fluid and surfactants at elevated temperature are required in order to perform forecasting calculations on the hot water injection, combined with surfactants, and its effectiveness assessment. For this reason, the following additional properties of reservoir fluids and injected fluids are to be considered:

- water and oil viscosity change depending on the temperature;
- change in the oil displacement ratio, depending on the temperature;
- change of the oil displacement ration depending of surfactant concentration;
- change of the water viscosity depending on the surfactant concentration.

Table 1 shows the dependence of the reservoir fluids viscosity on their temperatures.

Table 1
Oil and water viscosity depending on their temperature when surfactants are added.

Surfactant	Temperature, °C	Oil viscosity coefficient, u.f.	Oil viscosity at surface conditions, mPa·s	Oil viscosity in situ, mPa·s	Water viscosity coefficient, u.f.	Water (With Surfactant) Viscosity, mPa·s
1	10	1.17	92.91	52.02	1.07	1.70
	25	1.00	79.48	44.50	1.00	1.58
	30	0.94	75.02	42.01	0.78	1.24
	60	0.86	68.03	38.09	0.63	0.99
2 Neonol AF9-6)	10	1.17	92.91	52.02	1.25	5.52
	25	1.00	79.48	44.50	1.00	4.41
	30	0.94	75.02	42.01	0.92	4.04
	60	0.86	68.03	38.09	0.43	1.90

Table 2 shows the relation between oil displacement ration and residual oil saturation from surfactant concentration and temperature of injected water.

Table 2
Change in the washing capacity of water depending on surfactant concentrations and temperatures.

Surfactant	Surfactant concentration	Water temperature, °C			
		10	20	30	60
1		Change of oil recovery factor			
	Surfactant-free	56.40	56.99	57.58	59.37
	0,05% Surfactant	58.48	60.69	62.89	66.62
		Change of residual oil saturation			
	Surfactant-free	0.373	0.368	0.363	0.347
	0,05% Surfactant	0.355	0.336	0.317	0.285
		Residual oil saturation multiplier			
	Surfactant-free	1.014	1.000	0.986	0.945
	0,05% Surfactant	0.965	0.914	0.863	0.776
2 (Neonol AF9-6)		Change of oil recovery factor			
	Surfactant-free	56.40	56.99	57.58	59.37
	0,05% Surfactant	61.56	62.43	63.29	67.89
		Change of residual oil saturation			
	Surfactant-free	0.409	0.401	0.396	0.381
	0,05% Surfactant	0.358	0.350	0.342	0.299
		Residual oil saturation multiplier			
	Surfactant-free	1.025	1.006	0.994	0.956
	0,05% Surfactant	0.897	0.877	0.857	0.749

The above given functions were applied in the model for making forecasting estimates with the purpose of hot water and surfactants influence on the effectiveness of the Bobrikovsky horizon reservoir development.

After data has been applied the estimations are made for hydrodynamic model and the map of temperature distribution inside the reservoir is also given (Fig.5).

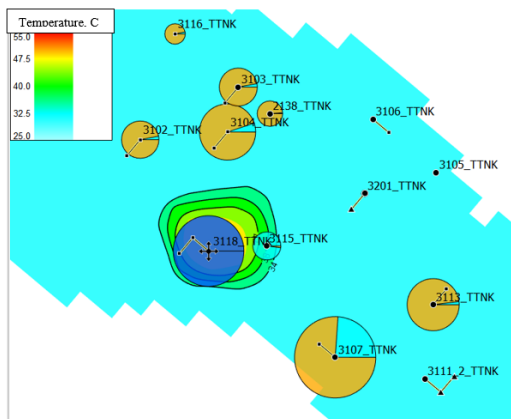


Figure 5. The map of temperature distribution inside the reservoir.

The estimates of three variants are presented: the basic – without water injection, the variant with cold water injection without surfactants and the variant with hot water injection combined with surfactants. The comparison is given in Figure 6.

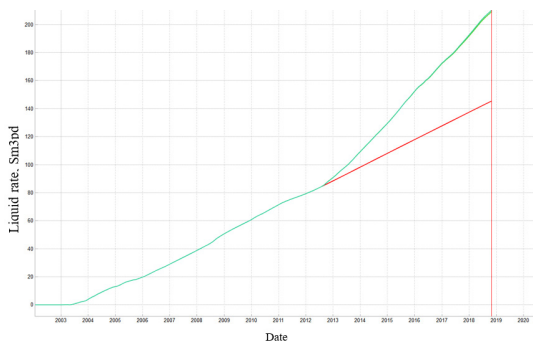


Figure 6. Three injection variants comparison.

Figure 6 shows that the main contribution to additional oil production is made up by water injection control and, as it turned out during the downhole analysis, equipment optimization. The contribution of hot water to the total production is about 3%.

Table 3*Oil production increase from different variants of water injection.*

Cumulative oil production	Without injection	Cold water injection (10°C)	Hot water injection (with Surfactant)
01.09.2012	85,247	85,247	85,247
01.11.2018	145,491	209,338	210,043
Over a period	60,244	124,091	124,796

The company achieved the increase of downhole pressure and of oil production as the result the new formation stimulation techniques appliance. The best option in terms of additional oil production (3%) and oil displacement rate was the variant of hot water injection with the addition of 0,05% surfactant №2 (Neonol AF9-6). The analysis of oil deposits development variants has shown that the hot water injection with the addition of surfactants provides a slight increase if additional oil production and oil displacement ratio in comparison with cold water injection. Also, the applied technology allowed to decrease emissions in the air by using associated gas as the mean of water heating [7].

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油井作业机械杂质控制方法的选择

SELECTION OF A METHOD FOR CONTROLLING MECHANICAL IMPURITIES DURING OIL WELL OPERATION

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抽象的。这篇文章涉及油井作业过程中的出砂问题。描述了负面影响及其对油井和管道性能的影响。该文章还介绍了防止机械杂质影响的现代方法。详细介绍了推荐的开槽滤波器的优点。

关键词: 机械杂质, 过滤器, 油井, 井下抽油设备, ESP, 缝隙过滤器。

Abstract. *The article deals with the problem of sanding during the operation of oil wells. Describes the negative effects and their impact on the performance of wells and pipelines. The article also presents modern methods of protection against the effects of mechanical impurities. The advantages of the recommended slotted filter are described in detail.*

Keywords: *mechanical impurities, filter, well, downhole pumping equipment, ESP, slotted filter.*

In today's oil production environment, we are increasingly confronted with factors that complicate the operation of field equipment. The high concentration of mechanical impurities in well products is the main cause of premature wear and failure of downhole equipment, which leads to increased costs and reduced profitability of production.

The problem of mechanical impurities in the oil industry is extremely urgent for several reasons.

First, mechanical impurities can significantly reduce productivity of oil production wells [1]. If solids accumulate in a well, they can clog the well and reduce production rates. This can lead to longer maintenance times and higher production costs.

Second, solids can affect the quality of the oil produced and its refining. Solids such as sand, clay, and rust can enter the oil. These impurities can affect oil chem-

istry, density, and viscosity. This can lead to higher refining costs as well as lower market value of the oil.

Third, mechanical impurities can cause damage to equipment and pumps on the surface [2]. If particulate matter enters the oil or fluid to be pumped, it can cause wear and tear on the equipment and reduce its efficiency. It can also lead to the need for regular maintenance and equipment replacement, which increases the cost of operating oil wells.

One of the most widespread and effective ways to protect downhole pumping equipment (DPE) from the impact of mechanical impurities is the installation of special filters at the intake of pumping units [3].

Filters can be of different types, such as mechanical, magnetic, gravity, ionic and others. The choice of a particular type of filter depends on the type of mechanical impurities that need to be removed, as well as the operating conditions of the well.

Let's select a filter for the well. In the field, the only source of available information when using filters are concentration and particle size distribution of particles carried out of the formation. The results of the analysis are presented in table 1.

Table 1
Rock particle size distribution

№	Sieve hole dimensions, mm		Average particle diameter of fractions, d_{cpi}	$\lg d_{cpi}$	Weight of the load m_i , g	Total weight of the sample $\sum m_i$, g	Mass concentration (fraction) of the fraction $C_{mi} \cdot 100\%$	Total mass concentration $\sum C_{mi} \cdot 100\%$
	from	to						
1	0,12	0,06	0,09	-1,046	0,04	0,04	0,08	0,08
2	0,16	0,12	0,14	-0,854	9,96	10	19,92	20
3	0,24	0,16	0,2	-0,699	6	16	12	32
4	0,34	0,24	0,29	-0,538	4	20	8	40
5	0,4	0,34	0,37	-0,432	21,5	41,5	43	83
6	0,9	0,4	0,65	-0,187	8,5	50	17	100

The average particle diameter of the fractions is calculated by the formula:

$$d_{cpi} = \frac{d_{i1} + d_{i2}}{2} \tag{1}$$

where d_i – hole sizes of sieves, mm

The total mass of each sieve is found by adding the mass of the previous sieves:

$$M = \sum m_i, \tag{2}$$

where m_i – sample weight, g

The mass concentration of the fractions is determined by the formula:

$$Cm_i = \frac{m_i}{M} \cdot 100\% , \tag{3}$$

The total mass concentration is calculated by the formula:

$$C_{Mi} = \frac{\sum m_i}{M} \cdot 100\% , \tag{4}$$

According to this methodology, the indicators for each sieve are calculated.

The obtained results allow you to build a curve of the total particle size distribution (Figure 1).

Analyzing Figure 1, we can say that 90% of the finer sand fractions pass when the diameter of the hole is equal to $d_{90}=0,43$ mm (point 1, serving to determine the size of the filter slots). 60% of the total weight composition includes even finer particles. This point is used to determine the heterogeneity coefficient (point 2, $d_{60} = 0,35$ mm). Point 3 ($d_{10} = 0,11$ mm) allows us to calculate the effective particle diameter.

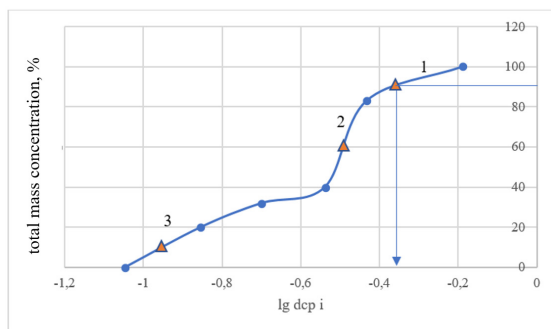


Figure 1. Total particle size distribution curve

Analyzing Figure 1, we can say that 90% of the finer sand fractions pass when the diameter of the hole is equal to $d_{90}=0,43$ mm (point 1, serving to determine the size of the filter slots). 60% of the total weight composition includes even finer particles. This point is used to determine the heterogeneity coefficient (point 2, $d_{60} = 0,35$ mm). Point 3 ($d_{10} = 0,11$ mm) allows us to calculate the effective particle diameter.

Table 2

Slot sizes of different downhole filters

Name of filter orifices	Definition formula	Absolute value
1. Width of rectangular slots of slotted filters, mm	$2 \cdot d_{90}$	0,86
2. Diameter of round filter holes, mm	$3 \cdot d_{90}$	1,29
3. Gravel grain diameter in gravel filters, mm	$(10 \dots 12) \cdot d_{90}$	4,3

Points 2 and 3 are used to determine the coefficient of heterogeneity, calculated by the formula:

$$k_n = \frac{d_{90}}{d_{10}} = 3,18 \quad (5)$$

The ideal choice for the role of the filter is the slotted filter ESP - inlet module Slotted filter (figure2).

Recommended for protection of pump working elements from proppant removal after hydraulic fracturing (HFR).

The slotted filter uses slot grids made of V-shaped high-strength stainless steel wire as a filter element. The filter is installed as part of the electric drive centrifugal pump unit (ECPI). The size of the detained particles is 0.1-0.2 mm. This filter has several advantages. Firstly, it has the property of self-cleaning due to ESP vibration. Secondly, it is easy to install, because the filter is installed as a part of the submersible pumping unit. Accordingly, lowering the filter does not increase time for current well repair. The filter is not subject to clogging, which explains minimal back-up losses at the pump intake.



Figure 2. Slotted filter

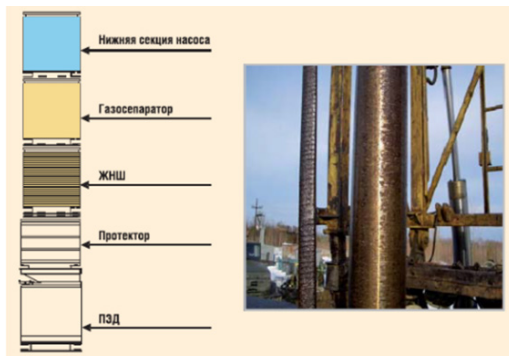


Figure 3. Location of the slotted filter in the well

Thus, the problem of mechanical impurities in the oil industry is extremely urgent, as it can adversely affect the operation of oil wells and the quality of oil produced. The article presented mechanical methods of protection against sand carry-over. One of the most effective ways is the use of slotted filter.

In general, the use of filters is an important part of the oil production process and helps reduce wear and tear on equipment, maintain well productivity and increase the efficiency of the entire production process.

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微结构介质凝胶中的不稳定传热
**UNSTEADY HEAT TRANSFER IN MICROSTRUCTURED
MEDIA-GELS**

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抽象的。这项工作致力于解决与开发基于科学的方法控制微结构介质和凝胶中的热传递相关的工程热物理学的基本问题。这个问题的出现是因为需要找到对复杂非均匀介质进行定向作用的方法，以控制软物质中的非平稳输运现象，以及预测后果并解释非平稳和波动现象发生的原因自然、生物和技术过程。使用获得的折射率和高速视频帧的相关性，确定了所研究的凝胶材料样品的两个干涉条纹之间的温差的定量值。结果，获得了不同性质和浓度的水凝胶温度场重建值的新数据，这些数据用于解决热传导的反问题并确定传递系数。

关键词：光学全息术，水凝胶，梯度测温法，3D 生物打印，水凝胶的热物理性质。

Abstract. *This work is devoted to solving the fundamental problem of engineering thermal physics associated with the development of science-based methods for controlling heat transfer in microstructured media and gels. This problem arises as a result of the need to find methods of directed actions on complex inhomogeneous media to control non-stationary transport phenomena in soft matter, as well as to predict the consequences and explain the causes of the occurrence of non-stationary and wave natural, biological, and also technogenic processes. Using the obtained dependences of the refractive index and high-speed video frames, the quantitative values of the temperature difference between two interference fringes of the studied samples of gel materials were determined. As a result, new data on the reconstructed values of the temperature fields for hydrogels of different nature and concentration were obtained, which were used to solve the inverse problem of heat conduction and determine the transfer coefficients.*

Keywords: *optical holography, hydrogels, gradient thermometry, 3D bioprinting, thermophysical properties of hydrogels.*

Introduction

At present, the practical use of soft matter, which includes mobile microstructured media, including gels, is of great interest. Gels are usually understood as heterogeneous systems, the dispersed phase of which is interconnected by intermolecular interactions, and the dispersion phase, which fills the free space, is a drop liquid. Gels can have different physical and chemical nature. The number of substances that form gels is large and varied, for example: gelatin, hyaluronic acid, agarose, alginates, etc. [1,2]. The practical fields of application of gels are increasingly expanding [3–5] due to the fact that they are referred to as so-called “smart materials” due to the uniqueness of their rheological, thermophysical, and physicochemical properties. In recent years, special interest in gels is also due to the fact that they are considered as the main working material for bioprinting, one of the promising areas in the development of regenerative medicine [6].

Depending on the initial components, the preparation method, the planned application, and the physicochemical properties of various gel materials, there are a large number of experimental methods for studying their characteristics. These include, for example, the method of differential scanning calorimetry, the method of IR spectroscopy, as well as methods of broadband dielectric spectroscopy and scanning electron microscopy.

The study of the thermophysical properties of hydrogels, especially taking into account phase transformations and the presence of modifying components, such as, for example, cell cultures, requires the use of optical non-invasive methods.

Experimental and Theoretical Study of Thermal Conductivity in Hydrogel Systems

To study thermal processes, including those associated with phase transitions, boiling and evaporation, known optical methods are used based on the dependence of the refractive index of continuous media on temperature and concentration [7]. The essence of the optical method of holographic interferometry is to obtain a series of interference patterns (interferograms) of the process under study both in the region of the boundary layer and in the entire volume of the studied optically transparent samples. Based on the results of interpretation of the interference pattern, characteristic temperature fields or streamlines are determined. The features of the use of optical methods for measuring thermal processes and the installation scheme were previously described in detail by the authors of the project in [8, 9]. The measuring complex is based on the original methods of holographic interferometry with elements of immersion tomography developed earlier by the authors (performers of this project).

Verification of the method of holographic interferometry

For the experimental study and visualization of the processes of both separate and joint heat and mass transfer in gel materials, both the main and individual local elements of the optical scheme were modernized in the scheme of the optical complex. Figure 1 shows a diagram of the experimental modified complex.

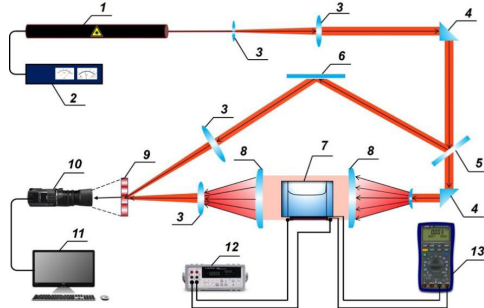


Figure 1. Scheme of the experimental optical setup: 1 - helium-neon laser, 2 - power supply, 3 - optical lenses, 4 - rectangular prism, 5 - translucent mirror, 6 - reflecting mirror, 7 - working area (cell), 8 - lenses, 9 - holographic plate, 10 - high-speed video camera, 11 - computer, 12 - direct current source, 13 - digital multimeter.

The technique for measuring temperature fields in optically transparent media, in particular liquids, is based on the dependence of the refractive index of the media under study on temperature. According to the optical scheme, in the experiment, an object light beam passing through a working area 5×10^{-3} m in size changed the refractive index due to the difference in the densities of the heated liquid, and at the point of intersection of the object and reference light beams, an image of lines was formed on a holographic photographic plate (7). equal densities - isotherms. To restore and decipher the lines of equal temperatures, it is necessary to know the temperature at least at one point of the investigated volume of the liquid and the gradient of the change in the refractive index of the liquid from temperature. In the experiments, the initial temperature of the liquids was measured by the contact method using thermocouples and was 20°C .

Experimental study of the dependence of the refractive index on the temperature of hydrogel materials

The dependence of the refractive indices on temperature in pure and mixed gels in the studies was determined using an IRF-23 refractometer, the principle of operation of which is based on studying the phenomena that occur when light passes through the interface between two media with different refractive indices.

This instrument makes it possible to determine the refractive indices for both transparent liquid solutions and gels. The experimental setup (Figure 2) is a thermometric complex for determining refractive indices, the main elements of which are: a helium-neon laser (He-Ne) with a power of 20 mW and a wavelength of 0.63 μm (1), an optical polarizing filter (2) and a refractometer (3), which includes a set of measuring prisms, a telescope, a reading device and an illumination system, as well as a direct current source (5) and a thermostat (6) connected to it.

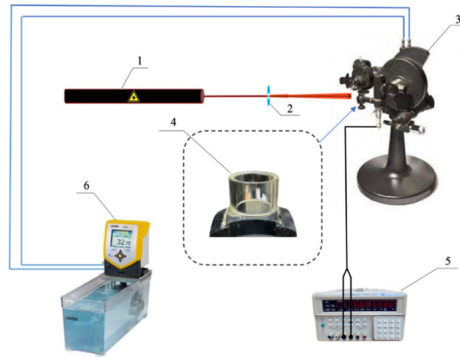


Figure 2. Installation scheme for measuring the refractive index:
1 – helium-neon laser, 2 – polarizing filter, 3 – IRF-23 refractometer,
4 – cell with gel, 5 – direct current source, 6 – thermostat.

To ensure measurement accuracy, the test sample must be optically homogeneous and have mutually perpendicular faces. Both pure and mixed gels were used in the experiment. The content of agarose in the sample was 0.1% wt., and gelatin 4.0% wt. The test sample was loaded into a cylindrical cuvette and mounted on a refractometer prism. After connecting the light source, the light beam passed through the gel sample and was refracted and displayed in the telescope of the instrument. According to the angle of refraction of an ocular micrometer correlated with the scale of the microscope, the dependences of the refractive index values on temperature for the gel samples under study were determined. The temperature range for studying the gels was due to the choice of microbiobjects (cells) favorable for the development and ranged from 20 to 40 $^{\circ}\text{C}$.

The most important feature in this study was the use of a polarizing and high-precision spatial filters in the optical scheme in combination with a high-resolution photographic plate PFG-01, as well as the use of a gradient heat flux sensor (GHFS) combined with a heating system. The use of GHFS made it possible not only to measure, but also to control the value of the density of the surface heat flux supplied to the lower part of the working section, i.e. heating intensity.

Study of the refractive index in gels

As a result of the experiments, the temperature dependences of the refractive indices for various samples of both pure and mixed hydrogels were obtained, which make it possible to reconstruct the temperature field in experiments on studying the dynamics of temperature fields. Figure 3 shows the characteristic dependences of the refractive index for two pure gels and one mixed gel at a He-Ne laser wavelength. As can be seen from the figure, the dependence is quite strong in a small temperature range, which has a significant effect on improving the accuracy of determining the temperature difference between adjacent isolines and allows minimizing the error in solving the inverse problem of heat conduction.

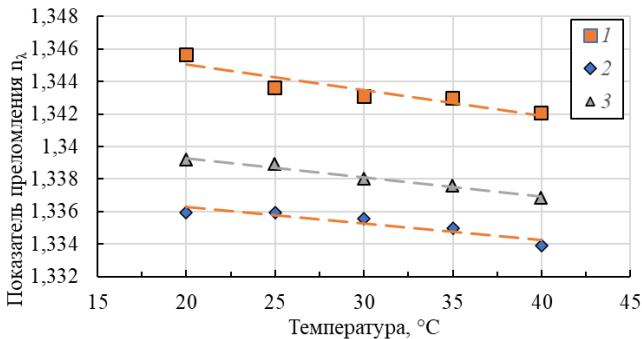


Figure 3. Dependence of the refractive index of various hydrogels on temperature at a wavelength of He-Ne laser ($\lambda=632.8\text{nm}$): 1 - gelatin gel 4.0% wt., 2 - agarose 0.4% wt., 3 - mixed gel of agarose and gelatin, respectively 0.1% and 4.0% of the mass; dots are experimental data, lines are calculated values.

Heat flow measurement in gels

A feature of experimental studies of non-stationary heat transfer in inhomogeneous microstructured hydrogels was the combination of optical and thermal methods. The use of a gradient heat flux sensor made it possible to fix the dynamics of changes in the magnitude of the surface heat flux in time and synchronize it with the results of high-speed video filming of the process of non-stationary heating of hydrogel samples with anisotropic properties.

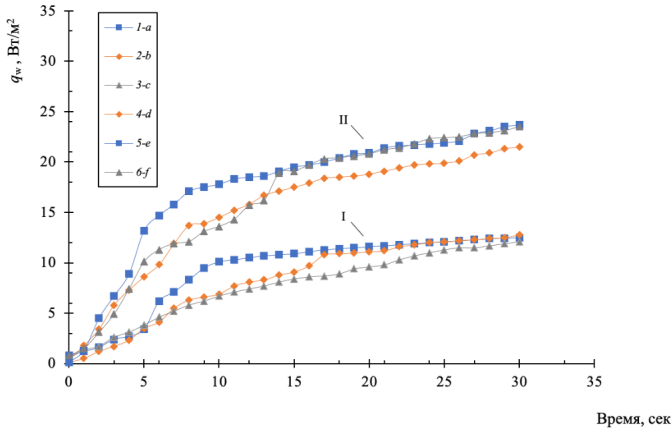


Figure 4. Changes in the heat flux density q_w (W/m^2) from time to time under different modes of heat load in the heater: I - at 1.5W, a) gelatin gel 4.0% wt., b) agarose gel 0.4% wt., c) mixed gel from agarose 0.1 wt. and gelatin 4.0 wt.; II - at 3.5W, d) gelatin gel 4.0% wt., e) agarose gel 0.4% wt., f) mixed agarose gel 0.1 wt. and gelatin 4.0 wt.

For comparison, Figure 4 shows the experimental results of measuring the density of the surface heat flux in the region of the bottom wall of the cuvette at different installed heat release powers $N = 1.5$ and 3.5 W, respectively. The graph shows that the values of the surface heat flux at $N = 3.5$ W are much higher compared to $N = 1.5$ W.

The data obtained are of great importance for the development and verification of computational methods for numerically solving the problem of the spatiotemporal distribution of temperature fields in gels with anisotropic properties, including the possibility of predicting the onset of melting and the occurrence of microconvective flows in soft gel materials. At the same time, as in previous studies, this method makes it possible to clearly determine the moment of the beginning of melting of the material under study and the moment of the beginning of free convection.

Measurement of temperature fields in gels

The technique used in this study, based on interferometric measurements, made it possible to visualize and restore the distribution of temperature fields in the entire volume of the cuvette.

On the basis of high-speed video filming of non-stationary heating of hydrogels, interference patterns of the process under study were obtained. Interference patterns are images on which lines of equal temperatures were recorded - iso-

therms. To restore and decipher, it is necessary to know the temperature at least at one point of the investigated volume of liquid and the gradient of the change in the refractive index of the medium from temperature. In the experiments, the initial temperature of the gels was measured by the contact method using thermocouples and was 20°C.

As an example, Figure 7 shows video frames of measuring temperature fields 30 seconds after the start of heating. The scale with restored temperature values for agarose and gelatin gels is also shown here. The thermal load installed on the current source was $N = 1.5$ W. The isotherms shown in Figure 7, parallel to the heating surface, characterize the mode of classical non-stationary heat conduction.

Using the approximate dependences of the refractive indices on temperature, the temperature gradients were calculated for both pure and mixed gel samples.

The obtained dependences of temperature gradients for the studied gels were used to determine the quantitative change in temperature between two interference fringes. The value of the temperature difference between two interference fringes was carried out according to the known dependence:

$$S_i = (x_i, y_i) = \frac{L}{\lambda} \cdot \frac{\partial n}{\partial T} \cdot \Delta T$$

Where

S – the number of interference fringes (isotherms);

λ – the wavelength of the light source;

L – the length of the optical path of the beam passing through the object under study;

$\frac{\partial n}{\partial T}$ – the gradient of the refractive index versus temperature;

ΔT – the temperature difference between two isotherms.

As a result, new data were obtained for gelatin, agarose, and mixed hydrogels. For example, for a gelatin gel, the change in temperature between two interference fringes with an initial temperature $T_{\text{нач}} = 20$ °C at a wavelength of a helium-neon laser $\lambda = 0.63$ μm and a beam length L passing through a cuvette of 5×10^{-3} m was $\Delta T = 0,8$ °C, and for agarose and mixed gels $\Delta T = 1.4$ °C and $\Delta T = 1.1$ °C, respectively.

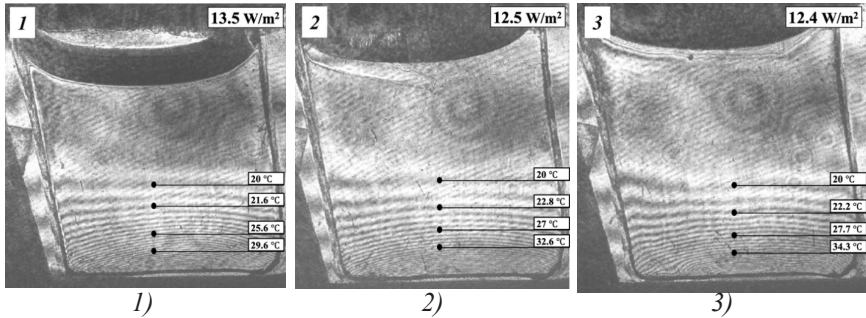


Figure 5. Video frames of temperature fields for different hydrogel samples at the same time $\tau = 30$ s from the start of heating at $N = 1.5$ W:
 1 - gelatin gel 4.0% wt., 2 - agarose gel 0.4% wt., 3 - mixed gel of agarose and gelatin, respectively 0.1% and 4.0% wt.

It has been established that under the same conditions of non-stationary heating, the required amount of heat for heating the agarose gel is higher compared to gelatin and mixed gels.

Conclusion

An experimental study of the propagation of temperature fields during non-stationary heating of hydrogels was carried out using the methods of optical holography and gradient heatmetry. Using the obtained dependences of the refractive index and high-speed video frames, the quantitative values of the temperature difference between two interference fringes of the studied samples of gel materials were determined. As a result, new data on the reconstructed values of the temperature fields for hydrogels of different nature and concentration were obtained, which were used to solve the inverse problem of heat conduction and determine the transfer coefficients. The use of the gradient heat logging method made it possible to fix the dynamics of changes in the magnitude of the surface heat flux in time and synchronize it with the results of high-speed video filming of the process of non-stationary heating of hydrogel samples. It has been established that at the same moment of time and comparable to the thickness of the heated layer for various hydrogel samples, the heating temperature of the mixed sample has a maximum value compared to pure hydrogels.

This study provides a fundamental understanding of heat transfer in soft materials, which in turn will allow more efficient design of printing devices based on hydrogels.

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