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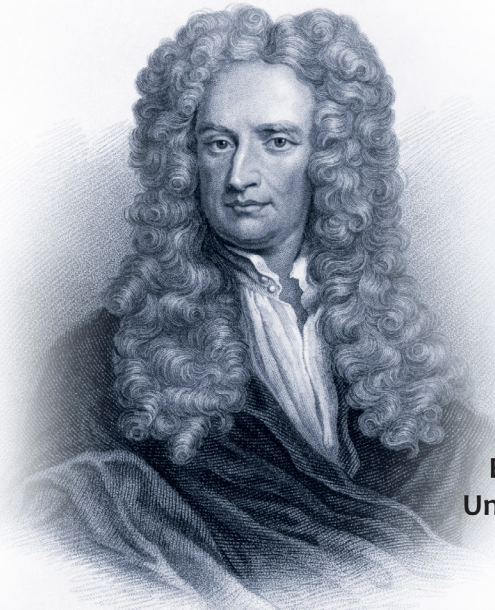

Birmingham
United Kingdom

International Conference "Process Management and Scientific Developments"

Birmingham, United Kingdom
(Novotel Birmingham Centre, May 2, 2020)

Materials of the International Conference
"Process Management and Scientific Developments"
(Birmingham, United Kingdom, May 2, 2020)

M67

ISBN 978-5-905695-36-0

These Conference Proceedings combine materials of the conference – research papers and thesis reports of scientific workers. They examines tecnical and sociological issues of research issues. Some articles deal with theoretical and methodological approaches and principles of research questions of personality professionalization.

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UDC 330

ISBN 978-5-905695-36-0

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THE PRACTICE OF USING AN INNOVATIVE DIGITAL PLATFORM FOR THE OPTIMAL TREATMENT OF CANCER PATIENTS [1]

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Abstract. One of the main tasks of digitalization of the Russian economy is the creation of industry-specific digital platforms based on various combinations of economic methods for processing large amounts of information in all spheres of society, including in the field of healthcare. This circumstance determines the relevance of this study in relation to cancer. The Onco Genotest company has developed an innovative digital platform, the functionality of which allows to determine the molecular genetic profile of the tumor and, based on it, select the optimal individual treatment regimens for patients with the goal of obtaining better results compared to traditional therapy. The innovative activity of the company is aimed at introducing into practice a personalized approach to the selection of specific methods of treatment of cancer patients. The results can be used in the diagnosis of cancer and the determination of methods for personalized therapy of cancer patients.

Keywords: Russian economy, digitalization, oncological diseases, digital platform, functional, molecular-genetic portrait of the tumor, personalized therapy.

Introduction

The target program “Digital Economy of the Russian Federation” as one of the main tasks of digitalization of the Russian economy provides for the creation of intersectoral digital platforms based on a combination of

[1]This article was prepared with the financial support of the Russian Foundation for Basic Research, project №20-10-00140a "Methodological aspects of modeling the Russian economy in the context of digitalization: sectoral breakdown."

various digital methods of information processing with specific methods to radically improve the functioning of all areas of society, including health [1].

In modern conditions, the digital platform economy is one of the promising trends in the development of a digital society, which helps to expand the practice of using methodological tools and innovative mechanisms from related fields of knowledge based on expanding access to information technologies and Internet resources. A digital platform can be defined as "a system of algorithmic relationships of a sufficiently large number of market participants, operating on the basis of a single information environment and allowing to reduce transaction costs by using a set of digital technologies and improving the principles of the division of labor [2].

Today in the world community it is customary to distinguish three main types of digital platforms.

1. Instrumental digital platform. It is based on a software or hardware-software complex (product) and solves individual applied problems.

2. Infrastructure digital platform. It is based on the unification of market participants in the information ecosystem to provide consumers in related sectors of the economy with turnkey solutions for automating their activities through the use of IT services implemented in its infrastructure.

3. Applied digital platform. It is a business model with the ability to algorithmically exchange certain values between a significant number of independent market participants in a single information environment, which leads to a sharp decrease in transaction costs due to the use of digital technologies.

In our country, two major information platforms are among the leading digitalization projects in the healthcare sector.

1. Unified State Information System in The Field Of Healthcare (USISH). It is a combination of information technology and technical tools that provide information support for methodological and organizational support for the activities of participants in the health system.

2. Unified Medical Information Analytical System of Moscow (UMIASM). It has been operating since 2012. To date, the number of users of this system has exceeded 9 million people and more than 10 thousand employees of medical institutions. The functionality of this system is constantly expanding, but so far it has implemented a range of the most routine operations: maintaining medical records, making an appointment with a doctor, getting directions for tests and examinations, filling out a sick leave, getting a prescription, etc. [3].

This article will reveal the experience of the practical use of applied digital platforms (of the third type) in Russia for the choice of treatment methods for cancer patients.

Main part

1. Promising areas of cancer treatment

In the modern world, oncology takes the 2nd place among diseases by the number of deaths for humans. However, only 5-10% of cases of cancer are associated with a genetic predisposition. Most of the cases are associated with diseases that a person acquires in the course of their life. The way out of this situation is seen in the development of genetic testing systems in order to determine oncological diseases and select the necessary therapy.

In the United States, the Food and Drug Administration (FDA) has currently approved about 50 molecular genetic tests for cancer detection. The FDA is responsible for protecting public health, ensuring the safety and efficacy of human and veterinary medicines, biological products, medical devices, food, cosmetics and products that emit radiation. The FDA also provides accurate, evidence-based medical information for the public [4]. Moreover, in 2018 alone, the FDA approved 15 new targeted drugs, and as of the end of the 3rd quarter of 2019, more than 900 targeted drugs were under development. Targeted or molecular-targeted therapy is one of the promising and rapidly developing areas of drug treatment (pharmacotherapy) of cancer [5].

Carrying out such developments requires significant financial investments. In 2017 alone, global investment in genomics amounted to 1.3 billion US dollars. By 2024, the global genetic testing market is expected to be 23 billion US dollars[4].

In Russia, about 600 thousand cases of cancer are detected annually, and the annual increase in such diseases throughout the country is 3%. For the prevention of cancer and treatment of cancer patients in Russia until 2024, 969 billion rubles are allocated [3].

Hundreds of publications annually appear in Russian and foreign scientific literature with the results of clinical trials, reviews of modern drugs, evaluation of diagnostic methods and the effect of certain mutations on the metabolism, progression and other characteristics of various tumors. Only the pages of the Russian Internet portal RosOncoWeb published more than 80 clinical trials that are currently underway [6]. If we take the world experience, then this figure will be an order of magnitude higher. The above circumstances contributed to the emergence of a steady tendency to increase the pace of development of personalized methods and approaches to the treatment of cancer patients.

However, in our country there are currently a number of problems in resolving this issue. The main one is that in Russia today there is no labo-

ratory that would meet all the requirements of modern clinical oncology in terms of molecular genetic oncology. There are also no laboratories performing a full range of molecular genetic testing. NGS testing (Next Gen sequencing - next generation sequencing) takes an average of 2 months.

2. Development of research methods and programs in the field of oncology

Below are the main areas of research in the field of cancer treatment, starting from 1977 to the present, namely:

- 1977 – the advent of sequencing — the dideoxynucleotide method, or the "chain termination" method, developed by F. Senger in 1977 [7]; Today, this method is widely used to determine the nucleotide sequence of DNA.

- 2005 – the advent of the first commercial NGS (Next-generation sequencing) sequencing for high-performance DNA sequencing developed by the biotechnological company 454 LIFE SCIENCES;

- 2006 – launch of the TCGA (The Cancer Genome Atlas) program for cataloging genetic mutations that cause cancer, using genome sequencing and bioinformatics at the cellular level;

- 2014 – launch of the MSK-IMPACT target test for mutations in both the rare and common oncological diseases within the TCGA program at the MEMORIAL SLOAN KETTERING CANCER CENTER, a cancer research center in New York;

- 2017 – the FDA approved the T790M mutation analysis in the EGFR gene to determine indications for EGFR inhibitors in some forms of lung cancer (NSCLC);

- 2018 – the FDA has approved the use of immune therapy for MSI-H tumors, of any location;

- currently (2019-2020) – the use of the drug against cancer LAROTREKTINIB for the treatment of tumors with rearrangements of the NTRK gene - Neurotrophic receptor tyrosine kinase, regardless of the localization of formation is approved;

- currently (2019-2020) –the use of TMB - MARKER of the mutational load of the tumor to determine the indications for immune therapy in the first line of treatment of some forms of lung cancer (NSCLC) is approved [4].

3. Functionality of the Onco Genotest digital platform

Onco Genotest company has successful experience in practical work with applied digital platforms. In its activities, the company uses a digital platform, the functionality of which allows you to develop personal approaches to the choice of cancer therapy methods for the tumor genome. For this, the latest treatment strategy for cancer patients is used. It is based

on the creation of compounds that are simultaneously able to visualize the focus of the disease, exert a therapeutic effect on it, monitor the kinetics of drug delivery to the tumor focus and, in the process of monitoring treatment, regulate the treatment regimen [8].

The company is actively introducing into clinical practice modern omix technology based on the advanced achievements of genomics, transcriptomics, proteomics, metabolomics, that is, sciences that study how the tumor cell genome is structured and how the information encoded in it is implemented [9, 10]. The company assesses the potential effectiveness of cancer therapy based on advanced laboratory research, as well as advisory, diagnostic, research and educational activities among doctors, patients and their relatives.

At the present stage, the key problem in the treatment of cancer is not only the development of new drugs, but also the choice of rational methods of therapy in relation to the individual genetics of specific patients. Tumor development is often accompanied by mutations that disrupt the structure of certain genes encoding the molecules, affect the susceptibility of tumor cells to the effects of drugs, tumor growth rate and metastasis.

For the timely detection of mutations, Onco Genotest specialists conduct studies to determine the genetic and molecular profile of the tumor. Knowing the genetic profile of the tumor, the attending physician can choose the scheme of individual therapy for the patient with oncology, which will allow you to get a positive result faster than if using traditional treatment regimens.

Some genetic disorders are associated with an increased risk of side effects when treated with certain drugs. Using the platform's digital functionality, company specialists can accurately determine those drugs that will not affect tumor cells with specific genetics. Such drugs are previously excluded from the treatment regimen for cancer patients.

Thus, in its activities, the Onco Genotest company is actively promoting a new personalized approach to the prevention and treatment of cancer and, thereby, creates the conditions for "providing each patient with the opportunity to receive optimal treatment, taking into account his individual data (including genetics) and molecular characteristics of a specific tumor "[11]. In this case, the main features of molecular genetic research are:

- determination based on the genetic heterogeneity of tumors of individual differences in the pharmacodynamics and pharmacokinetics of the drugs used;

- determination of the prognosis of the course of the disease and its treatment tactics based on the molecular genotype of the tumor [12, 13].

4. Work scheme of the Onko Genotest digital platform

The Onco Genotest digital platform provides a fairly simple interaction scheme between the attending physician and the company's specialists.

1. The attending physician fills out the patient's medical form and performs his registration on the bioinformation platform.

2. The attending physician determines the indications for the study of the tumor.

3. Onco Genotest experts conduct individual consultations for each patient, specify the indications for the study of the tumor and its volume.

4. Ready biomaterial of the patient is delivered to the company by courier.

5. After the study, the attending physician and patient gain access to a full interpretation of its results on a digital bioinformation platform.

The advantages of the digital bioinformation platform developed and used in the activities of Onco Genotest are as follows:

- determination of potentially effective/ ineffective/ toxic drugs, prognosis of relapse, resistance;
- support and storage of data of various types, namely: clinical history, genetic markers of NGS (Next-generation sequencing), digitized histological preparations, results of immunohistochemical studies (IHC) and the use of the modern method of FISH cytogenetic analysis that can detect mutational changes in chromosomes (including translocation and microdeletion) and perform differential diagnosis of malignant blood diseases and solid tumors, data from clinical trials;
- interactivity and visibility of results, tutorial function;
- re-analysis of data in the light of the results of new studies;
- accessibility from anywhere in the world, holding online consultations.

Combined, this information allows the oncologist to choose the most effective personalized therapy for the treatment of each individual patient.

Conclusion

Based on the results of the studies, the following conclusions can be formulated.

1. The Onco Genotest company works using the latest innovative achievements in the field of healthcare digitalization. The functionality of the digital platform is aimed at expanding the practice of introducing a new personalized approach to the treatment of cancer.

2. Modern molecular genetic diagnostics should provide not only high quality, but also the speed of research. In many cases, this factor plays an important role in the timely selection of treatment methods for cancer patients.

3. Thanks to the developed digital platform, Onco Genotest already uses innovative solutions and implements a complete list of molecular genetic research methods to ensure timely diagnosis of cancer and modern methods of treating cancer patients.

4. Recommendations for product modeling and technological solutions in the future activities of the Onco Genotest company.

For products: screening and early detection of oncology; identification of hereditary predisposition, selection of therapy according to the molecular profile of the tumor; monitoring the effectiveness of therapy; providing research results for pharmacological companies.

For technological solutions: technology integration; organization of parallel technological processes; standardization of processes; improving the quality and speed of research; process automation and digitalization of research results.

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COMPANY HUMAN CAPITAL DEVELOPMENT BASED ON OKR METHODOLOGY[1]

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Abstract. The article is devoted to a new methodology of management and work planning of personnel of companies and enterprises of various industries - OKR. A brief description of the technique, its basic principles and features are presented. It is shown that OKR has an impact on the development of the human capital of the company as a whole and the professional competencies of each employee.

Keywords: goal, key result, goal setting, planning, human capital, company, professional competencies.

Introduction

The OKR (Objectives and Key Results) methodology was developed in 1968 by Andy Grove, co-founder and CEO of Intel. The MBO (Management by Objectives) toolkit [1] was used as the basis. In 1974, John Dorr studied the OKR methodology and then integrated it into Google. Google's experience has been borrowed by a number of companies: Linkedin, Zynga, Twitter, Oracle, Netflix, BMW, Disney, Salesforce, Samsung. In our country, this methodology is used by Avito, NGENIX, Ultimate Guitar, Wrike, CIAN and others.

Main part

The essence of the OKR methodology is to set goals for the development of the company and use planning methods to achieve them, which allow us to model the tree of strategic development goals, starting with the company as a whole and ending with its individual divisions up to specific employees [2, 3].

[1]This article was prepared with the financial support of the Russian Foundation for Basic Research, project № 19-29-07168mk.

In goals, the key value of the company's business is usually reflected, which allows their wording in a rather abstract form. The goal sets the direction, not the length of the path. For example, "make the product attractive to users." It should be easy to remember and expressed in a clear, concise language. Finally, the goal should be measurable, so that at the end of the reporting period the company as a whole or its employees can report on its achievement or non-achievement. For this, a set of measurable key indicators (results) is established for each goal, from the totality of which you can determine the level of achievement of the goal. If the goal answers the question "What?" or "Why?" then key metrics provide insight into "How?" and, thus, characterize specific results in the development of the company or its employees. This may require translation of qualitative characteristics into quantitative indicators. Key results not only show specific numbers, but also determine the area in which they were achieved. For example, the goal of "Ensuring Sustainable Growth" includes two key results (KR): a revenue plan (thousand rubles) and a plan for working with clients (people).

Divisions (departments) of the company should have a number of full levers of influence on the achievement of the established results. This means either the presence of all necessary competencies, or the opportunity to get them in a short time. If a situation arises when the results of the work of one division (department) of an enterprise depend too much on the achievement of results by another department, then this increases the risk of not achieving the goal. In this case, the development of a contingency plan is recommended.

The goals of departments and divisions do not follow directly from the goals of the company, but affect them in the long run. For example, the goal of "Accelerating the delivery of products to the final consumer" [2] does not follow directly from the company's goal of "Occupying a certain market share", but has a strategic impact on the final result.

Key results describe the task to be solved, but do not determine specific ways to solve it. This gives the company employees the opportunity to maneuver in making tactical decisions. Developers of the OKR methodology recommend creating no more than 5 goals for the planning period and no more than 4 key results for each goal.

A key feature of this methodology is that planned goals must be elusive. If the goals are 100% achieved, they are considered insufficiently ambitious, and this should be taken into account when planning for the next period. Optimal is the achievement of 60-75% of the results for each goal. Thus, from the very beginning, OKR motivates employees to a bolder approach to planning. Such an approach can contribute to the growth of

competencies associated with the disclosure of the creative potential of employees, a flexible approach to decision making and a constant orientation towards achieving the goal. As a result, OKR affects the development of the human capital of the company as a whole and the professional competencies of each employee.

Another feature of the methodology that distinguishes it from KPI (key performance indicators) and similar methods for measuring effectiveness is that OKR is not intended to be used as a criterion for evaluating employee performance. [4] Employees should not be afraid of failure to fulfill complex goals due to expected punishment or non-receipt of remuneration. Thus, an important principle of the methodology is to distance OKR results from financial motivation, although this contradicts the usual planning approach. As soon as there is a direct correlation between achieving the goal and the amount of remuneration, the system gets out of control, there is competition between employees, suspicions, and a favorable climate is violated. This does not mean that there should be no bonuses. They simply should not directly depend on the achievement of goals.

The OKR methodology provides for the decomposition of goals from the corporate level to a specific employee. This allows you to coordinate the work of individual specialists and company departments in one direction. OKR involves the distribution of goals at three levels: the company as a whole; department or unit; individual employee [3]. But, as practice shows, some companies refuse to set goals at the employee level and are limited only to goals for departments and the company as a whole. This is due to the difficulty of decomposing goals at the level of individual employees in the cross-functional department. If the task is to distribute the goal in the division (department) and express the percentage of each employee, this may contradict the functional tasks of the employees (for example, how to split the goal of “Obtaining a certain market share” among the employees of the programming and software development department, where the results of each are difficult to measure individually). In a monofunctional unit of a company (for example, a sales department), this can lead to internal competition among employees.

In addition, setting a goal for a specific project for each employee limits their activities and does not allow changing the topic of the project if it loses its relevance in the implementation process.

It would also be wrong to mean by personal OKR a personal development plan for each employee. This, too, is a deviation from the methodology and may lead to a shift in the focus of attention of employees to achieving personal goals [2].

The degree of specificity of goals and indicators at each level is different, although their consistency is necessary to achieve the general goals of the company. Adjustment of annual goals is allowed at the end of each quarter, but changes in quarterly goals are undesirable.

Another limitation is how exactly the common goals and indicators are formulated. Unlike traditional planning, more than half of the goals should be formulated “bottom-up” - at meetings of several departments of the company working on the same project. This rule is based on the fact that each employee understands his area of responsibility and knows the problems of end users of goods or services.

And another important principle is transparency. Each department of the company must clearly understand not only its goals and results, but also the similar indicators of other departments or divisions.

The formulation process can include several iterations, therefore, department employees can discuss everything and get a clear idea of further coordination of work. On average, this work takes from 2 to 4 weeks per quarter. It is important that the overall rhythm of setting up the OKR is respected. This ensures the transparency of processes and synchronization between divisions of the company and does not allow the process to stretch in time.

At the beginning of OKR development, it is necessary to determine the place of each unit in the structure of the company and understand what goals it needs to achieve in the long term. There are a number of tools that can help with this. For example, to determine the mission of the unit, that is, to formulate a simple, but if possible comprehensive definition of the main goal of his work for the future. It is also important to formulate the long-term directions of the unit. These may be quite general formulations, but their task is to help understand how the main goal can be achieved. Without this, it is difficult to imagine how the work of a certain unit corresponds to a specific direction of the company’s business. A unit may be effective internally, but may be of little use to achieve the overall goal of the company.

You should not try to carefully observe all the described requirements and rules. OKR is a flexible system involving compromise decisions at all stages. You must also understand that it takes time to create and adapt a system to a specific business. Usually it takes from 3 months to a year [2].

The OKR methodology does not have to describe absolutely all the processes that occur in a particular division of the company. You can choose only processes aimed at adding new value, and do not use operational activities.

The uniqueness of the OKR methodology is that any result obtained during its work can be useful. If the results are, at first glance, unfavorable, it is necessary to analyze the significance of the goal, identify its relevance to the result, and then decide on the formulation of a new goal, or abandonment of this goal.

Conclusion

The conducted studies allow us to conclude that the application of the OKR methodology is possible in the practical activities of enterprises and companies in various sectors of the economy. It will allow to achieve a number of positive effects in their activities, namely:

ensure the adoption of comprehensively informed decisions at all levels of company management;

2) increase the transparency of communication between company departments in the planning and implementation of projects;

3) ensure the development of human capital of the company as a whole by improving the quality of professional competencies of each employee;

4) increase the coherence of the work of all divisions of the company in terms of achieving the common goal of its strategic development, determined using the OKR methodology.

Acknowledgments.

The reported study was funded by RFBR, project number 19-29-07168mk.

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A STUDY OF THE SYSTEMIC RELATIONSHIPS OF STAFF TURNOVER IN EDUCATIONAL INSTITUTIONS WITH THE DEVELOPMENT OF INTELLECTUAL CAPITAL IN THE REGIONS

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Abstract. This article explores the reasons for the turnover of teaching staff, shows the relationship between the dynamics of staff movement and the deterioration in the quality of training of students. The novelty of the study lies in the fact that with the help of a tripartite approach, a systematic relationship of educational processes with the formation of intellectual capital of the regions is shown. A causal relationship has been established between the turnover of young high school teachers and the formation of the intellectual potential of the regions.

Empirical basis: a set of documents reflecting staff turnover in state educational institutions.

Research methods: theoretical review and synthesis of scientific data, analysis of statistical data. When processing the results, methods of mathematical statistics were used.

The result of the study is establishment of a direct relationship between the turnover of young secondary school teachers and the formation of intellectual capital in the regions.

The study is of great practical importance for managerial practice in the formation and adjustment of measures aimed at reducing staff turnover, in particular, state educational institutions.

Keywords: staff turnover, education, human resources, region, intellectual capital.

Over the past few years, the problem of the turnover of young teachers has been of great interest to researchers. In any organization, the negative consequence of staff turnover is a decrease in the economic and social ef-

ficiency of its activities [6]. However, in the case of educational institutions, the factor of the formation of the future intellectual potential of the region by teachers [2] becomes significant.

The aim of the study is to use the example of secondary schools to analyze the main factors that provoke high turnover of teaching staff and substantiate the systematic relationship between staff turnover and the formation of the region's intellectual potential.

The results of studying this problem over many years and finding the main source of high turnover of teachers, as well as the reluctance of young teachers to work at school, became the basis for the application of different methods of managing the situation in Russia: economic - increasing wages and stimulating payments; organizational - improving working conditions; socio-psychological - increasing the prestige of the profession, self-realization and self-affirmation of teachers as participants in various competitions, including "Teacher of the Year", etc. However, this did not bring the desired effect. The shortage of teachers in schools of the Russian Federation is 11%.

Upon dismissal, employees of various organizations name such reasons for staff turnover [2]: poor-quality selection of employees; lack of career progression; incorrect adaptation system; dissatisfaction with the management methods of the organization; low pay; adverse working conditions; dissatisfaction with the psychological atmosphere in the team and others.

HR - portal. ru, regularly conducting surveys of employers to the above reasons adds [7]: dissatisfaction with the profession; mismatch of the scope of work and the level of the position; uncomfortable schedule; dissatisfaction with the social package; location of work relative to place of residence.

The problem of the relationship between the turnover of young teachers and the decline in the quality of intellectual capital in the regions was studied from the perspective of three stakeholders: 1) the administration of the municipality (region); 2) a budgetary educational institution; 3) teachers.

This approach to addressing the problem is caused by internal and external factors affecting the development of the education system. The main regional environmental factors for the school are:

- the overwhelming majority of teachers work in public schools that are under municipal jurisdiction; therefore, the demand for teachers is set by the state depending on the financial capabilities and the demographic situation in the region;

- remuneration is ensured by cash inflows from local budgets, 1st category remuneration is tied to the minimum wage, which has a different value by region (not lower than the federal minimum wage from 1.01.2020 - 12130 rubles). So, for example, in the Kemerovo Oblast from January 1, 2020, the minimum wage is set at 15,769 rubles for budgetary organizations (taking into account the district coefficient) and for commercial organizations and individual entrepreneurs –21471.45 rubles [3], in Moscow - 20195 rubles, in the republic of Khakassia 19408 rubles, in St. Petersburg - 19000 rubles, etc.

Other external factors affecting the functioning of the education system as an employer (budget educational institution) compared with enterprises and organizations of other sectors of the national economy include:

- determination of the number of teachers in schools on the basis of standard school programs, the normative load per teacher and the number of students, which may vary from year to year;

- impact on teachers of the regional labor market. In all federal Okrugs of Russia, school wages are below the average wage in the region. According to the Federal State Statistics Service for 2019, the average nominal wage in Russia amounted to 47,468 rubles, while "education and science" were among the lowest paid groups of mass professions - 26,300 rubles [1]. At the same time, according to the Federal State Statistics Service, seven percent of education workers received less than 11,280 rubles (minimum wage in 2019), and twenty percent received less than 15 thousand rubles a month. A similar situation is developing in the regions of our country. The analysis of indicators by region revealed a trend - the average salary of school teachers is 15-25% lower than the regional average. In the case of young teachers, this gap is much larger. Also, according to a review of the statistics reviewed, we can conclude that the richer the region where the institution is located, the greater the gap between the average salaries of teachers in different territories.

The consequence of the turnover of young teachers is the lost opportunity to form an innovative intellectual potential of the region:

1) from the point of view of the region's economy - the lack of young teachers trained in modern teaching methods will lead to the inadequate formation in school students of the competencies required for the development of the region. According to VTsIOM, 47% of Russian graduates prefer to work in a field that is not related to education, due to low wages and high academic workloads;

2) from the point of view of a budgetary institution - this means excessive spending on staff recruitment and adaptation of employees, disrup-

tions in the educational process, disruption of the transfer of experience to young employees, a decline in the prestige of an educational institution, and a decrease in interest in student learning;

3) from the point of view of the teacher, this is a decline in the moral and psychological mood of a person who has left the desired professional activity, forced to master an unfamiliar profession and build relationships with new colleagues.

As the research base, we have chosen secondary school №35, located in Penza. According to official data presented on the school's website, the number of 1st grade students is growing every year [8]. The teaching staff of the school - 51 people. A qualitative analysis of the teaching staff allows us to speak about a high educational level of the teaching staff: 94% of teachers have higher education and 6% have secondary special education.

The structure of employees by teaching experience is presented in table 1.

Table 1 The structure of employees by teaching experience,%

Indicators	**Indicator values**						
Work experience	up to 1 year	up to 5 years	5-10 years	10-20 years	20-25 years	25-30 years	30 -40 years
Structure, %	9,8	5,9	13,7	9,8	7,8	13,7	39,3

Based on table 1, we can note the uneven presence of people of different ages (more than 50% of teachers over 50) and the aging of the teaching staff. This suggests that the development potential of the institution, which is traditionally associated with the age of workers under 40, is about 30%.

Identical dynamics are observed throughout the country and are confirmed by RANEPA studies. According to their monitoring of effectiveness in Russian schools, 56.6% of teachers have experience of more than 20 years, and only 8.13% of teachers have experience of up to 3 years [5].

Similar information was specified by the former Minister of Education of the Russian Federation, O. Vasilyeva, who indicated that only 5% of young specialists currently work in schools [9]. According to the forecasts of the Russian Ministry of Education, in 10 years the shortage of teachers can reach up to 190 thousand people.

The study identified external and internal motivators that facilitate the decision to leave school. Three groups of reasons are distinguished:

1) internal factors for an educational institution (inadequate workload, unfair pay structure, conflicts);

2) personality factors (dissatisfaction with working conditions, conflicts);

3) factors external to the educational institution (wage rates, uncompetitive with regional average).

Against the background of the identified causes of staff turnover due to external and internal factors, the quality of knowledge received by students demonstrates a downward trend. The quality of knowledge is understood as the correspondence of learning objectives to their results. The quality of knowledge is evaluated in accordance with a set of criteria established in pedagogical practice, for example, completeness, depth, systematic, systematic, awareness of the application of knowledge and others. Table 2 presents the results of the analysis of student performance over the past 5 years [8].

Table 2 The quality of students' knowledge on the stages of school education

Stages of education	Years					
	2014	2015	2016	2017	2018	2019
Primary school	59,1	61,1	56,3	57,1	60,2	55
Middle school	34,8	37,9	34,6	32,4	29,8	30
High school	23,6	46,4	27,1	41,1	33,3	28,3
Around school	43	47,8	42	42	41,2	38

Based on table 2, we can conclude that over the past 5 years (from 2015 to 2019), the quality of knowledge has fallen: - in primary school - by 10%; - in middle school - by 20.8%; - in high school - by 39%; - the average for the school is 20.5%.

Table 3 presents the dynamics of the average exam score for core subjects of 2019 compared to 2018, which also has a downward trend.

Table 3 Dynamics of the average USE score compared to 2018

Mathematics (core.)	Russian language	Social science	Informatics and ICT	Physics	Chemistry
-1,03	-4	-7	-1,63	+2,6	+1,5

Negative dynamics is observed in continuing education after the 9th grade - an ever smaller number of students extend their education in the 10th grade of the school and choose institutions of secondary vocational education (SVE).

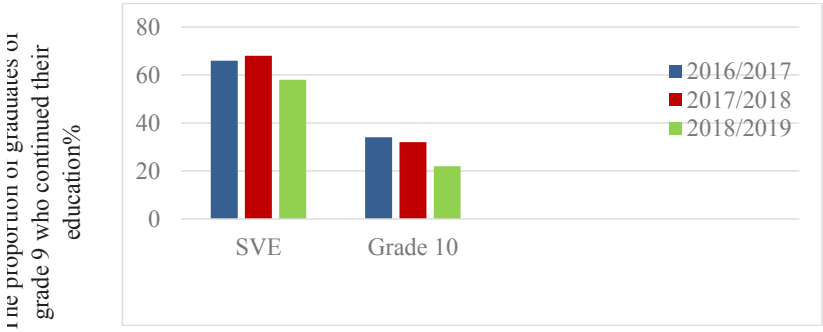

Figure 1 - Dynamics of the proportion of graduates who continued their studies after grade 9

The graph shown in Figure 1 shows that if in 2016 more than 30% of graduates continued to study in the 10th grade, then in the 2018/2019 academic year, only 20%.

In this school, according to the all-Russian trend, the proportion of ninth-graders who continue to study in secondary school continues to decline, and the percentage of those who choose to study in the SVE system for training programs for middle managers continues to increase.

Also, a smaller number of 11th grade graduates enter higher education institutions. Figure 2 shows the trends in the choice of an educational institution after the end of 11 classes, which shows that about 10% of graduates of the 2018/2019 academic year chose SVE.

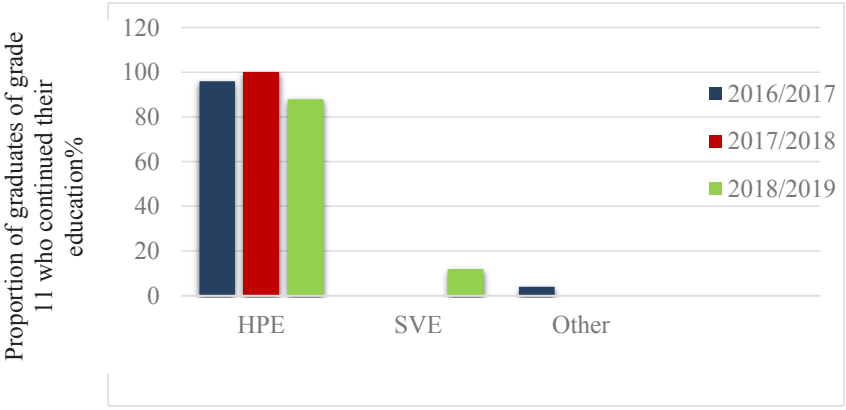

Figure 2 - Dynamics of the proportion of graduates who continued their studies after grade 11 in various educational institutions

As can be seen from Figure 2, a fairly new tendency has formed for our society, when 11th grade graduates enter schools for secondary vocational education.

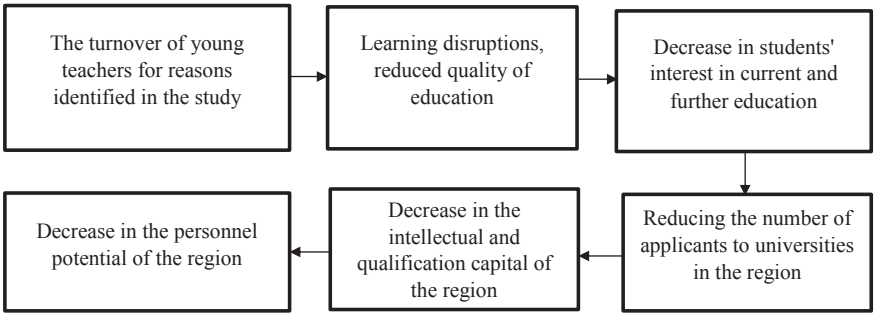

Figure 3 - Causal relationship between the processes of staff turnover of young high school teachers and the formation of the intellectual potential of the region

Note: developed by the authors

Thus, a causal relationship between the turnover of young secondary school teachers (similarly to secondary vocational education and higher education teachers) and the region's intellectual potential is presented in Figure 3.

And at the present stage, for the development of an innovative economy, the regions really need high-quality intellectual resources:

- scientific and engineering personnel trained in the field of inventive and innovative activities;
- specialists trained in economics and management (innovation management);
- personnel with knowledge in the field of security and protection of the results of intellectual activity.

The analysis revealed a systemic relationship between the processes taking place in the educational system and the formation of the personnel potential of the region. Such a relationship is shown in Figure 4.

As a result of the study of systemic connections, it was found that there is a direct correlation between the turnover of young high school teachers and the formation of the region's intellectual potential.

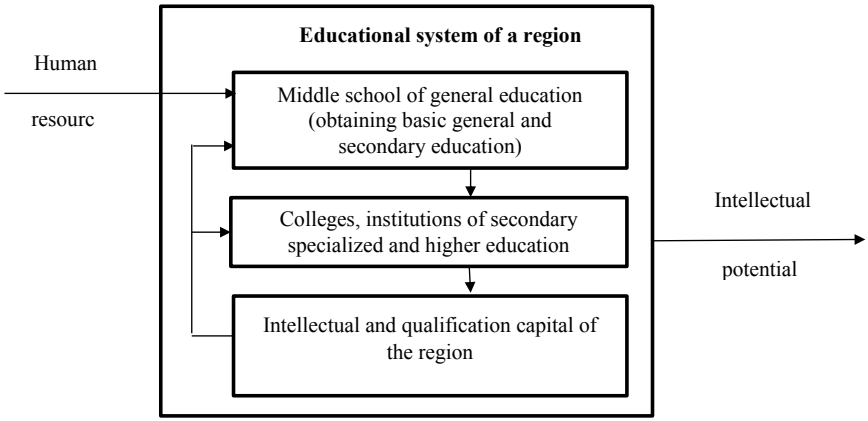

Figure 4 - System connection of educational processes with the formation of the personnel potential of the region

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CURRENT PROBLEMS OF WORK WITH THE TALENT POOL

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Abstract. At present, the work on planning, forming and developing a talent pool is an indispensable tool for the survival of a company in a competitive environment, as well as a possible resource that, with the right approach, can lead an organization to market leadership. The article analyzes the current problems of working with the personnel reserve and suggests options for solving them based on the experience of the most successful International Corporations.

Keywords: Personnel Management. Personnel reserve. Staff development. HR work.

Currently, interest in the personnel reserve has resumed due to fierce competition for qualified personnel. Companies are aware of the shortage of experienced executives and specialists firsthand.

There is no doubt that in each company it is necessary to allocate and further encourage the most valuable and effective employees. There are employees who hold the whole lines of activity and the work of departments, and there are those who accompany their activities, and the replacement of which is unlikely to be noticeable. We will turn our attention to the category of valuable and highly effective employees of the company.

The main goals of creating a personnel reserve, as a rule, are:

- Meeting the needs of the business in qualified personnel;
- Decrease in staff turnover (more precisely, the turnover of the most valuable employees);
- Increasing the motivation of professional activity;
- Creation of conditions for professional and career growth of the best employees.

Also, some leaders want to achieve continuity, i.e. preservation of experience, leadership style, values, etc. in the team with the help of the personnel reserve [3].

Next, we consider the current problems of working with personnel reserve and ways to solve them.

1) Hiring an external candidate for a vacant position is 6 times more expensive than training an employee within the company, but employers still resort to searching.

Attracting an external candidate for a vacant position is 6 times more expensive than training an employee within the company. If we are talking about replacing a highly efficient candidate, then the company's losses may amount to several of his annual salaries. At the same time, with the introduction of an effective talent management strategy, company profits increase by an average of 26%, according to a study by Bersin & Associates [6].

These statistics confirm the validity of the implementation of programs to work with the personnel reserve or successors in most modern companies. However, these programs do not always show high performance.

2) Underestimation of the problem

From the outside it may seem that the task of creating a list of successors for key positions is not difficult: it is necessary to select and train promising candidates for each significant position, and they will be motivated by inclusion in the career promotion program - “career elevators”, “routes”, "talent pools", programs for employees with high potential (HiPo).

In fact, HR departments are faced with a number of factors that reduce the effectiveness of such programs. The main one is due to the fact that not all companies get into the personnel reserve as a result guarantees a high position. This inevitably leads to the transfer of reservists to other employers.

According to Forbes Magazine, if the rate of appointments from human resources does not exceed 65-70%, then employees lose confidence in the program. They are ready to wait 3-5 years "on the bench" if promises of career growth will be proved in practice. If this does not happen, they understand that the expectations and efforts are not in line with the company's intentions.

The conclusion is obvious: they are looking for a higher position from another employer. On the other hand, what is the level of trust of top management in training programs for successors, reservists or HiPo? 80% of customers have such resources, but apply to select alternative external

candidates for key positions, because they are not sure of their quality, according to the Recruitment Agency "Contact" (InterSearch Russia). At the very least, they make a request for mapping - comparing the profiles of external candidates with internal ones for compliance with the requirements of the vacancy [5].

It turns out that the internal and external candidates have equal chances. So, why are real job vacancies in the company not from among the participants in development programs?

3) Inoperative tool

• The problem arises from the lack of communication between reservists and top management. A long acquaintance, the recommendations of trusted employees, acquaintances or external professionals - a common criterion for deciding on a serious appointment.

• It happens that management never encountered candidates who were prepared for them by the HR department for many years. When it comes time to make a choice, there is simply not enough information to make a decision.

• Often, management's expectations of a new appointment do not match the profile in which the reservist is being trained. When time comes to appoint a new person for a specific position, the HR specialist offers his reservist, and the manager declares that he needs a completely different person with other functions, knowledge, personal qualities. This is the problem of the general request for the preparation of the internal reserve: without specifying the tasks, competencies, expectations and other significant factors.

• In rapidly changing conditions, in dynamically developing companies, many profiles for the preparation of the reserve cease to meet the objectives of the vacancy. Their updating, revision is required.

• The potential of candidates initially selected for the program requires an annual assessment. For several years, it may open differently or not open at all. Thus, this list requires an annual review [4].

Options for resolving personnel reserve problems

1. Collaboration

When developing a vacancy profile, work only with “qualified orders”, that is, with those that were developed jointly with the CEO and other senior management taking into account the company's promising tasks.

A qualified order cannot be limited to a simple assignment to find candidates for a position; it must more accurately describe what specific competencies are needed and what is expected from a candidate.

For example, the personnel reserve in large US financial companies is structured as follows: 3-5 candidates are determined for each of the approximately 100 top positions. To do this, the central office sends to the structural units of the corporation a list of information that it would like to receive about the staff. The head of the unit prepares the necessary package, which is then discussed by the management of the unit and the corporation [5].

This process is called the “Managers Review”. Its informative base is: a review of a business strategy, an assessment of existing and planned needs and resources, an introduction of the most talented employees, and a plan for personnel changes. Top managers of the corporation create their own reports on their vision of the problem.

2. Qualitative selection

It is important to initially be more demanding of candidates for the reserve. Particular attention should be paid to communications with applicants at the selection stage.

Initially, it is important to assess a person’s motivation, how much he is ready to invest in himself. As a rule, people who understand that they need to develop know very well in which areas they have gaps. For them, focusing on relevant learning becomes an opportunity, not a burden. If a person is not motivated initially, then there is no reason to force him.

3. Personnel committees

It is very important to ensure communication between top management and reservists. The HR department needs to introduce the reservist to the management, and it is better to provide the opportunity to look at the candidate in action - in the work on the project.

For companies that implement the so-called production system, an effective tool is to attract reservists to improvement projects with the subsequent presentation of these projects to top management. Thus, the leadership can see reservists in solving specific problems and form their opinion about them. [2]

Such a system, as a rule, is built through Personnel Committees. For example, it works in some large international insurance companies. Personnel committees have a two-level system: a second-level committee approves candidates for the positions of CEO-3 (a position three levels lower than the general director), a first-level committee that includes members of the board, CEO-2 (a position two levels lower than the general director). As soon as the leadership began to participate in the approval of the list of reservists, the composition of the personnel reserve became more qualitative and realistic for further advancement.

4. Focus on the strong

The personnel reserve is no less effective than well-designed career routes, which involve preparing candidates for the specific requirements of the position, require a lot of administration and narrow down the search for applicants for the required vacancy.

At the same time, the formation of the Talent Pool takes place according to many skills and competencies, which then allows using an automated system to make a selection of people according to very narrow criteria. The Talent Pool system allows you to quickly make a list of people who have the necessary skills for the vacancy. This is especially important for companies with frequently changing job titles.

At Motorola, according to a study by Forbes Magazine, there is a “group of talented employees,” which includes about 20% of all employees in the company. An individual development plan is created for each member of the group, which is initially developed with the participation of the candidate himself: the possibilities and conditions of his career movements are being worked out. The issues of internal movements in the company are handled by a specially created Global Rotation Center [5].

A feature of working with Talent Pool is the focus on the strengths of the candidates and their development, which later will help them in their new position.

5. Automated systems

Progress has gone a long way, but the practice of transferring information about employees between managers and HR specialists on word of mouth is still used even in leading companies.

With more than a thousand employees, the HR department simply cannot know everyone by sight. Automated systems make it possible to evaluate such important qualities as the employee’s potential, his professionalism and effectiveness in digital terms, and even rate candidates. This data is much more convenient to manipulate before management.

Systems can store a large number of profiles, and thereby significantly expand the funnel for the selection of potential employees. For large companies, this trivially reduces labor costs for data processing and allows you to highlight those promising employees who were not visible or who were "put away" so that they did not replace their boss.

It is recommended to formulate such a personnel reserve plan, which includes employees who are ready to advance “now”, “in 2-4 years” and in the future (up to 10 years). A detailed review of the plan is carried out every two years with an annual update of the basic information.

A multidisciplinary information system is used to efficiently work with such a volume of information and to visualize the various possibilities of occupying posts, which allows automating most routine processes.

6. New employees

In general, it is optimal for the effectiveness of internal reserve management programs if 80% of vacancies are closed due to the promotion and rotation of the personnel reserve within the organization and 20% due to the attraction of new employees from the labor market [6].

This ratio allows you to maintain corporate values and knowledge, and at the same time, provides an "infusion of fresh blood." However, such a performance of the personnel reserve programs can be achieved after several years of debugging processes. Demanding immediate success from the HR department 1-2 years after the start of work is unrealistic.

Planning for work with a personnel reserve is a process that requires considerable attention and enormous resources from HR specialists and the head of the company.

If the organization can spare time and money for this, then it is prepared for a sharp loss of key specialists and can more effectively achieve its goals. Companies with such experience conduct training of personnel reserve constantly, and not occasionally.

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THE INFLUENCE OF INTERNAL AND EXTERNAL FACTORS ON TRENDS OF THE SOCIO-ECONOMIC DEVELOPMENT OF THE RUSSIAN FEDERATION

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Abstract. Socio-economic transformations in Russia, their positive and negative trends are an important issue not only for the scientific community and authorities, but also for the entire population. Understanding exactly which factors have the greatest influence on improving the socio-economic situation in the country and the formation of accurate forecasts, allows not only to adapt, but also to find a number of advantages from the current situation within the state. The set of the advantages presented makes it possible not only to maintain a stable socio-economic situation within the country, which is undoubtedly important for its citizens, but also to attract foreign investors, which are an important source of stimulating the growth of the Russian economy. In this regard, the determination of the most significant factors affecting the trends of the socio-economic development of the Russian Federation is an extremely urgent problem.

Methods. Mathematical modeling, correlation and regression analysis.

Expected results. While analyzing the trends of the socio-economic development of the Russian Federation, it is necessary to consider a set of factors affecting these processes. There are many concepts for classifying these factors, however, for clarity, the most general typology was selected, which divides the entire population into 5 large groups: internal supply and demand factors, external supply and demand factors and other factors (which, for example, include changes in the legislative framework) [1]. The expected result of this work is to identify the most significant combination of factors that have the greatest impact on the socio-economic development of Russia.

The practical significance of the work. The results obtained in this article can help to adjust the economic policy of the Russian Federation by focusing primarily on those factors that have the greatest influence on shaping the stability of economic development. In addition, the study allows to study in detail how much, in fact, it is the internal factors that significantly affect the development of the economy in Russia.

Keywords: socio-economic development, factors of economic growth, Russian Federation.

During the analysis of the influence of factors of all five groups on the socio-economic development of the Russian Federation, the study was divided into two stages.

First of all, on the basis of the correlation analysis, one, the most statistically significant indicator was selected in each group, the influence of which on the resulting indicator - GDP per capita - has the most significant and determining effect.

As the result, the following factors were selected as the most significant:

- For a group of internal demand factors - government spending;
- For a group of internal supply factors, domestic investment in fixed assets;
- For a group of external demand factors, world prices for raw materials (oil);
- For a group of external supply factors, an inflow of financial resources from abroad (foreign direct investment in the Russian Federation).

At the second stage of the study, a regression analysis was carried out to identify the relationship between individual factors and gross domestic product per capita, which was taken as a universal comparison indicator characterizing the level of socio-economic development of Russia.

The results of the study are presented in graphs that allow to describe the data using the constraint equation (Figures 1-4).

The first to be analyzed was the internal demand factor. The dynamics of government spending in the period from 1999 to 2019 was very unstable, due to the many difficulties and shocks of the Russian economy, especially in 2008 and 2014. However, despite this fact, there is a strong positive correlation between this indicator and the value of GDP per capita (with a determination coefficient of 0.89). The dispersion of values in recent years can be explained by both the imposed sanctions and the domestic political factors, which requires significant adjustment. But the general trend allows to predict the nearest future, taking into account the amendments to the current situation.

The next indicator considered was the internal factor of supply, which demonstrated the best results of the interconnection.

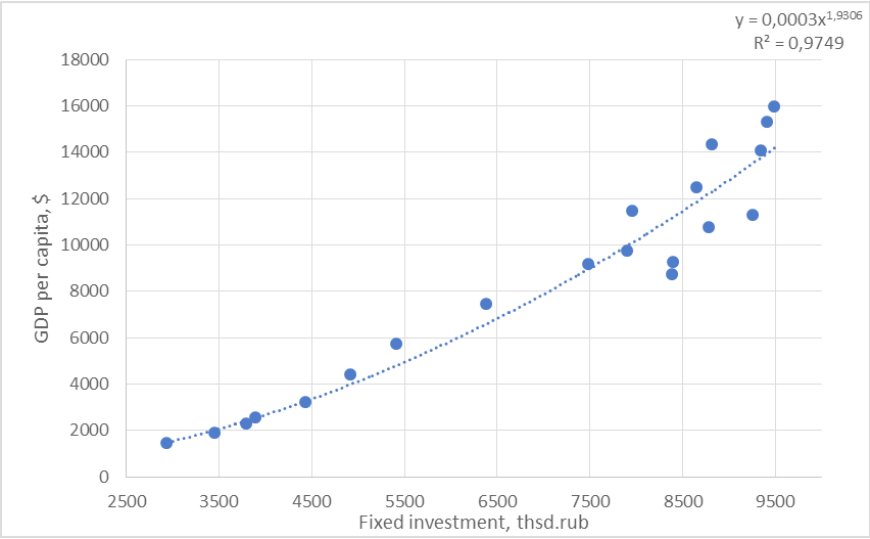

Figure 2. The interconnection between fixed investment and GDP per capita [3]

Over the same period of 20 years, the rate of investment in fixed assets has also been very unstable. However, we can certainly note its strongest influence on GDP per capita, and therefore on the socio-economic development of the Russian Federation as a whole (with a determination coefficient of 0.98, it can be claimed that the constraint equation is significant in the considerable model). Thus, internal supply factors have the greatest impact on the level of socio-economic development in Russia. This group of factors, in addition to the considered indicator of investments in fixed assets, also includes an increase in the money supply (that is, expansionary monetary policy of the Central Bank of the Russian Federation).

The next indicator was the external demand factor - the average world oil prices at the end of the year (for convenience of comparison with the data of GDP per capita).

As expected initially, the fact of a significant dependence of Russia on oil prices on the world markets was confirmed. However, although there is a strong correlation between the indicators (the determination coefficient is 0.88), this dependence is still slightly less than between the internal factors, both of supply and demand.

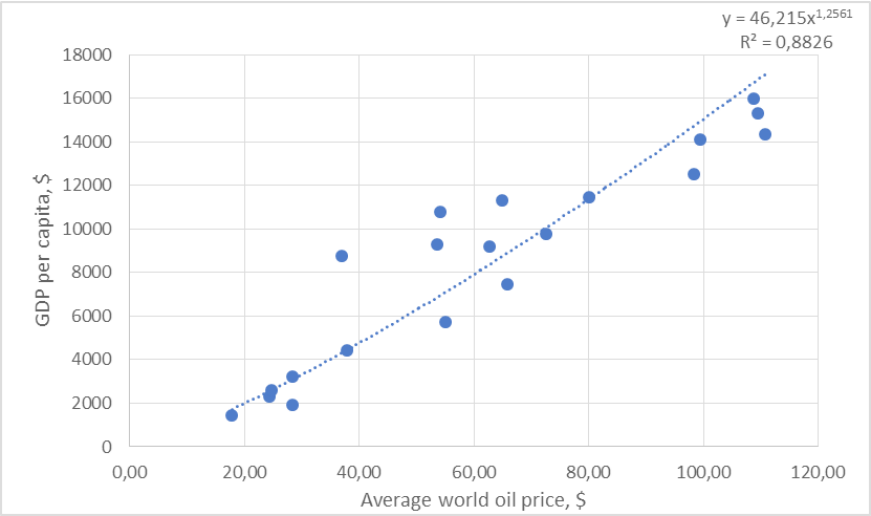

Figure 3. The interconnection between average world oil price and GDP per capita [4]

The last group of indicators analyzed was external supply factors, presented in the form of direct foreign investment in the Russian Federation as a whole in various sectors of the economy.

This group shows the least impact on the level of socio-economic development in Russia. The randomness of this factor can be characterized by the largest outliers. However, it cannot be ignored and excluded from the study. It should be noted that a comprehensive analysis is required to build a multifactor model, which will be the next stage of the study.

At this stage, it should be mentioned and characterized that the internal factors are supposed to be significant enough, so there is a need for their detailed study. In addition, the direction of the change in the dependences makes it possible to identify a linear relationship in a multivariate model.

The fifth group, called “other factors”, includes various qualitative indicators that are difficult to quantify. To assess them, a correlation and regression analysis was carried out, during which the combined influence of the four groups listed above was comparable to a determination coefficient of 0.996, which indicates a very insignificant effect of other factors on the indicator in question. However, the demographic factor and its significance in the considered model should be taken into account. A significant part of this factor is labor resources and their potential, quality, which is also determined by high technology.

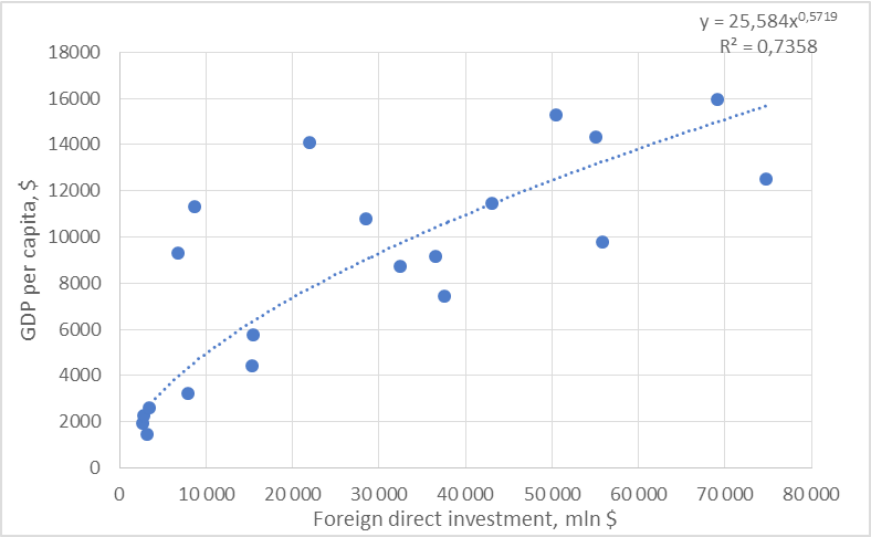

Figure 4. The interconnection between foreign direct investment and GDP per capita [5]

As a result of multivariate analysis, the hypothesis of linear regression of the main indicator from the considered factors was confirmed. On the graph (Figure 5) it is clearly seen that the dynamics of the actual and estimated values of the effective indicator coincides.

The regression equation has the following form:

$$y = -768{,}924 + 0{,}322 \cdot G + 0{,}035 \cdot I_f + 91{,}966 \cdot Pw + 0{,}0245 \cdot FDI,$$

with determination coefficient $R^2 = 0{,}996277664$

The regressors in this equation are: G - government spending of the Russian Federation per year, I_f - investment in fixed assets, Pw - average world oil price, FDI - foreign direct investment in Russia.

All coefficients in the equation are significant and positive, and oil prices, as expected, have the maximum contribution to the resulting indicator. Thus, we can conclude that the obtained model is adequate, which allows to use it in further forecasting the GDP per capita.

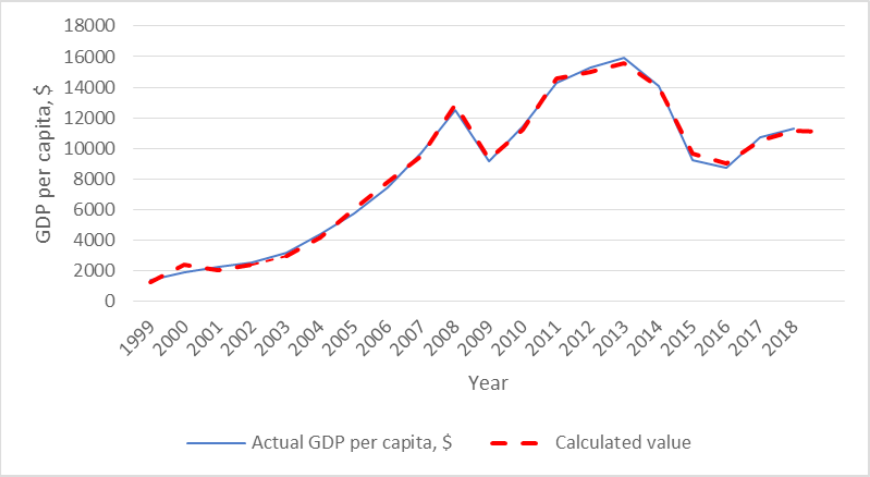

Figure 5. The ratio of actual and calculated values in the period from 1999 to 2019

Based on the study, we can conclude that all the selected factors really have a significant impact on the level of socio-economic development of Russia. However, it can be noted that internal factors, contrary to popular belief, have more significant impact on economic growth in the country. Internal factors were considered as the most significant. A linear trend is noticed in the multifactor model.

In conclusion, it can be claimed that while implementing the socio-economic policy of the Russian Federation, the greatest attention should be paid to internal factors, in particular to investments in fixed assets of Russian enterprises with significant potential.

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THE MAIN TRENDS OF DEVELOPMENT OF MECHANICAL ENGINEERING IN MODERN RUSSIA

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Abstract. The authors emphasize the system-forming role of the machine-building complex in the national economy, the changes in specific weight of mechanical engineering in Russia, as well as its structure and main industries and also the key problems of mechanical engineering that do not allow it to implement innovative functions fully. The author argues for the need to modernize this industry as soon as possible, which will accelerate the pace and improve the quality of Russia's socio-economic development.

Keywords: mechanical engineering, machine-building complex, basic production assets, technological paradigm, sectoral structure, modernization of production.

In accordance with the canons of economic science, mechanical engineering is the foundation of industry in any developed country. This thesis is based on the following indisputable fact: the main tools of labor are created within the framework of mechanical engineering. This fact directly affects the direction and pace of scientific and technological progress in other sectors of the economy. This also affects the increase in labor productivity and other key indicators that determine the effectiveness of the economic development [1]. Russia is no exception. The state of domestic engineering is the most important factor in the reproduction of the national economy, determines the basic economic proportions, and, therefore, the level of national security of Russia.

That's why the high theoretical and practical significance of research in this field is undeniable. First of all it should be noted that mechanical engineering in its modern form includes a large number of specialized industries. In this regard, the studied segment of the national economy is considered as an intersectoral complex. In this context it seems justified to use the term "machine-building complex", which accounts for 22.2% of the total structure of Russian industry [2].

This indicator should be considered in a dynamic aspect. Analysis from these positions allows us to make the following conclusion: the ratio of various industries in the structure of domestic industry for the period from 1992 to the present has not remained unchanged. At the same time the share of the machine – building complex decreased by 6.7%, while other segments increased their share: the fuel industry – by 22%, non – ferrous metallurgy – by 22.4%, food production - by 6%, oil and chemical industry - by 12.5% [2]. As a conclusion: machine-building complex, on the one hand, has retained its fundamental importance; on the other hand, its share in the structure of industry has decreased, which is evidence of serious negative trends.

In this context it is necessary to highlight the structure of the machine-building complex as a combination of a number of specialized industries that are similar in terms of using raw materials, technologies and methods of production process. As a rule, the structure of this complex includes 12 major industries, more than 100 sub-sectors and specialized industries. The main ones are electrical industry, transport, heavy and power engineering, tool and machine tool industry, chemical and petroleum engineering, engineering for food and light industry, agricultural and tractor engineering.

Another approach to the structure of the machine-building complex is associated with the allocation of two enlarged clusters – metalworking and mechanical engineering. The first of them includes the industry of metal products and constructions, repair of equipment and machinery. The role of this cluster is importance but it has a subordinate role in relation to others. As an argument: the share of the machine-building cluster in Russia is about 1/5 of total industrial production, 1/4 of the main production assets (OPF) and 1/3 of the industrial production staff [3]. The range of manufactured engineering products is variety because a deep differentiation of machine-building industries, which has a great impact on the location of production. Thus, there is no doubt that the cluster of mechanical engineering is a multidisciplinary and specialized component of the machine-building complex.

Another important aspect of the research is related to the significant innovative functions of this complex, which is objectively due to the key role in the production process. According to the criteria of technical equipment

degree there are 5 levels of technological structure in the structure of this complex [4].

In this approach the first level is represented by the production of equipment for enterprises that process primary raw materials and materials for the mining industry. The second level involves the production of equipment for the agricultural sector. The third level covers the production of building material, production of equipment for non-ferrous and ferrous metallurgy. The fourth level of technological structure includes electrical engineering, automotive and bearing industry, and so on. The fifth level is formed by economic entities that are associated with high technologies: fiber-optic technology, computer production, production of equipment and machines with numerical control, the aviation industry, and space and rocket production.

There is no doubt that the increase the production of the fourth and fifth technological structures will allow implement the innovative function of the national economic segment. However, this positive trend is hindered by a set of destructive factors, some of them have already reached the level of crisis phenomena. These include [5]:

- disproportions in the structure of industry and an increase the share of raw materials production;
- rupture of cooperation in production and sales of machine building products as a result of the collapse of the Soviet Union;
- deep financial crisis in the Russian Federation and neighboring countries, which are the main consumers of domestic engineering products;
- severe competition in the global arms market, economic and political pressure on the Russian Federation as a key participant of this market and problems with the sale of Russian engineering products as a result;
- loss of market positions by a lot of representatives of the Russian machine building industry in international markets (machine tool, automobile, aircraft, etc.).

Unfortunately, it is not yet possible to talk about changing the vector of negative trends. There were no significant positive changes in the Russian machine-building industry during the period of economic reforms. Moreover, it was primarily affected by the harmful effects of deindustrialization of the economy. Thus, over the past 10 years, the fifth-level engineering industries focused on the production of high-tech products have reduced output from 45.3 to 27.5%. During this period, the production of high-tech high-performance equipment has decreased tenfold, and in some positions – even ten times. Also, the production of progressive cutting tools has decreased significantly, primarily from abrasive micro-powders, super-hard materials and polycrystalline synthetic diamonds, ceramics, etc. At the same time,

the share of lower-level, fourth-level production (bearing and automotive) increased from 16.8% to 32.3% over the same period. The growth of the share of machinery and equipment repair (from 8.5 to 14% over the past 10 years) is an evidence of financial crisis growing so economic entities can only maintain an aging fleet of equipment in working condition [5].

Another negative trend is associated with the fact that no more than 10-15% of capacity has been used in mechanical engineering over the past decades. We are talking about morally and physically outdated fixed assets, a significant part of them existed at the beginning of the 90s, and, therefore, they do not apply the high requirements of high-tech technologies. There are other symptoms such as lack of demand for a large number of modern Russian technological developments which help to produce an equipment with high material, energy and labor - saving characteristics [6]. At the same time these technologies ensure a reduction in the amount of raw materials, fuel, and human resources consumed, which allow Russian manufacturers set prices as similar as world prices. Thus it can be concluded that the domestic engineering industry is not able to implement the requirements of global and internal markets.

Based on the well-known fact that Russia has the largest territory in the world and included more than 80 federal subjects, it should be useful to pay attention to the regional aspects of the problems. Mechanical engineering plays an important role at the sub-federal level. At the same time, there is a serious variation in indicators: for example, the range the share of industry in the regional gross product is from 7.7 to 38.2%. The highest level of engineering development is in the North-Western, Volga and Central Federal districts.

The location of machine-building enterprises is not so dependent on natural factors, but the availability of water and other natural resources. The main factors of placement of industry enterprises are: proximity of consumers; availability of labor in the territory; high labor and scientific and technical potential; cooperation and specialization of production. A characteristic feature of mechanical engineering is the significant role of the consumer factor, which largely determines the location of production. Another specific characteristic of the machine-building complex is a high degree of specialization of production, which means the concentration of production of a single product (or a part of it), or on performing only a few operations in its manufacture. The specialization is appear both in the isolation of industries and productions, and in a clear division of labor between some economic entities in the same industry. For example, the automotive industry is directly represented by the production of vehicles,

trolleybuses and buses. Thus, specialization is traditionally the main direction of intensification of machine-building production [5]. It combines new opportunities for using of high-performance technological equipment, robotics, and automation of production processes, which contributes to increasing labor productivity, as well as increasing the efficiency of production development. As an example, the Kama automobile complex includes 6 large specialized factories: foundry; repair and tool; press-frame; diesel; car assembly; forging-press. These plants are equipped with technological equipment that helps quickly switch from the production of some types of vehicles to others without additional costs. It should be noted that the specialization of industrial production has directly led to extensive links in the cooperative supply of products between economic entities of different sectors such as chemical, metallurgical, textile and other industries. Cooperation indicates the participation of several economic entities in the production process at once, each of them performs a specific technological operation.

The pace of development of mechanical engineering has been ahead of the development of the entire industry for a long time. The industries that determine scientific and technological progress (primarily instrument-making, machine-tool construction, electronic and electrical industries) were developing at a rapid pace. In addition to the growth of mechanical engineering output there were also an increasing of creation and production of machine-building products and the introduction of advanced technologies. The largest part of products of automation tools and samples of new types of machines commensurate with the best Russian and foreign standards and some of them even exceed this level.

Nevertheless, some changes in the development of machine-building industry is not crucial. Scientific and technical base of production failed to meet the standards of a public production. The share of equipment operated for more than 10-15 years is high (for comparison, this indicator is 6-8 years in Japanese machine-building enterprises, and 10 -12 years in European countries). In this regard we can make a conclusion: it is required a large-scale reconstruction of machine-building enterprises to accelerate the socio-economic development of the country.

Finally, it is necessary to show a problem of management in organizational and legal sphere. In modern conditions, almost all enterprises of domestic engineering are joint-stock companies. At the same time, it should be noted that changes in property relations did not lead to the expected economic effect. Unfortunately, most of the privatized enterprises in Russia have not yet occurred significant changes in the range, structure and volume

of output. In this regard, it seems reasonable to conclude that there is no significant economic effect from the denationalization of enterprises. But the entry to a new level of production was a strategic goal of the privatization carried out in post-Soviet Russia.

Summarizing the content of the article, it should be emphasized that Russian engineering remains the cornerstone of the national economy. At the same time, the studied complex is characterized by an extremely worn-out material and technical base, an unstable production structure, and a low specific weight of progressive productions. The innovative impact of the machine-building complex on the national industry is small. There is no alternative to a rapid radical reconstruction of the machine-building complex and its key industries, including instrument-making, machine-tool construction, computer engineering, electronic and electrical industries. This is the main task of developing the Russian machine-building complex, which will allow the Russian Federation to assume a high-tech sustainable development strategy. This will create a fundamental opportunity to reduce our country's lag behind the world's leading countries in terms of investment and innovation parameters as quickly as possible. Undoubtedly, all this will have a very positive impact on the pace and quality of Russia's socio-economic development and the level of national security.

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EVALUATION OF THE PROSPECTS OF INNOVATIVE INVESTMENT PROJECTS IN THE ENERGY SECTOR

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Abstract. The article provides theoretical provisions and practical examples of technological forecasting in the context of planning and calculations efficiency indicators for energy enterprises. This method is recommended primarily for innovative projects because of methodological difficulties in predicting the results of the "innovative" component effect when planning innovations.

Keywords: innovation investment projects, technological forecasting, generating companies, obsolescence, energy sector, index method.

The article will consider the role of technological forecasting in planning and calculating indicators of energy enterprises and also examples of such type of forecasting. Technological forecasts (which allow using not only investment, but also innovative characteristics of equipment as a base for analysis and all possible deviations and risks of uncertainty in this case) are all the more relevant because of morally and physically outdated of equipment and other fixed assets.

As practice shows, the main method of assessing the degree of outdate in Russia and especially abroad is an accounting of physical deterioration when comparing the useful life and the working life of assets. In this case

it can be used the “useful life of fixed assets laid down in the calculation of depreciation rates for full recovery” indicator as a “working life of assets” [7, 64]. Using this type of methodology usually leads to a following situation: the depreciation rates becomes much higher than the estimated (normative) depreciation rates; the last one in turn is the basis for carrying out renovation measures at energy enterprises. It seems that the solution to this contradiction should be changing the methodology for assess depreciation rates with appropriate fixing it in the regulatory and methodological documents.

It is important to take into account the following: replacing outdated equipment with completely identical one can not have fundamentally consequences for energy enterprises because of obsolescence in additional to physical depreciation. According to various scientists and researchers (including E.Ametistov, V.Fomina, P.Rogalev, A.Zubkova and others) almost all the condensing heat and power capacity in Russian energy sector is obsolete. This circumstance was emphasized by L.Gitelman who said that “new types of power equipment with higher technical and economic characteristics appear than equipment of similar quality are devalued” [4, 105]. Energy enterprises using equipment with lower technical and economic characteristics lose out in a competitive market. The term “obsolescence” means in this way “the loss of value due to scientific and technological progress and increased productivity” of buildings, structures, machines, automata and other equipment. Thus, “constant revolutions of the means of production” [5, 338], which are increasing along with “the capitalist mode of production” and dictate the necessity of “constant compensation their obsolescence, which occurs long before they physically expire”. In accordance with Karl Marx’s publications these regularities are the basis of modern capitalism, and the rate of scientific and technical progress only accelerates upon change of technological structures in the last hundred years [5, 340].

It appears that obsolescence “is expressed in the wear of equipment before the end of their physical life as a result of puts new products and cost-effective types of equipment on the market” [9, 55]. The rate of retirement due to obsolescence is determined by the pace of technological progress in the industry. Correct assessment of it allows to determine the optimal moment for upgrading or replacing outdated equipment. In relation to distribution and generating power plants “obsolescence” is expressed in significantly higher fuel consumption for electricity generation. Obsolete equipment has worse reliability indicators and less maneuverability than improved units of equipment [9, 57].

Further the authors give a gradation of obsolescence's degrees, which it seems appropriate to take as a basis for further comparisons. Thus, obsolescence show itself in several forms: hidden (occurs at the beginning of development of a new model of equipment); partial (from the beginning of mass production of a new model); full (the main position of the new model in the fleet of existing equipment, when it can be replaced to the park of "obsolete machines"; it is not removed usually in energy sector but transferred to "high operation mode" or to reserve [9, 57].

The amount of obsolescence is determined by the ratio of operating parameters of new and existing equipment: power of the unit of equipment; efficiency; technical resource; share of the unit; environmental characteristics.

The level of obsolescence of a unit of equipment can be calculate using the formula:

$$O_{\%} = \frac{LV}{P_o} * 100\%$$

$$LV = P_o - P_N * \prod_{i=1}^{n} \beta_i$$

where $O_{\%}$ – level of obsolescence of existing equipment, %; LV - loss of value when outdating unit due to obsolescence; P_O, P_N - prices of the old and new units; ßi - a coefficient reflecting the ratio of the operating setting for new and old equipment (ß < 1.0 if new technology is better old; ß > 1.0 when a new technique is worse than the old); $\prod$ - sign of the product; n - the number of considered operational parameters of the equipment for this purpose.

According to V.Fomina it can be allocated two forms of obsolescence: the first type (the production begins to cost less as the result of productivity growth, appears exactly the same equipment at a lower price) and second type (on the market facilities of the same purpose, but with improved technical and economic characteristics. As a result old units of equipment not even fully worn-out prevent the general increase in labor productivity).

Formula for calculating the first type of obsolescence is given below:

$O_1 = RC^{t-1} - RC^t$

where

MO_1 – the amount of first type of obsolescence, RC^{t-1} - replacement cost of the previous revaluation; RC^t - replacement cost of the revaluation at the current moment.

The amount of replacement cost of revaluation at the current moment should be less than the replacement cost for the previous time of revaluation.

Formula for calculating the second type of obsolescence is given below:

$$O_2 = RC_0 - RC_1 * \frac{G_0 * T_0}{G_1 * T_1}$$

where

MO_2 – the amount of second type of moral obsolescence, RC_0 - replacement cost of the previous revaluation; RC_1 - replacement cost of revaluation at the current moment, G_1 and G_0 - annual electricity generation by existing and new fixed assets, T_1 and T_0 - the useful lives of existing and new fixed assets, years.

According to the authors of this article all these methods do not let to calculate a completely correct value of the indicator of obsolescence because the replacement cost is the amount of expenses necessary to restore worn-out fixed assets, calculated based on current prices; thus, it will include the amount of both obsolescence and physical depreciation.

As a solution to this contradiction one of the authors in his earlier publications proposed to define second type of obsolescence as the difference between the inventory value of existing and new operating systems, adjusted for the performance (production) of existing operating systems.

$$O_2 = IV_0 - IV_1 * \frac{G_0 * T_0}{G_1 * T_1}$$

where MO_2 – the amount of second type of moral obsolescence, IV_0 and IV_1 - inventory value of existing and new fixed assets, G_1 and G_0 - annual electricity generation by existing and new fixed assets, T_1 and T_0 - the useful lives of existing and new fixed assets, years.

The proposed mechanism, however, is not applicable if there is an additional parameter of “innovation” (when the project is “innovation-investment”). The authors of this article consider it appropriate forecasting innovation performance by comparing the value of investment on early replacement of the facility upon expiration of obsolescence and relevant indicators in relation to the old objects using the criteria of minimum cost, maximum effect and maximum profit [3, 124].

Despite the indisputable practical significance of the above methods, they allow to evaluate the parameters that already achieved (for example,

the number of years obsolescence occurred, provided that this period has already expired). However, in practice of evaluating innovative projects there is often a situation when it turns out to be more promising to implement equipment that has a shorter year of development and start of serial production than the alternative.

The authors propose to resolve this contradiction by adding an indicator of equipment obsolescence to the methodology for calculating the effectiveness of innovations (and more specifically, innovation and investment projects in the energy sector). In this case, we are talking about forecasting the technical and technological parameters of innovations (that is, in fact, the previously mentioned technological forecasting, endowed with all the characteristic properties described above). A.Ilyshev, N.Ilysheva, I.Voropanova [6, 124] give methods for evaluating the possible timing of maintaining competitive advantages when fundamentally new types of products or technologies are creating based on the agreed opinion of experts.

The methodology of expert research generally includes the construction of evaluation scales, organization, conduct, processing of survey results, obtaining ratings / analyzing results.

At the second stage, each of the experts was interviewed to get their estimates of the possible period of maintaining competitive advantages and the degree of demand for innovation.

The analysis of the questionnaire results begins with the compilation of a summary table. At the intersection of each row and column, the position assigned to the features by the expert is indicated.

In order to improve the consistency of experts' opinions it is possible to conduct a second round of expert survey and add "degree of novelty" indicator to the list of assessments and therefore the importance of the “obsolescence” indicator in this case.

A ten-point scale for assessing the degree of innovation (D) is included the following situations:

- implemented for the first time in the world – 10 points;
- implemented for the first time in the country – 7 points;
- implemented for the first time in the region – 5 points;
- implemented in the form of improvements to a previously created project – 2 points.

In this case, the gradation of the degree of prospects for innovative investment projects is based on a combination of the timing of maintaining the competitive advantages and the average level of demand for project results over the corresponding period of life cycle.

An example of a possible combination of two project prospects for energy company is given below.

Table 1 - Combinations of the number of hours using a power plant and timing of maintaining the competitive advantages when implementing innovations in thermal power plants

Timing of maintaining the competitive advantages, T, years	Time ranged in years	The number of hours using a power plant (% of annual values), N				
		1	2	3	4	5
		below 60	61-70	71-80	81-90	91 and more
1	15-17	1,1	1,2	1,3	1,4	1,5
2	17-21	2,1	2,2	2,3	2,4	2,5
3	21-24	3,1	3,2	3,3	3,4	3,5
4	24-27	4,1	4,2	4,3	4,4	4,5
5	27-30	5,1	5,2	5,3	5,4	5,5

In the table, oblique lines delimit the combinations of two features that form gradations of the number of using a power plant perspective degrees. In this example the dependence of obsolescence for thermal power plants is shown in the table of compliance. It is shown the degree of prospects for the values of innovation investment project at the intersection of the table.

Table 2 - Gradation of degrees of prospects for innovation and investment projects (by a combination of two features)

The degree of perspective of innovation investment project		Combining the timing of maintaining competitive advantages and the relevance of innovation investment project results
Code	Name	
A	Top	5,5; 5,4; 4,5
B	Very high	5,3; 4,4; 3,5
C	High	5,2; 4,3; 3,4; 2,5
D	Above-average	5,1; 4,2; 3,3; 2,4; 1,5
E	Average	4,1; 3,2; 2,3; 1,4
F	Below the average	3,1; 2,2; 1,3
C	Very low	1,1; 1,2; 2,1

In this case the calculation of the table indicators (each of which corresponds to a certain degree of demand (prospects) for equipment) will be carried out using the following formula:

P = N * T * D

where P – a degree of prospects for innovation and investment projects, N – The number of hours using a power plant, % per year; T - timing of maintaining the competitive advantages; D - the degree of innovation of the innovation investment project, units.

This method is recommended primarily for innovative investment projects because of methodological difficulties in predicting the results of the "innovative" component effect when planning innovations.

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THE VALUE OF LAW IN RUSSIAN PHILOSOPHY OF LAW (B. A. KISTYAKOVSKY)

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Abstract. The article discusses the problems of philosophy of law - the question of understanding the law in the system of value coordinates. On the example of the theory of B. A. Kistyakovsky, the contribution of the philosophy of the Baden school of neo-Kantianism to the substantiation of law as a formal value and cultural good is shown.

Keywords: philosophy of law, jurisprudence, neo-Kantianism, value of law, B. A. Kistyakovsky

The attitude to law in political and legal ideology is different, if not polar, from identifying legal requirements with moral norms to rejecting law as an external force imposed on a person by the state against his will. Understanding of law as a cultural phenomenon was defended by the famous Russian lawyer Bogdan Aleksandrovich Kistyakovsky. Developing the ideas of the Baden school of neo-Kantianism, the jurist emphasized that the material and spiritual development of society, as well as the external power of the state, depend on how much law really prevails in the life of its people.

The theoretical concepts of understanding law in the concept of Kistyakovsky essentially substantiated methodological pluralism. According to his approach, law is both a **phenomenon** (social, mental) and a state-organizational and normative **concept**, not merging with any one of these areas, but preserving its autonomy, originality, and self-worth. The legal phenomenon, Kistyakovsky believed, cannot be compared with scientific truth, moral perfection, religious shrine, which are of an absolute nature. **The content of the law is relative:** it is determined by changing social conditions. However, this does not underestimate the importance of law: of all the formal values (logic, methodology), law largely affects

human behavior - being a social regulator, it creates external conditions for the manifestation of a person's internal freedom. Proceeding from this, Kistyakovsky defended "the comprehensive disciplinary significance of law", in many respects thanks to which "justice is transformed from a spiritual mood into a vital matter"[1].

The Russian philosopher of law complained about the lack of treatises on law of public importance in Russian literature, such as, for example, Hobbes' "Leviathan", Milton's writings, Lilburn's pamphlets, which, although, reflecting opposing socio-political interests and programs, did not destroy each other, but, on the contrary, contributed to the formation of legal thinking of his era and entered independent sources in the history of political and legal thought. According to Kistyakovsky, in Russian legal literature at the beginning of the XX century, not a single article can be recalled which would put forward any legal idea of public importance. "Where is our" Spirit of Laws "(Montesquieu – E.F.), our" Social Contract "(Russo – E.F.)?" - the lawyer lamented. Arguments that the Russian people entered the historical path later than others and therefore there is no need for them to independently develop ideas of freedom and individual rights, since they are all expressed and embodied, do not work. Following the Kantian methodology, Kistyakovsky believed that it was not enough just to borrow ideas - it was necessary to live through them, no matter how obvious they were. It is important, the scientist reasoned, to be completely enveloped by these ideas, and only in this case, assimilating with other elements of consciousness, they excite the human will to be active, only in this case can one claim to realize human rights and freedoms and build a legal state.

At the turn of the XIX-XX centuries, Kistyakovsky critically evaluated the legal consciousness of the Russian intelligentsia, which, in his estimation, never fully embraced by the ideas of individual rights and the rule of law. Moreover, the Russian intelligentsia never respected law as an institution and did not see value in it: neither Chicherin nor Solovyov created anything significant in the field of legal ideas. Such a skeptical attitude to law could not but affect the extremely low level of development of our legal consciousness.

The legal consciousness of the Russian intelligentsia is characterized, on the one hand, by the desire to build a complex social mechanism solely on ethical standards; on the other hand, an addiction to formalization, reduction to texts and paragraphs of the law or charter. The Russian intellectual sees the rule of law not as a legal conviction, not as a means of

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protecting his own interests from arbitrariness on the part of the state and other persons, but only as a coercive rule that manifests itself outside, an evil that prevents a person from being free. Both of these understandings, according to the Russian lawyer, are erroneous, and give rise to a tendency toward bureaucracy, a detailed regulation of all social relations by articles of the written laws. The desire to maximize the formalization of human relations in society is a hallmark of not the legal, but the opposite of it, the police state[2]. In addition, there are no single examples of the idea of freedom, a person, a legal system, or a constitutional state - all these concepts get their own coloring in the minds of each individual people, like the individuality and originality of each person, which form the basis of law and order in society.

In polemic with representatives of the normative and ethical understanding of law (P.I. Novogortsev, E.N. Trubetskoy), B. A. Kistyakovsky argued that legal norms should not be based only on ethical prescriptions - specific social institutions cannot be built on them. Any public organization and state body require a certain material content and therefore must be embodied in the rules of law governing their activities.

At the beginning of the XX century in Russia, Kistyakovsky saw the reason for the low authority of law in all its forms in the politicization of legislative activity and urged, like other liberal-minded thinkers, to vigorously combat this phenomenon: “In our country, law has always been made much more dependent on other factors of public life than this corresponds to the true position and its real role. The broad circles of our society still have not recognized and are not recognizing law as an independent force that regulates, directs, creates various forms of personal and public life. (...) On the contrary, the law is given in our country the significance of only a subordinate instrument or means for purposes alien to it"[3]. According to Kistyakovsky, law in the minds of the majority of the population of Russia is the result of a clash and struggle of political forces. To strengthen the authority of the law, he proposed a number of measures: it is necessary to ensure that all laws are accurately and correctly executed and not subjected to a perverted interpretation; the class of lawyers must be actively involved in the reform of the legal life of society; representatives of the Russian intelligentsia should insist on recognition of the right of independent significance - the law should not be an appendage to the economic, political and other aspects of public and state life. Based

[2]Kistyakovsky B. A. In defense of law (Tasks of our intelligentsia. Milestones. M., 1909) // Kistyakovsky B. A. Philosophy and sociology of law. SPb, 1998. P. 371.

[3]Kistyakovsky B. A. The path to the rule of law (Tasks of our lawyers) // Kistyakovsky B. A. Philosophy and sociology of law. SPb, 1998. P 381.

on these comments, one can notice a hidden polemic by Kistyakovsky with the ideology of Marxism, whose representatives regarded law as a superstructure over economic relations in society, and with the sociological methodology as a whole, which studies law in a social series, as one of the regular phenomena of reality. B. A. Kistyakovsky clearly showed his commitment to the methodology of neo-Kantianism - the law belongs to the field of the spiritual sphere of man, it is a **cultural good**. The law, he argued, in its essence should always be above political parties, and its authority should be determined by the requirements of legality, i.e. steady observance of legal norms by all subjects of law, and not by any external forces and influences. Therefore, lawyers should introduce bills for discussion and strive to resolve all issues of the publication of new laws in terms of law, and not of any political processes. Improving the legal order formally, with the help of law, it is possible to achieve improvement in material relations, i.e. clear correspondence of the norms of law to the real needs of the population and the level of their legal consciousness. In educating the generation of lawyers who are able to establish the independent importance of law in the state, fundamental legal science and education are given a big role.

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COMPARATIVE ANALYSIS OF SINO-RUSSIAN COOPERATION IN HIGHER SCHOOL PROJECT MODELS

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Abstract. With the development of economic globalization, the internationalization of education has become a key development object in the development of education in various countries. As the main form of internationalization of education, cooperative school running directly determines the process of internationalization of education. This article visually analyzes the current status of Sino-Russian exchanges and cooperation in the field of education in the form of data. Taking the Sino-Russian cooperative education project as an example, the Moscow State Pedagogical University and the Moscow Art Department of Weinan Pedagogical University), A comparative analysis of the running models of the Russian International Class Program (Cooperative Running Mode: 2 + 2) of Moscow State Pedagogical University and Hebei Foreign Studies University. Summarize the experience of running a school, and put forward corresponding opinions to improve the quality of running a school.

Keywords: Cooperative school projects, international education, universities.

1. Analysis of the status Sino-Russian higher education exchanges and cooperation

In recent years, with the increase in the number of Chinese students studying abroad, China has become the world's largest source of foreign students. By 2019, the number of Chinese students abroad has exceeded 65,000. At present, the competition for the internationalization of education is becoming increasingly fierce, Russia and China should take advantage of the educational resources of the two countries and develop international cooperation in the field of educational exchanges. At one time, the governments of Russia and China are also actively supporting cooperation between the two countries in the field of education.

With the increasing learning enthusiasm of Chinese students, Russian education has gradually been accepted by Chinese students and has become one of the countries with the highest priority in studying abroad. According to data from the Social Research Center of the Russian Ministry of Education, the number of Chinese students studying in Russian universities in the 2015-2016 school year was 22,529. In the 2017-2018 school year, Chinese students studying in universities in 85 Russian cities. Among all foreign students in Russia, the number of Chinese students is the third, after Ukraine and Kazakhstan.

As of 2018, the number of Chinese students studying in Russia is close to 30,000. As Sino-Russian relations enter a new era, studying in Russia is entering a new era. In 2012, China and Russia signed the "Sino-Russian Humanities Cooperation Action Plan", which mentioned that by 2020, the number of exchange students between the two countries will reach 100,000.

According to information statistics released by the Information Platform of the Chinese-Foreign Cooperation in Running Schools of the Ministry of Education of the People's Republic of China, as of August 2019, the Chinese-foreign cooperatively-run schools and Chinese-foreign cooperatively-run schools established and held in accordance with the Regulations on Chinese-Foreign Cooperation in Running Schools and their implementation measures According to the data compiled by China, 8 Sino-foreign cooperatively-run schools (3 at the junior college level and 5 at the undergraduate level and above) that have been jointly established by China and Russia in China have carried out 70 Sino-foreign cooperative education projects (25 specialist education, 45 undergraduate and higher levels), Chinese-Russian cooperative education institutions account for 5.5% of Sino-foreign cooperative education institutions, and Chinese-Russian cooperation projects account for 3.3% of the total number of Chinese-foreign cooperative education projects.

2. Comparison of "4 + 0" Sino-Russian cooperative education project and "2 + 2" Sino-Russian cooperative education project

Due to the implementation of the “Belt and Road” project, exchanges and cooperation in the humanitarian field between the two countries have been accelerated, and its foundation is cooperation in the field of education. In 2017, based on the decision of the leaders of the two countries, the Moscow Art Institute (hereinafter referred to as WPU) was established on the basis of Shaanxi Weinan Normal University.

The Moscow Institute of Arts of the Weinan Pedagogical University is a project in which the WPU and the Moscow State Pedagogical Uni-

versity (hereinafter - MPSU) jointly implement programs of higher pedagogical education at the undergraduate level.Currently, joint educational programs(hereinafter - CEP) implemented by Chinese universities can be divided into two main categories: the first category is a higher education institution, which works together with foreign universities to implement CEPs on the basis of an agreement on cooperation between universities. The second category - programs are implemented at sites created in joint structural divisions of a Chinese university. In this case, not only a cooperation agreement is drawn up between universities, but also interstate agreements on the implementation of joint projects in the field of education and science. In this case, joint training of students by two universities is carried out on a voluntary basis. Both parties jointly develop training programs, share professional courses and provide conditions for internships and training for students and teachers. To manage the implementation of SOPs, a special management body is created for the structural unit. Through the SOP, the entire educational process is coordinated, including various resources of universities (personnel, educational and methodical complexes, material and technical support, etc.). SOPs contribute to expanding access to investment in education, developing and reforming the education system.

The Moscow Institute of Arts of the Weinan Pedagogical University (hereinafter referred to as the MIA WPU), created with the participation of the Moscow State Pedagogical University and belongs to the second category. At present, this is so far the only project in Russia and China in the field of teacher education, where, with the participation of a Russian university, a educational unit for the implementation of CEPs for the training of teachers is functioning in a Chinese university.

Project running mode: "4 + 0", both China and Russia teach together, Chinese students can enjoy high-quality teaching resources abroad without going abroad, students enjoy the school status of the two schools after entering the school, and they can get the graduation certificate. This cooperative mode of running a school retains the respective teaching modes of the Chinese and foreign cooperative parties. The two sides of the cooperation can get the graduation certificate issued by both schools through the course docking and mutual recognition of credits.

The Russian "2 + 2 Double Degree" project co-founded by Moscow State Pedagogical University and Hebei University of Foreign Languages was established in 2015. It is a fine project established by Hebei University of Foreign Languages and Moscow State Normal University after a long period of discussion, research and preparation. The two schools jointly

developed a teaching plan, which incorporates the mandatory courses of the first and second grades of the Russian Federation under the Russian Federation Ministry of Education, the Chinese undergraduate level general courses and professional foreign language practice courses. While ensuring the basic quality education of college students, the core of the course is positioned on the Russian professional courses, focusing on training students' Russian language ability. This project implements small class teaching, which enables the effective implementation of participatory teaching. The increase in the number of exchanges between teachers and students, and between students and students, while providing a good teaching environment for students, improves the quality of school running.

Project running mode: "2 + 2", students study in China for the first two years, after passing the language test, they can study abroad in the third year. Because students of this project study abroad for a long time, all Russian learn and The living environment is more conducive to the improvement of students 'language level and cross-cultural communication ability; at the same time, due to the need to study and live in unfamiliar countries, students' information search ability and problem-solving ability can be more exercised.

3. Suggestions on "4 + 0" and "2 + 2" Sino-Russian cooperation in running schools3.1 The students of the "4 + 0" school project enjoy the educational resources abroad without having to go abroad, but also lose the opportunity to experience the foreign cultural atmosphere for themselves. The students of the project have never received real education abroad and experienced life abroad. They are not sure whether their foreign language ability has really improved, and they have little knowledge about foreign countries. When developing teaching plans, the two sides of the cooperative school should not only consider the teacher ’s overseas training plan, but also develop a short-term overseas training plan for students. While receiving advanced foreign education, they should also understand the customs and culture of the other country and their peers abroad. Students communicate and learn, and truly integrate into the foreign teaching environment. While opening their horizons, they can also test whether their language level and professional level have improved. At the same time, after a short-term training abroad, the foreign school can issue a certificate to the student, certifying that the student has been trained in the short-term foreign school. During the job search process after graduation, the student is also an excellent talent with an international perspective.

3.2 Students of the "2 + 2" project will have significantly improved their language skills and cross-cultural communication skills through two years

of studying and living in Russian. However, during the period when they first arrived abroad, students have to adapt to all aspects of their study and life. The teaching methods and living habits in different countries are completely different. For quite a long time, students are in a state of half a hundred self-study. When slowly adapting to study and life abroad, you must be busy with exams and prepare to return to China. In response to this situation, both schools can formulate short-term learning and life training at the beginning of the third year of students studying abroad while formulating teaching plans. This kind of short-term training can be conducted by senior local students of relevant majors leading freshmen to make After a short period of study and understanding of the customs and culture of the other country and the foreign teaching methods of this major, students will quickly enter the foreign life before entering the normal foreign study life. In this way, while improving students 'adaptability to the new living environment, they can also effectively improve students' learning efficiency and their ability to accept professional knowledge.

In summary, at the same time as the rapid development of the Sino-foreign cooperative education project, a project questionnaire survey should be conducted regularly to understand the actual needs of the students and the practical problems facing them. The teaching plan, regularly improve the teaching plan, make corresponding adjustments according to the actual situation, better complete the school task, and maximize the students to make full use of the teaching resources of the school project.

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THE ROLE OF DISTANCE LEARNING TECHNOLOGIES IN TEACHING A FOREIGN LANGUAGE AT A UNIVERSITY

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Abstract. This article discusses the issues of popularization and implementation of distance learning in the process of teaching a foreign language at a university. The experience of foreign researchers on the use of electronic educational resources in technical education in the universities is presented. The experience of organizing blended learning a foreign language in the professional field on the basis of an electronic educational resource is presented. The author, taking into account the personal experience of teaching a foreign language to students of the Astrakhan State Technical University, specifies the conceptual apparatus of distance learning, notes the positive and negative aspects of this technology, and suggests ways to optimize teaching foreign languages in modern conditions.

Keywords: distance learning, electronic educational resource, information and communication technologies, individual work, university, students.

Currently, trends in higher education are aimed at introducing innovative models and teaching technologies, which should contribute to improving the quality of technical education. The introduction of new state standards of higher professional education implies the need for changes in the organization of the educational process associated with the revision of existing and the introduction of new innovative technologies. In the context of globalization and internationalization the introduction of breakthrough technologies and innovations in the economy actualizes the growth of international integration and cooperation, changes the models of the labor market and entrepreneurship undoubtedly. This, in turn, gives rise to new thinking, new motives for employment and further professional activities, as well as new, ever-increasing demands on the part of society for the criteria for training future specialists. The request, first of all, is aimed at preparing an innovatively-oriented, critically thinking and functionally competent person, capable of continuously updating his knowledge, quickly retraining and changing the field of application of his abilities for a successful life in a rapidly changing world [1]. Experience shows that one of the significant components of the

competitiveness of specialists is also a high level of knowledge of a foreign language. The analysis of modern trends in higher education, i.e. trends in its change, indicates the recognition of distance learning as one of the priority areas. This high-tech method of teaching, in particular foreign languages, in conditions of excess information and lack of time with constantly increasing demands on the quality of assimilation of material deserves close attention.

In fact distance learning is a wide category of teaching methods, which offers a combination of diverse communication technologies, techniques and tools that allow teachers and students to communicate with each other to transfer and receive knowledge without linking them in time and space. The use of distance learning technologies in higher technical education has become an integral part of student learning.

In foreign literature, the advantages of using e-learning, computer and distance learning technologies in comparison with traditional teaching methods are described by means of five "A":

1. Analytics. Thanks to electronic educational technologies, it is possible to collect detailed information about the learning process (the peculiarities of the student's behavior in a virtual environment, the learning process itself, the assessment of learning outcomes and the establishment of feedback).

2. Access. Thanks to the Internet, it is possible to access any electronic educational resource from anywhere in the world and at any time.

3. Adaptability. Providing the ability to change and fine-tune electronic educational resources for students is one of the features of distance educational technologies, which allows making the learning process personality-oriented and more effective.

4. Assessment. Distance learning technologies allow us to make continuous and long the process of assessing the formation of competencies in students of technical areas of training.

5. Agility. Technologies allow curricula to be rebuilt faster and to be expanded as needed, as well as providing communication of teachers and students in various ways [2].

However, despite the obvious advantages of distance learning technologies, issues related to overloading information on electronic educational resources, quality control of information, its interpretation and relevance, as well as the problem of copyright claims to these resources still remain relevant. Moreover, in a number of countries, including Russia, they cannot oblige students of technical areas of training to use electronic educational resources, since universities are not able to provide access to these resources to everyone, most often due to insufficient material support. Thus, we see that innovation in higher education is a complex process that requires consideration from various points of view. Here, students of technical areas of

training, who may have educational needs different from those offered by teachers, should play an active role. Now one of the teacher's roles is to help the student to show his abilities and to show where and how they will be implemented in his professional activity. Realistic teaching methods are closely related to the introduction of distance educational technologies, since it is thanks to virtual technologies that we have the opportunity to create situations that are as close as possible to the reality. It is interesting that even when electronic tasks related to real production situations are not compulsory, but they give students the opportunity to evaluate their knowledge on virtual objects in reality, then the majority of students complete them. Thanks to such tasks, students acquire preliminary experience of interaction with the production environment, which further facilitates their work in reality [3].

Due to the fact that computer technologies were introduced into the learning process of students, the researchers began to develop principles on which the structure of any electronic educational module should be based. The emphasis is on ten principles, divided into three levels: global (managing objectives, framing, minimizing technical load), rhetorical (optimizing modality, making modality explicit, scaffolding, elaboration, spaced repeating) and detailed (managing text, managing devices), which began to be considered universal for creating an electronic educational module [4]. At the same time, one should not forget about the need for constant updating of information on electronic educational resources for students. The creation of electronic educational resources leads to the fact that more and more teachers begin to use distance educational technologies to improve the quality of training and respond to the challenges of modern technocratic society. Electronic courses are being developed in disciplines that were previously considered unsuitable for distance learning, new software is introduced that allows you to create animated videos, interactive classes in inter-professional groups are started, which makes the learning process more interesting and motivates students of a technical university to achieve the desired result.

Speaking about the features of distance learning of foreign languages, we distinguish the following conditions that should be taken into account when developing the methodology: 1) the possibility of a systematic accumulation of training materials, the possibility of editing and storage; 2) the possibility of interpersonal communication between the teacher and a student, students with each other, as well as with the foreign partners; 3) the ability to control the process from the teacher's side; 4) the ability to choose the time and pace of learning from the student's side. It should be noted that in order to maximize the effectiveness of distance learning, it is necessary to create a favorable environment for independent study of a foreign language and self-control.

The application of a systematic approach to the informatization of foreign language education allows us to consider the principles of this process at three levels (methodological, technological, system-integration and conceptual-strategic), the implementation will create a universal educational environment for teaching foreign languages. At the methodological and technological levels, the principles of mastering certain aspects of a foreign language and types of speech activity are developed, and then the strategies and techniques for the formation of skills using information and communication technologies are determined. At the system-integration level, technologies and teaching methods are synthesized within the framework of one electronic educational environment. At the conceptual and strategic level, the existing educational programs in foreign languages are being adapted to new technological conditions. When developing the informational educational environment for a foreign language, some authors highlight the following requirements that must be met to organize continuous educational informational interaction in the learning process, namely: 1) the interconnectedness of linguistic informational resources; 2) a variety of information resources; 3) the inclusion of the language portfolio in the student's complex; 4) the creation of a teaching unit; 5) ensuring the automation of the processes of control and correction of the results of educational activities; 6) the possibility of replenishing the resource with new information; 7) ensuring the integration of pedagogical technologies and proprietary techniques [5].

We should also mention the methodological principles that regulate professional communication in other languages through information and communication technologies: the principles of conditionality, necessity, information content, reliability, dialogue interaction, interactivity, adaptability, interface friendliness, complexity and methodological support.

Guided by these requirements and principles, now more and more universities begin to introduce distance educational technologies in their activities to teach students a foreign language. This trend is observed in teaching a foreign language for professional purposes. In pedagogical practice they use electronic reference and information systems when teaching a foreign language for special purposes; develop professionally-oriented electronic dictionaries for the formation of a foreign language lexical skill; introduce computer technologies in the process of teaching foreign languages for specific areas of student technical training, in the form of such a discipline as “Foreign language in the professional field”; information and communication technologies are becoming a means of improving foreign language education in the correspondence form of training in all technical areas of training; they also use distance learning technologies for teaching business foreign language for 3-4 year students.

The educational platform Moodle for teaching a foreign language got a wide spread. This platform is used for distance learning a foreign language in the professional field in the magistracy, since it allows you to organize individual work more productively, and it has also shown its effectiveness in providing feedback in the framework of studying a foreign language. Moreover, taking into consideration that the Moodle platform is an international educational platform, it allows you to create and implement international projects when teaching a foreign language. This system has also shown its effectiveness for creating distance learning courses in a foreign language in a professionally oriented field. Thus, the pedagogical potential of distance educational technologies in teaching a foreign language to students of various technical areas of training becomes apparent. The best option for organizing training for a professionally-oriented foreign language is a full-fledged electronic environment in which the student will feel comfortable and participate in the educational process along with its other participants actively. However, if at the moment the university or teachers do not have the necessary resources to create such an electronic environment, then the first step may be to develop an electronic version of the textbook in a foreign language.

Foreign language training of students is a humanitarian component of education in a non-linguistic university, which helps to reveal the creative potential of the student's personality, the development of his independence and initiative. There is a need to pay more attention to the organization of individual work of students, which in modern conditions is advisable to complement the interaction of students with the information environment. A number of researchers believe that the students' preparation for individual work with the means of information and communication technologies in studying a foreign language contributed to a deeper study of the chosen topic, analysis and systematization of the received material, planning and description of the results of their activities. Also, determining the effectiveness of distance learning a foreign language, we substantiated its potential for self-development of a person and its compliance with the principles of a personality-oriented approach in education.

The introduction of distance learning technologies has allowed the creation of pedagogical support for individual work of students in a foreign language, the introduction of Internet testing as a type of individual work of a student in the existing practice of teaching a foreign language in a non-linguistic university, the development of electronic educational resources of a playful nature for individual study of a foreign language and suggestion of an algorithm for individual work with online resources to improve writing skills in a foreign language.

It becomes obvious that the potential of distance learning technologies is just beginning to unfold as part of the teaching of a professionally-oriented foreign language. There is a lack of reliable research data on the actual effectiveness of distance learning technologies for organizing students' individual work in learning a foreign language. Now at our disposal we have theoretical material that describes models for creating an electronic resource in foreign languages [6] and a virtual learning environment, reflecting the main trends in modernizing the system of teaching a foreign language at a university using information and communication technologies [7] and the possibility of integrating distance and full-time education of foreign languages [8], summarizing the issues and problems of the use of distance learning technologies in the management of language education in accordance with the modern globalization trends and international cooperation [9], as well as providing the analysis of the resources of open educational platforms in order to integrate them into the existing system of foreign language training for students [10]. However, we urgently need more applied research, demonstrating the effectiveness and feasibility of using distance technologies in the educational process. Otherwise, in the race for innovation, we risk losing sight of what really meets the needs of the student and contributes to the formation of relevant competencies.

Another aspect, that is often overlooked when discussing the introduction of innovations in the educational process when teaching a foreign language, is the preparation of the teaching staff for the use of information and communication technologies in their teaching practice. The development of information and communication competencies among foreign language teachers is a priority now, because without a competent approach to the use of innovative methods, it is possible not to facilitate educational activities, but rather to overload and complicate them. The motivation to use information and communication technologies should be present for both students and teachers.

Taking into consideration this problem, electronic educational resources are being created for the training of teachers of a foreign language, which are aimed at improving their information literacy [11]. Thus, despite a sufficient number of studies on the use of distance learning technologies in teaching a foreign language, there are two aspects that require close attention: the formation of information and communicative competence of teachers and research aimed at comparing the results of teaching a foreign language using electronic educational resources and without them.

It is difficult to imagine modern technical education without using the latest achievements of scientific and technological progress in the educational process. One of the alternatives to traditional university education is a mixed

form of education. The term “blended learning” is used to describe the combined organization of the educational process, when e-learning technologies (distance, computer and web-based learning) are combined with traditional teaching a foreign language in the classroom in face-to-face. Modern computer technologies can provide knowledge transfer and access to a variety of educational information on an equal, and sometimes much more effectively than traditional teaching aids. Blended learning at the Astrakhan State Technical University at the sub department of Foreign Languages is carried out as part of the teaching of the discipline "Foreign Language in the Professional Field" for graduate students of the Institute of Oil and Gas.

The modular training system, on the one hand, provides freedom in passing the modules, but on the other hand, when using the control function it does not allow the formation of “gaps” in mastering the discipline: for each passed module, the student reports to the teacher and only after that can move on.

The student knowledge control system includes training educational control, entry testl, test control on one topic and several modules, and final test. Testing data is recorded in the electronic "record book" visible to students and in the electronic journal of the teacher. The teacher considering the results of the current testing has an idea of the degree of preparation of each student, so the final assessment of the learning outcomes becomes more predictable, the probability of a random result and elements of subjectivity is reduced.

However, we consider it impossible to completely switch to distance learning a foreign language in a non-linguistic university. The methodology of teaching a foreign language is based on a communicative approach, so we should not deprive a student of full-time communication with the teacher and other students as part of the study of the discipline. Moreover, the task of developing communication skills is more effective in the audience, when the teacher can correct mistakes and direct the student.

In this regard, we consider it possible to introduce a mixed form of training when a student will be able to master certain material independently at a convenient time for him, but at the same time he will not be deprived of the opportunity to communicate in a foreign language in the audience. A number of creative projects included in each module allow students to motivate themselves to work individually and creatively. A prerequisite for the implementation of creative projects is their presentation in the audience, which allows students to share experience on projects, discuss and evaluate the activities of other students. Moreover, the mixed form of teaching a foreign language contributes to the effective teaching of students with different levels of proficiency in a foreign language. The need to devote a lot

of time to repeating material that is part of the school curriculum will disappear. Students can organize their work to study and repeat each topic individually. The teacher will be able to distribute class hours more efficiently and to organize the learning process in such a way as to develop students' communicative and creative abilities. Blended learning is the middle ground between traditional classroom and distance learning. It provides an opportunity for both students and teachers to distribute class hours properly and use them with maximum efficiency. This form of training makes the knowledge assessment system more objective and less dependent on the teacher, motivates students to search for solutions to their tasks using Internet resources individually, helps to increase their social and professional mobility, social activity, outlook and level of consciousness.

The obvious advantages of distance learning technologies related to the availability of materials, the convenience of their use and the possibilities of organizing their study time are not in doubt. However, there are still unresolved issues regarding the overload of information on electronic educational resources and quality control, as well as its competent methodological organization that meets the goals and objectives of training.

The use of distance educational technologies in teaching a foreign language at a university is still at an initial stage. Although most studies talk about the effectiveness of the use of electronic educational resources in the learning process, there is still no reliable data confirming the improvement in the quality of training using distance learning technologies compared to more traditional teaching methods. An important aspect of the introduction of e-learning is the willingness and ability of teachers and students to new teaching methods and technologies. But a methodically correctly organized educational process using electronic educational resources and sufficiently high material support can bring foreign language training to a qualitatively new level.

Undoubtedly the best option for organizing teaching a foreign language in the professional sphere may be a full electronic environment in which students and teachers will feel comfortable and participate in the educational process along with its other participants actively.

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SOCIO-PEDAGOGICAL SUPPORT OF INTERPERSONAL CONFLICTS AMONG TEENAGERS

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Summary. This article discusses interpersonal conflicts of adolescents. In the study, under the social pedagogical support of conflict situations, a special type of interaction between teachers and schoolchildren contributes to the formation of flexible social behavior of pupils, necessary for constructive resolution of contradictions that arise in communication with peers.

Keywords: conflict, education, social and pedagogical support

The role and significance of conflict in life, in general, and in school is understood ambiguously. In recent years, a vast number of researchers are inclined to think about the inevitability of conflicts and the need for a culture of resolving them in society. Unfortunately, more frequently children in conflict situations use a strategy of rivalry, adjustment and suppress their negative emotions or pretend that everything is fine. Implementation of creative and innovative solutions to conflicts, in which interests of all parties to the conflict aretaken into account and solution is sought, is a social rarity.

Interpersonal relationships can be different in their value content. S.L. Rubinstein saw the ethical basis of human relations in "affirmation of the existence of another person." Some relationships depersonalize people, others open up the possibility for the development of individuality. In school conditions, it is important for student to feel not only his intellectual, but also communicative viability, i.e. to feel worthy of respect, to be able to master mature forms and models of behavior that are free from psychological violence, pressure, manipulations [1, p. 284].

L.I. Bozhovich in his work called “Personality and its formation in child-

hood" emphasized that child's mental development is formed not only by the nature of his leading activity, but also by the nature of relationships system with surrounding people that he meets at different stages of his development [2, p. 164]. Therefore, communication of adolescents with peers and adults must be considered as the most important psychological condition for personal development.

However, as the analysis of modern pedagogical process shows that the need of favorable and confidential communication at school among adolescent students does not receive its satisfaction.

A.K. Markova believes that teachers pay more attention to the learning process, and not to education, and pay little time to communication techniques [3, p. 26]. This circumstance leads to formation of increased anxiety, development of feelings of self-doubt associated with inadequate and unstable self-esteem, difficulties in personal development, establishment of interpersonal contacts, and prevents orientation in life situations. All this is aggravated if the child does not have favorable communication in the family.

Considering conflict as an effective mean of education, influencing on personality, scientists indicate that overcoming conflict situations is possible only on the basis of special psychological and pedagogical knowledge and corresponding skills.

Meanwhile, many teachers negatively assess any conflict as a phenomenon testifying to failures in their educational work. Most educators still have a cautious attitude to the word "conflict," in their views this concept is associated with deterioration in relationships, violation of discipline, and phenomenon, which is harmful to educational process.

In pedagogical literature, prevention, attenuation, and resolution of conflicts are more frequently discussed. Basing on the foregoing, we can conclude that for a long time there were no uniform views on the nature and causes of conflicts; the fact of the existence of contradictions and conflicts was not recognized; even the existence of conflicts was perceived as a negative phenomenon that interferes with normal functioning of pedagogical system and causes its structural disturbances.

It is established that contradictions that arise among adolescents do not always lead to conflict. Depending on skillful and sensitive pedagogical leadership ability, the contradiction will grow into conflict or the solution will be found in discussions and disputes.

Successful resolution of the conflict sometimes depends on position taken by a teacher in relation to it. The positions of authoritarian interference (suppression), neutrality or avoidance taken by the teacher are the

reason that adolescents arbitrarily build relationships in their team and the process of preventing and resolving conflicts becomes uncontrollable. The adjustment of the content of children's communication takes place positively only if the communication between teacher andclass is respectful, trusting, and reasonably demanding [4; p.20]. Research by S.V. Berezin and K.S. Lisetskii [5-7] shows that the most important condition for the formation of adolescents as subjects of overcoming destructive logic of a spontaneously developing conflict is the participation in conflict of an intermediary that implements functions of conflict management. The function of an intermediary is, therefore, according to expression of V.A. Petrovsky is "to predetermine the unforeseen", in other words, to be outside the destructive logic of spontaneous conflict that leads conflicting teenagers beyond it.

Social and pedagogical support is carried out primarily for educational purposes.

If a conflict arises in school, the initiative to resolve it should belong to teacher. Here, the special role of the teacher, is a mediator between:

- student - student; student - teacher; student - parent.

The use of mediation is based on the fact that is well-known to specialists: participation of third, neutral, person in the negotiation process has a positive effect on its effectiveness. "Natural" intermediaries may include people who, due to their position or professional activity, are periodically forced to take on some form or another the functions of regulating relations between people. First of all, these are leaders and teachers, as well as social educators and psychologists engaged in practical activities.

Such a strategy of behavior in a brewing conflict situation and even in the case of already developing specific confrontation, which allows us to find out real causes of the conflict, interests and goals of the rival parties, possible limits of their mutual claims and possible concessions to each other, will be more correct, which will make it possible to seek and find compromise solutions. Conditions under which not one party, but each participant of the conflict confrontation can win. In this case, it becomes possible to understand and evaluate the conflict as an undisclosed possibility of exerting a managerial influence on current situation and finding the most favorable way out of it.

An important constructive role in the management influence on the conflict situation can be performed by mastering social technologies of conflict management.

This social technology is a set of methods and techniques to analyse

sources and causes of conflicts, identify the interests and goals of the conflicting parties, possibilities, limits and extent of the impact to reduce the intensity of conflict confrontation, shifting it from a confrontational stage in a non-confrontational, finding options for negotiations, compromising between the warring parties to transform them from opponents to partners.

The way to resolve the conflict is through negotiations, where the social educator acts as a third party, facilitating constructive discussion and finding a solution to the problem.

Negotiations are the discussions of conflict issues held in order to take joint actions to resolve contradictions. The willingness to participate in negotiations corresponds to desire for cooperation, which does not exclude the possibility of new discrepancies. Negotiations allow you to reduce the tension of relationships, navigate current situation to make a mutually beneficial decision. In pedagogical activity of a social teacher, successful negotiations stimulate the entire educational process. By increasing personal potential in overcoming and resolving conflicts, social teacher increases personal authority in teaching staff, as well as among students and parents.

The key to successful negotiation result is thorough, professional preparation: analysis of one's own capabilities, analysis of opponents 'capabilities, analysis of sources and object of the conflict; analysis of possible changes to negotiation scenario and possible counterarguments.

In order for negotiations to become possible, certain conditions are necessary:

- existence of the interdependence of parties involved in the conflict;

-absence of significant difference in capabilities (powers) of the parties to the conflict;

- compliance with the stage of development of the conflict to possibilities of negotiations;

- participation in negotiations of parties that can make decisions in this situation.

A visible criterion for the effectiveness of negotiations is the agreement reached, but its existence should not be interpreted as an absolute success.

A number of criteria can be used to evaluate the success of negotiations.

1) The most important indicator of success is the degree of solution to the problem. The agreement reached during negotiation process is evidence of the solution to the problem. However, depending on nature of agreements, the outcome of the confrontation between parties is different:

- completion of conflict within the framework of the "win-win" model

finally removes problem from the agenda;

- the end of the conflict in the “win-lose” scenario, or “lose-lose” does not exclude conflict interaction in the future.

2) Another important criterion for success is subjective assessment of negotiations and their results. Negotiations are successful if both parties are satisfied with their results and regard the agreement reached as a fair solution to the problem. However, it is possible that subsequently these estimates will change.

3) The success of negotiations allows us to evaluate such a criterion as the fulfillment of the terms of the agreement. Even the most brilliant result of negotiations will noticeably fade if problems arise in fulfilling the obligations undertaken by the parties. Therefore, the best way to ensure long-term effect of negotiations is to include a plan for its implementation in the agreement.

The effectiveness of these mediator efforts largely depends on how the intermediarycomplete the information about parties to the conflict, disputed issues, balance of power of the parties, their interests and positions, possible approaches to solving the problem, degree of their involvement in the conflict, etc.

In the event that negotiations were successful, mediator takes control of the implementation of agreement. As noted above, success of the negotiation process is determined not only by reaching an agreement, but also by fulfilling its conditions. Therefore, mediator have to make sure that the final agreement includes dates for the parties to fulfill their obligations. It is also possible to establish something like a trial period, i.e. the time during which parties could evaluate the effectiveness of agreement.

Having studied the pedagogical literature, scientist B.Z. Vulfov sees the meaning of pedagogical support in maintaining, stimulating, developing positive activity, initiative, social creativity, and true independence of the students themselves. Accompanying –is a satisfaction of the real conscious or unconscious needs of students with participation of teacher [8].

According to M.I. Rozhkova, socio-pedagogical support is a method aimed at supporting the child in building their social relations, teaching child new models of interaction with himself and the world, and overcoming difficulties of socialization [9].

Despite the differences in the definitions considered, scientists are united in their characteristics of a child as a subject of educational process and a teacher - as a person capable of partnerships with a growing person.
In the study, under the socio-pedagogical support of conflict situations, we understand a special type of interaction between teachers and schoolchil-

dren, which contributes to formation of flexible social behavior of pupils, necessary for constructive resolution of contradictions that arise in communication with peers.

Socio-pedagogical support of conflict situations among adolescents can be based on a reflective-activity approach, the essence of which is to encourage students to reflectively value analysis of what is happening, and to include them in various types of activities (communication, play, study), during which social competencies necessary for flexible behavior in situations of disagreement (tolerance, the manifestation of empathicity in communication, the ability to predict, etc.).

Different specialists can act as subjects of socio-pedagogical support of conflict situations in a school environment: class teacher, subject teacher, social teacher, psychologist interacting with each other and, if necessary, with other subjects of social education of schoolchildren.

In our opinion, strategic goal of socio-pedagogical support of conflict situations is to organize pedagogical process in teenage environment, which would contribute to formation of flexible social behavior skills.

The tactical goal involves creating conditions for constructive solution to teenage conflict situations. The operational goal of socio-pedagogical support of conflict situations is presented ,as follows:

- in teaching methods of behavior in conflict situations;
- in formation of a set of competencies in adolescents, such as: self-regulation, tolerance, reflection, regulatory and empathic abilities, providing constructive solution to conflict situations;
- in formation of constructive experience of communication with peers through inclusion in various activities: study, play, debate, etc.

The current stage involves direct assistance of the teacher in resolving conflicts between adolescents, describes the stages that are held by teacher in a conflict situation. Conflict situations have a pedagogical potential and are able to regulate social relations. The teacher's task is to consider the conflict not as a negative phenomenon in the life of adolescents, but to use its resource to solve pedagogical problems.

A specific feature of the socio-pedagogical support of conflict situations in teenage environment, based on a reflective-activity approach, is the teacher's specific position, which involves not solving the problem for a child, but stimulating his independence, active life position in solving the problem, in particular the problem related to conflict resolution. It can be actions to change the unfavorable course of the situation - switching attention, using light irony, "step towards", extraordinary actions, etc.

The socio-pedagogical support of conflict situations among adoles-

cents acts as the target function of professional pedagogical activity. Under the socio-pedagogical support of interpersonal conflicts of adolescents, we understand the educational impacts consistently carried out by the teacher at all stages of emergence, development and completion of interpersonal conflicts of adolescents in order to change the content and intensity of conflict interaction and its scale.

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PREPARATION OF MASTER'S STUDENTS FOR PEDAGOGICAL ACTIVITIES IN EDUCATIONAL ECOSYSTEMS

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Abstract. The article is devoted to the preparation of master's students for the implementation of pedagogical activities in the conditions of educational ecosystems.

Keywords: educational ecosystem, ecosphere approach to education, ecosphere.

The Russian system of teacher education is undergoing serious changes at the present time. The main problem for universities is bringing the system of training of teaching staff in accordance with the requirements of the time. The main reasons for dynamic changes in content and technologies in higher education are the desire to include them as widely as possible in socio-cultural and information relations in society. Traditional models of teaching and upbringing in higher education come into conflict with developing educational complexes as an educational ecosphere. Under educational ecosystems, modern researchers P. Luksha, D. Peskov, D. Nikandrov, P. Kim represent the interconnection of a variety of information, socio-cultural and industrial spaces that represent the possibility of solving actual real problems in various spheres of society. [1]

The presentation of education in a broad social context defines the new professional philosophy of the master's student as a future teacher. In professional identification, he defines himself as a specialist included in a broad integrative environment, where there is an intensive exchange of innovative educational products, adaptive educational content that creates conditions for implementing the requirements of state projects in the field of education and achieving the results defined in Federal state educational standards, as well as the possibility of personal, professional and social self-realization.

Pedagogical activity in educational ecosystems determines the need to strengthen the development of master's students research, project -team, and communicative qualities that ensure readiness to cooperate with various educational communities and use their potential as a resource for the development of educational process subjects.

The fundamental elements of the educational system are changed in ecosphere coordinates: the activity of the teacher, the views of the student as a subject of education and the environment in which the educational process is carried out. Universal and professional competencies are subjects to change in the ecosphere approach. The matter of particular importance is the process of developing system and project thinking, strategic and predictive vision of educational prospects, readiness for cultural and meaning-making educational activities.

The teacher in ecosphere education acts as a facilitator, increasing the motivation of students to search and learn, appears as a navigator in information streams, strives for united creative activity. He makes serious efforts to attract the resources laid down in the cultural, social, technical and information spheres for the learning process.

In the complicated conditions of the ecosphere of education, it is important for the future teacher to master the competencies in the master's program which will allow to carry out personalized training in the future.

As a tutor in individual educational routes, he provides the safety of students on the Internet, supervises personal paths of education, taking into account the opportunities and problems of students. In order to implement a productive approach to the development of students' creative potential, the teacher freely navigates the existing systems of formal, non-formal, informal education in real pedagogical practice and the Internet sphere.

Organizing the educational process, he thinks as a whole system, integrating in unity the elements of design, modeling, organization and analysis of its implementation. Pedagogical integration in educational ecosystems acts as a mechanism for expanding and supplementing school educational programs, going beyond the subject of study. Deepening of the content is possible on the basis of mastering the methods and technologies of new directions in pedagogical science. Based on the system analysis of the new educational environment, the master's professional competence is supplemented with knowledge and skills in the field of cyber pedagogy, media pedagogy, museum pedagogy, etc. When carrying out teaching activities in a particular region, the teacher is ready to present activities in the context of an educational cluster in both vertical and horizontal embodiment, combining their activities with various cultural, educational, additional edu-

cation and leisure institutions. Combining with various educational centers provides an innovative effect in the activity of the teacher. Such pedagogical activity is aimed to develop students ' competitive qualities, skills in non-standard situations, ideas about the world around them as a space for personal initiative and creative human capabilities. The pedagogical process for mastering master's degree students appears as a system for solving multi-level pedagogical tasks. These include the tasks of mastering innovative content in the field of education abroad and in the country as a resource of their own creative activity. By identifying current trends in education, a master's student can formulate trends that may become system-forming in the long term. The information received for the student leads to the need to master the competencies that will be in demand in teaching activities in the future. This advanced system of education at the University prepares students not only for the teaching activities of today, but also underlie the human potential of the educational system that is still being formed.

Openness to innovations in ecosphere education contains the possibility of pedagogical application of previously rarely demanded methods and forms of education and upbringing. Having deep knowledge in the field of psychology, the master student masters the technologies of preparing the student to display their abilities in various types of competitive forms: olympiads, quests, creative festivals. For the implementation of competitive educational activities requires a developed analytical and critical thinking and the ability to solve complex theoretical and cognitive and practice-oriented tasks. The success of mastering such competencies is determined by the ability to effectively communicate, openness to innovation and perspective scientific ideas, and productive professional activity.

The idea of changing the subject position of the student should be emphasized while teaching students in the master's program to pedagogical activity in the conditions of ecosphere education. Personal position changes from a student of the class who is mastering a certain amount of knowledge defined by the standard to a subject who can have innovative educational products that act as an unlimited resource for development for him. In this situation, the student's personal ecosphere of development is formed within the social ecosphere of education. On their own initiative, with the active consultation of the teacher, a system of using the educational potential of the cultural complex of the student's place of residence is formed: museums, libraries, philharmonic halls, theaters, palaces of children's creativity. According to their abilities, they can choose the path of immersion in science in the conditions of specialized children's centers,

such as Quantorium or Sirius. Establishing continuity and complementarity of school education and various extracurricular forms of knowledge acquisition are one of the most difficult tasks for a teacher in the conditions of ecosphere education. Acting as a mentor, he transmits the experience of research and project activities, accompanying the student in the process of scientific search for a topic, putting forward a hypothesis, selecting research methods, presenting scientific results to the audience. For this activity, undergraduates master the methods of developing the student's personal potential, social and research activity, motivation to study, reflection of their achievements, and the ability to form their own route in learning as integral manifestations of the personal educational ecosphere. The result of this mentoring activity of the teacher is a student's awareness of the need for quality education.

Along with the global, federal, regional and personal forms of educational ecosystems, the most significant point is the idea of an educational institution as an ecosystem. The school acts as a startup aimed at meeting the numerous requests of students and their parents, promoting innovative pedagogical ideas. The resource for such development is project management. The teacher in this situation acts as a member of a creative group or innovative team, participating in the development of strategic planning and development programs of the educational institution. In the master's program, students master the necessary competencies for this type of activity: strategic planning and teamwork. These include setting goals, organizing the search for solutions, and being ready to achieve high results. This activity is carried out as an active communication process. Pedagogical communication skills in eco-educational systems are supplemented by the ability to collaborate – the ability to negotiate, discuss team tasks, and offer solutions to problems.

The school, developing as an ecosystem, is built on principles that are important for future teachers to adopt. The educational environment of the school is considered as a dynamic space with constantly expanding resources for development, training and education of students, useful infrastructure, establishing recourses with various educational centers, activities with which are based on the mutual interest of improving the quality of education.

The innovative nature of the school's ecosphere makes it possible to effectively adapt to constantly changing conditions in society, make the most diverse use of internal resources and actively exchange innovative educational products with external partners . Such principles of the school's ecosphere development contribute to the development of a new under-

standing of education and new approaches to its development for master's students.

Thus, the present preparation of graduate students for teaching activities involves the active acceptance of ecosphere approach ideas to the development of education, bringing together various participants, integrating resources of various educational and cultural institutions, the informational and educational potential of the global Internet resources and creating the conditions for an active role of future teachers in a rapidly changing educational environment.

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DIGITALIZATION OF EDUCATION AS A CONDITION FOR THE TRAINING OF MASTERS

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Abstract. The relevance of the problem under study is due to the fact that the modern digital society has new requirements for the training of masters in the application and production of electronic educational materials, as well as the development of the capabilities of digital tools and services in the process of independent extraction and presentation of knowledge. The article is aimed at solving one of the problems of digitalization of education in the area of preparation 44.04.01 “Pedagogical education” (master's level) (master's program “Information and Communication Technologies in Education”). The paper presents the experience of training masters at the Faculty of Mathematics, Physics and Informatics, Federal State Budgetary Educational Establishment of Higher Education “Dagestan State Pedagogical University”, where the leading place is occupied by official electronic teaching materials in the disciplines of the variable part of the main professional educational program (MPEP) in the context of digitalization of education.

Keywords: digitalization of education, master's training, master's program, electronic educational materials, web portfolios, digital tools and services.

Education is one of the main tasks of any country and any society. Vocational training of future teachers is given an important place in the documents determining the nature of updating teacher education in our country (the Law "On Education" and the Law "On Education of the Russian Federation"; "The Concept of Modernization of Russian Education until 2010; State Program of the Russian Federation "Development of Education for 2013- 2020”; The concept of support for the development of teacher edu-

cation (2013); Program for the modernization of teacher education 2014-2017; Federal project "Modern Digital Environment in the Russian Federation").

In education, digitalization is aimed at ensuring the continuity of the learning process, as well as its individualization based on advanced learning technologies, which appeared in connection with the intensive development of information and communication technologies (ICT). The concept of “digital literacy” is currently used in the analysis of the use of computers, mobile devices, applied programs and applications for solving various professional and pedagogical problems [4, 5].

One of the conditions for modernizing teacher education is the digitalization of teacher education, where digital tools and services play an important role.

Modern society in the context of its digitalization, presents new requirements for the preparation of masters of teacher education in the application and production of the Internet information resource, as well as the development of methods and means of information interaction in computer networks, the implementation of ICT capabilities and digital tools and services in the process of self-extraction and representations of knowledge.

Based on a theoretical analysis of research on the development of the tiered system of higher pedagogical education in Russia, we can identify the following factors for its systematic development:

- changing the demands of the regional educational market;
- the presence of fierce competition in force in this system;
- new understanding of the criteria for assessing the level of digital competence of future masters;
- rethinking the qualification characteristics of future masters of teacher education;
- finding new principles for organizing the system of higher pedagogical education, taking into account international standards and national experience.

Based on the analysis of the Federal State Educational Standards of Higher Education in the area of preparation 44.04.01 “Pedagogical Education” (master's level), we single out the main goals of training masters:

- the development of knowledge and scientific thinking among graduate students, the development and consolidation of their skills in conducting scientific and pedagogical work;
- training of research and scientific-pedagogical personnel for universities and other areas of professional activity or for further education in graduate school [3].

The authors of this article, being representatives of universities of the Republic of Dagestan, contribute to the process of training masters based on digital tools and services. The main approach adopted by us is that the methodology for using their graduate students can be based on activities to solve research problems using the Internet and the development of electronic educational materials, which are the main components of the digital educational environment of the university.

The introduction of digital tools and services in the system of teacher education is becoming more and more large every year. Most of the educational, scientific and methodological developments used in practice have been translated into electronic form.

For the practical implementation of federal programs in the field of digitalization of education, we are contributing to the master's training process, which requires the university's digital educational environment, which is a comprehensive multi-purpose system combining educational and teaching resources, software products, knowledge control systems and, at the same time, a highly constructive environment for organization of various forms of independent work based on educational digital tools and services.

Such an environment is a dynamically developing, self-organizing system, open to the teacher and student, the diversity of the content and functions of which creates the possibility for students to build an individual educational trajectory.

We apply the following forms of using digital tools and services in the educational process of the magistracy:

1. The use of official electronic teaching materials allows you to intensify the activities of future masters, improves the quality of training for a particular discipline, reflects the essential aspects of objects, visually embodying the principle of visualization.

2. The use of multimedia presentations based on digital tools and services makes it possible to present educational material as a system of bright reference images filled with exhaustive structured information in an algorithmic order.

3. The use of Internet resources, which carries the enormous potential of educational services (e-mail, search engines, electronic conferences) and is becoming an integral part of modern education. Obtaining educationally significant information from the network, future masters gain skills in working with digital tools and services.

4. The use of digital tools and services allows the interactive organization of educational and cognitive activities of future masters.

Master students in the direction 04.04.01 “Pedagogical education” (master's program “Information and Communication Technologies in Education”) must be able to solve problems related to:

- the creation and use of modern digital tools and services focused on the formation of skills to carry out various types of independent activities for the collection, processing, storage, transmission, production of educational information, as well as educational activities to formalize the processes of presenting and extracting knowledge and ensuring the comfort and motivation of the educational process;
- the functioning of "virtual" open educational systems of telecommunication access based on the potential of a distributed information resource, providing social adaptation to life in a digital society;
- the use of digital tools and services in the management of educational organizations, the development of policies for their implementation in the educational process;
- the use of the educational material base of digitalization of education;
- the creation and use on the basis of digital tools and services of means for monitoring the development of the educational process in organizations;
- the organization of research and experimental activities based on means of automating the processing of the results of a training experiment, which takes place both in real and virtual conditions.

Based on the publications of foreign scientists we studied [6, 7], we believe that in the educational process it is also possible to more effectively use the capabilities of social Internet networks, mobile phone applications. This will additionally attract students who are active users of these networks, and most of them are now.

At present, digital educational resources and network social services are rapidly developing, which make it possible to successfully organize a fundamentally new educational format. One of such a form is the network form of the implementation of educational programs of the magistracy.

In the Federal document "Methodological recommendations for the organization of educational activities using network forms of implementation of educational programs" 2the network form refers to the organization of training using the resources of several organizations engaged in educational activities [2].

The Dagestan State Pedagogical University and the Novosibirsk State Pedagogical University signed an agreement dated July 5, 2016 “On the network form for the implementation of the main professional educational programs of higher education “Information and communication technologies

in teaching foreign languages" and "Information and communication technologies in education" in the field of training 04.04.01 Pedagogical education "in order to improve the quality of training of students, ensuring the integration of education educational and scientific activities, expanding students' access to educational resources and their more efficient use, providing students with the opportunity to choose training courses, disciplines, modules, implement a competency-based approach, including using distance educational technologies and e-learning, as well as exchange training experience, improving the teaching and research work of partner universities. Partner universities provide students with the opportunity to master the educational program using the resources of their organizations (the resources necessary for training, internships and other types of educational activities provided for by the online educational program, including internships).

Our practical experience of teaching in the magistracy in the direction of preparation 44.04.01 "Pedagogical Education" (for the master's program "Information and Communication Technologies in Education") at the Faculty of Mathematics, Physics and Informatics of the Federal State Budgetary Educational Establishment of Higher Education "Dagestan State Pedagogical University" makes it possible to increase the efficiency of using digital tools and services in the system of higher pedagogical education.

The main approach adopted by us is connected with the methodology of using digital tools and services by future masters of teacher education, which is based on activities to solve research problems using the Internet, allowing you to transfer the main computational load to external servers in relation to the university, through the use of cloud technology.

One of the components of the university's digital educational environment is the 4portfolio.ru platform, that allows future masters to create and maintain a web portfolio.

Web Portfolio – is a combination of portfolio technology and social network technology, which acts as a modern tool for interaction in the network community, providing access to personal information of the teacher and student, regardless of place of work or study.

The future master's web portfolio - is its own website with an unlimited number of pages, which will allow them to colorfully present the results in a variety of activities - educational, scientific, creative, etc., as well as a tool for personal development and improvement, for visual self-presentation on the Internet community.

We have created and maintained a web portfolio of future masters, where the important place is occupied by the multimedia projects developed by them on the main content lines of the school course in computer

science and ICT, as well as electronic educational materials in various disciplines of the variable part of the master's curriculum.

By ELM we mean a learning tool that implements the capabilities of digital tools and services for the provision of educational information with the use of multimedia technology and online interactive learning tools [1].

We provide educational information in the form of electronic educational-methodical complexes (EEMC), electronic educational-methodical module (EEMM) and electronic educational-methodical materials (EEMM).

Master students under the guidance of Professor T.G. Vezirova, developed and used in the educational process of educational organizations, the following ELMs: Computer networks; Higher mathematics; Multimedia technology; Portal technologies in education; Computer graphics; ICT competency of the teacher; Means of information and telecommunication technologies in teacher education.

Some ELMs are registered with the Federal State Unitary Enterprise Scientific and Information Center "Informregister" of the mandatory federal copy of the electronic publication (Moscow), while others are registered on the website of the Department of Distance Learning and Continuing Education of the Don State Technical University (Rostov on Don, http://skif.donstu.edu.ru) in the section “Dagestan State Pedagogical University”, as well as on the website of undergraduates of the faculty of mathematics, physics and computer science of the FSBEI HE “Dagestan State Pedagogical University” (http://magistr-fmf.ru).

Undergraduates from a partner university (Novosibirsk State Pedagogical University) have access to electronic teaching materials developed by undergraduates of the Dagestan State Pedagogical University together with Professor T.G. Vezirov, which are posted on the portal http://skif.donstu.edu.ru and on the educational website http://magistr-fmf.ru

For graduate students of a partner university, we have prepared video lectures using the WebcamMax program in the following disciplines:

1. Theory and methods of informatization of education.
2. Modern information and communication technologies in teacher education.
3. Distance learning technologies in teaching foreign languages.
4. ICT competency of the teacher.
5. Internet and web 2.0 services in teaching foreign languages.

Our experience in the magistracy, as well as studies conducted, showed that the use of modern digital tools and services allows to:

- strengthen motivation, increase interest and expand the cognitive needs of future bachelors and masters of teacher education;

- provide individualization of training, create the prerequisites for the transition to a personality-oriented learning;
- increase the interactivity of training, to develop the dialogical nature of the educational process based on official electronic educational materials;
- "immerse" future masters in a virtual environment with the ability to simulate training and professional situations, initiating manifestations of willingness to solve problems.

An analysis of the motives for using electronic educational materials in the educational process of the master's program showed that most future masters (73%) have a desire to improve their professional training with the use of modern digital tools and services. We believe that in the educational process of the magistracy it is also possible to more effectively use the capabilities of social networks of the Internet, mobile device applications, which will additionally attract magistracy students who are active users of these networks.

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THE STRUCTURE OF RUNNING EXERCISES OF LONG JUMPERS AND ITS ROLE IN THE TRAINING PROCESS

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Abstract. The results of a biomechanical analysis of the main running exercises used in the training process of jumpers with a running start are presented, and the possibility of choosing them when planning, taking into account the existing differences in structure, is shown.

Keywords. The biomechanics of running exercises, the length and frequency of steps, the speed of running and run-up, the similarity and difference of the studied training tools.

Analysis of the means of running training used by long jumpers (Galukhin R.M., Molotilov E.V., 1986, 2002), revealed that many of the funds are borrowed from the arsenal of training exercises of runners for short distances. Special running exercises, running with acceleration, running on segments of up to 100 m are widely represented. Of significant importance in the training process of long jump runners, to increase the technical ability of running during a run-up and to develop speed, are running short segments from low and high start, from walking - a technique based on the experience of training sprint runners.

The selection and planning of means of running training for long jumpers is carried out without due consideration of the structure of the competitive exercise, which leads to the implementation of a significant amount of non-specific loads. A modern approach to training long jumpers involves increasing the specific weight of the run, performed at maximum speed. At the same time, the study of scientific and methodological literature has shown that questions related to the structure of running training of highly qualified long jumpers still need to be answered.

The beginning of research on run-up forms in long jumps was presented in our article in the 4th issue of the "Tidings" collection of Tula State University, and here we offer an analysis of running forms of exercises used to increase the speed of a regular sprint run, which is the basis for run- up of long jumpers.

Differences between run-up in jumping from running from a low start at the same distance.

Comparison of these exercises according to the kinematic parameters of steps made it possible to identify differences ($p<0.05$) in running speed, pace of steps and in their length, respectively, in 100, 87.5, 58.7% of the compared steps. On the records of the tempo-rhythmic structure of the run in both exercises, one can see differences in the dynamics of speed, which is characterized by a large angle of inclination of the speed curve in the starting acceleration (40°) and a lower coefficient of variation of the speed increments (32.2%) in running from a low start compared to a run-up of a competitive exercise (24° and 58.2%) (Table 1, Fig. 1-2).

Table 1

Running speed in run-up and in jogging exercises of long jumpers (M ± m)

Measured characteristics	Long jumps with full run-up	Running from walking	High start running	Low start running
Maximum speed (in m/s)	10,12 ±0,13	9,73 ±0,30	10,22 ±0,11	10,18 ±0,18
Average speed (in m/s)	7,90 ±0,18	9,64 ±0,16	8,22 ±0,25	8,38 ±0,25
Speed in the last 6 steps (in m/s)	9,32 ±0,22	9,78 ±0,14	9,61 ±0,03	9,64 ±0,04
Speed in the last 3 steps (in m/s)	9,73 ±0,30	10,00 ±0,13	9,71 ±0,05	9,66 ±0,10
Speed on 4th - 6th steps from the end (in m/s)	8,98 ±0,10	9,57 ±0,19	9,54 ±0,05	9,74 ±0,11
Speed in the last 2 steps (in m/s)	9,97 ±0,18	10,02 ±0,24	9,69 ±0,10	9,60 ±0,15
Speed on 3rd - 4th steps from the end (in m/s)	8,98 ±0,37	9,79 ±0,18	9,65 ±0,11	9,68 ±0,14
The difference in speed between the last 3rd and 4th - 6th steps from the end (in m/s)	0,75	0,43	0,17	-0,08
The difference in speed between the last 2nd and 3rd - 4th steps from the end (in m/s)	0,99	0,23	0,04	-0,08
Curve of the starting acceleration slope (in deg.)	24°	s	37°	40°
Coefficient of variation of speed increment (in %)	58,2	50,8	67,5	32,2
Running activity in the last 6 steps (in cu)	1,18	1,43	1,46	1,62

The analysis of the final part of the competitive exercises revealed differences ($p < 0.05$) in speed at the 4-6th from the end of the run-up steps. (9.74±0.11, 8.98±0.10 m/s).

Of interest is the dynamics of speed in the last 6 steps. In running from a low start, the speed decreases at the time of finishing, and in full, run-up increases. This is confirmed by the difference in speeds at the last 3 and 4-6th from the end of the run-up steps, as well as at the last 2 and 3-4th from the end of the run-up steps, respectively 0.08 and 0.08 m/s when running from a low start, 0.75 and 0.99 m/s in a competitive exercise. Such dynamics of speed in the compared exercises leads to differences in the parameters of running activity in the last 6 steps. And the data in Table 1 indicate that in running from a low start the speed range is greater (1.62) than in the run-up of a competitive exercise (1.18).

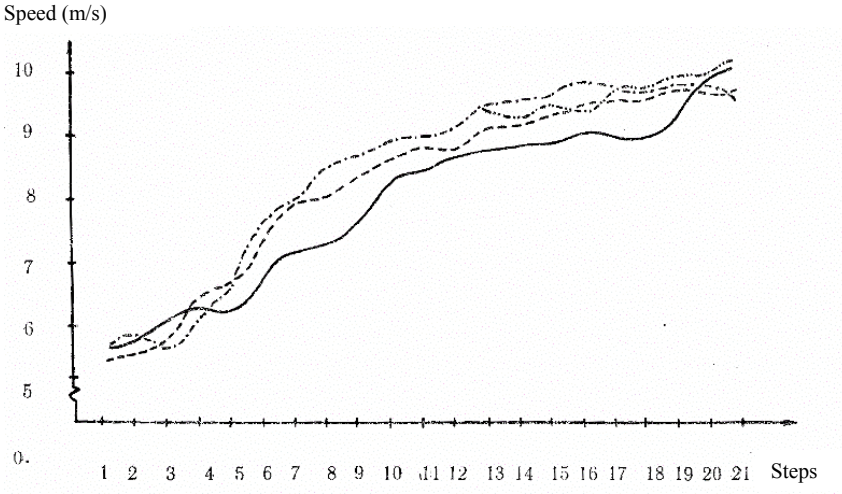

Fig. 1 Dynamics of running speed in competitive and running exercises for long jumpers

Long jump with full run-up
Low start running
High start running
Walking start running

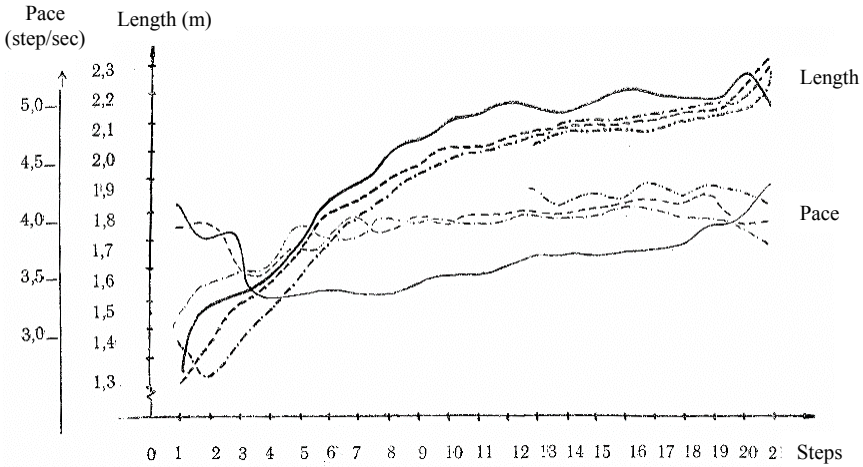

Fig. 2 Dynamics of length and pace of running steps in competitive and running exercises for long jumpers

Long jump with full run-up
Low start running
High start running
Walking start running

As a result, the main differences between the run-up of a competitive exercise and running from a low start were manifested in the following indicators:

— speed, length and pace, respectively, in 100, 85.7 and 87.5% of the compared steps;

— starting acceleration angles (24° and 40°, the difference was 40%);

— the coefficient of variation of the increment of speed at each step of 58.2 and 32.2%, the difference 26%);

— speeds at 4-6th from the end of the run-up steps (8.98 and 9.74 m/s, — 7.8%);

— the difference in speed between the last 3rd and 4-6th from the end of the run-up steps (0.75 and 0.08 m/s, — 10.7%);

— the difference in speed between the last 2 and 3-4 steps (0.99 and 0.08 m/s,— 8.1%);

— running activity in the last 6 steps (1.18 and 1.62, — 27.2%).

Differences between a run-up in a jump and a run from a high start.

Comparison of these exercises according to the kinematic parameters of steps made it possible to identify differences ($p<0.05$) in speed, step length, and pace of running, respectively, in 52.4, 57.1, 80.9% of the compared steps. Recording the tempo-rhythm structure of the run showed the

speeds achieved by jumpers in the run-up of a competitive exercise and in running from a high start. If we look at the speed graph, the angle of inclination of its curve (the section corresponding to the starting acceleration), it is clear that in running from a high start, the angle of inclination is greater (37°) than in full run-up (24°).

The coefficient of variation of the speed increment at each step in a run from a high start is greater (67.5%) than in a competitive exercise (58.2%) (Table 1). Along with this, significant differences were found in the full run-up in jumping and running from a high start in speed at the 4-6th from the end of the run-up steps (8.98±0.10, 9.54±0.05 m/s) and average pace (3.84±0.07, 4.12±0.04 steps/s) (Tables 1 and 2).

Table 2

The pace of steps in run-up and in running exercises of long jumpers (M ± m)

Measured characteristics		Long jumps with full run-up	Running from walking	High start running	Low start running
PACE	Maximum (in steps/s)	4,37±0,07	4,51±0,09	4,41±0,06	4,44±0,07
	Medium (in steps/s)	3,84±0,07	4,39±0,03	4,12±0,04	4,02±0,06
	In the last 6 steps (in steps/s)	4,09±0,12	4,39±0,03	4,28±0,09	4,17±0,05
	In the last 3 steps (in steps/s)	4,09±0,12	4,40±0,06	4,27±0,09	4,10±0,08
LENGTH	Maximum (in m)	2,37±0,02	2,37±0,05	2,36±0,02	2,38±0,03
	In the last 6 steps (in m)	2,28±0,02	2,22±0,03	2,28±0,05	2,23±0,03
	In the last 3 steps (in m)	2,28±0,04	2,27±0,05	2,35±0,09	2,30±0,04

The last steps of a full run-up with a jump are characterized by a significant increase in speed: its difference between the last 3 and previous 3 steps, as well as the last 2 and previous 2 steps, respectively, 0.75 and 0.99 m/s. At the same time, when running from a high start, the dynamics of speed is less pronounced: 0.17, 0.04 m/s (Table 1).

The marked increase in speed in both exercises leads to differences in running parameters in the last 6 steps. From the table. 1 it can be seen that in the high-start run, the values of the speed changes are higher (1.46 m/s) than in the competitive exercise (1.18 m/s).

Thus, the main differences between the run-up in a competitive exercise and running from a high start were manifested in the following parameters:

— speed, length and pace respectively in 52.4, 57.1, 80.9% of the compared steps;

— the corners of the curve of the graph of the starting acceleration (24º and 37º, — 35.1%);

— coefficients of variation of the increment of speed at each step (58.2 and 67.5 - difference of 9.3%);

— speeds at 4-6th from the end of the run-up steps (8.98 and 9.54 m/s — 5.9%);

— average pace of steps (3.84 and 4.12 steps/s — 6,8%);

— speed difference in the last 3 and previous 3 steps (0.75 and 0.17 m/s — 77.3%);

— speed difference in the last 2 and previous 2 steps (0.99 and 0.04 m/s — 96%);

— running activity in the last 6 steps (1.18 and 1.46 — 19.2%).

Differences between the run-up of a competitive exercise and running from walking.

The peculiarity of running from walking is that the athlete, having a margin of speed achieved through preliminary run-up, runs the distance to "full strength". In our case, the last 6 steps in the run for 20 m from walking were investigated (Tables 1 and 2).

The picture of speed increase in the compared exercises is similar. At the same time, the coefficients of variation in its growth range from 50.8% (running on the move) to 58.2% (run-up in the long jump).

In running from walking, the athlete exceeds the speed at the 4-6th steps from the end of the run-up and the average pace of the competitive exercise. In Tables 1 and 2, these differences are visible ($p < 0.05$). They are obvious from comparing the speed of 4-6 meters from the end of the run-up steps (8.98±0.10, 9.57±0.19 m/s) and the average pace (3.84±0.07, 4.39±0.03 step/s).

In running from walking, speed increases by the time of finishing, i.e. its dynamics in the last 6 steps are similar to the run-up of a competitive exercise. However, differences also appear in these parameters. From Table 1 it can be seen that in the last steps of the full run-up, the indicators of the speed difference between the last 3rd and previous 3rd, last 2nd and previous 2nd steps are respectively 0.75 and 0.99 m/s. At the same time, on the run, this speed difference is 0.43 and 0.23 m/s.

The above-noted increase in speed leads to differences in running activity (Table 1): in running from walking, it is 1.43 m/s; in the run-up of a competitive exercise — 1.18 m/s.

We summarize the main differences between the run-up of a competitive exercise and running from walking. They appeared:

— in the coefficients of variation of the increment of speed at each step (58.2, and 50.8%, the difference is 7.4%);

— in the speed of the 4th-6th from the end of the run-up steps (8.98 and 9.57 m/s — 6.2%);

— at an average pace (3.84 and 4.39 steps/s — 12.5%);

— in the speed difference at the last 3 and previous 3 steps (0.75 and 0.43 m/s — 42.7%);

— in the speed difference at the last 2 penultimate 3 — 4 steps (0.99 and 0.23 m/s — 76.8%);

— in running activity at the last 6 steps (1.18 and 1.43 — 1.7.5%).

From the above it follows that the "traditionally" used running means can by no means always guarantee the formation of a good skill of performing a competitive exercise - long jump from run-up. Therefore, the main condition for the planned training work should be compliance with the principle of adequacy of the selection of means in accordance with the structure of the competitive exercise. Comparison of competitive exercises and running means of long jumpers led to the following results.

The greatest similarity was revealed between the competitive exercise and the run. According to the results of tables 1; 2 and 3 show that the variation coefficients between these exercises differ slightly (by 7.4%), and this difference in this case is the smallest among the parameters of running from high and low starts presented in the text.

In running, the jumper gains more speed than in the competitive exercise at the 4-6th from the end of the run-up steps (by 6.2%). This happens, apparently, due to the average pace, which is higher (12.5%) in running.

The main similarity between a competitive exercise and running from a move is observed in the dynamics of their speed at the last 6 steps, which is not so pronounced when comparing competitive exercises and running from high and low starts.

Perhaps the relative similarities between running and full run-ups in the long jump are mainly based on the closeness of the ratio of speeds in the last 3 and previous 3 steps, as well as in the last 2 and previous 2 steps: in both cases, there is some increase in speed to the moment of completion during exercise.

If we compare the increase in speed in running from walking and a high start, it is clear that in running from walking, the difference in speeds between the last 3rd and previous 3rd steps, as well as the last 2nd and previous 2nd steps (respectively, 42, 7 and 76.8%) are more similar to this difference in the run-up of a competitive exercise than from a high start running — 77.3 and 96.0%, respectively.

Table 3

Differences in the parameters of the full run-up in a jump and the basic exercises of running training among highly qualified jumpers in length (%)

Measured characteristic		Long jumps with full run-up	Running from walking	High start running	Low start running
SPEED	Maximum (m/s)	10,2±0,13	s	s	s
	In the last 3 steps (m/s)	9,32±0,22	s	s	s
	On steps 4-6 from the end (m/s)	8,98±0,10	>6,2	>5,9	>7,8
	On steps 3–4 from the end (m/s)	8,98±0,31	s	s	s
	The difference between the last 3rd and 4th – 6th steps from the end (m/s)	0,75	<42,7	>77,3	–10,7
	The difference between the last 2nd and 3rd–4th steps from the end (m/s)	0,99	<76,8	<96,0	–8,1
	Run-up graph curve angle (deg.)	24	s	>35,1	>40,0
	Running activity on the last 6 steps (cu)	1,18	>17,5	>19,2	>27,2
	The coefficient of variation of the increment of speed (%)	58,2	<7,4	>9,3	<26,0
	Average pace (m/s)	3,84±0,07	>12,5	>6,8	
	Pace in the last 3 steps (m/s)	4,27±0,16	s	s	s
LENGTH	Maximum (m)	2,37±0,02	s	s	s
	In the last 6 steps (m)	2,28±0,02	s	s	s
	In the last 3 steps (m)	2,28±0,04	s	s	s

Note: > – < — in comparison with a competitive exercise.

Thus, running from walking is more similar to a run-up in a competitive exercise than running from a high start. However, as the analysis of the structure showed, such comparisons were not carried out, which ultimately leads to a “purely intuitive” application of running from walking.

The degree of similarity between running from high and low starts with run-up in competitive long jumps was revealed.

Running from both a low and a high start is characterized by a sharper increase in speed than a full run-up of a long jump. Nevertheless, in terms of the slope of the starting acceleration speed curve, running from a high start is “closer” to the run-up in jumps than running from a low start (differences are 35.1, 40.0%, respectively).

A comparative analysis of the parameters of the variation coefficients of the speed increment at each step showed that in running from a low start, the difference from full run-up in a long jump is greater (26.0%) than in running from a high start (9.3%). This emphasizes the sprint orientation of running from a low start and, conversely, the more complex structure of increasing speed in running from a high start.

Of interest is the dynamics of increasing speed in the last 6 steps in a run from a low start. Here, the speed difference between the last 3rd and previous 3rd, last 2nd and previous 2nd steps has a negative value. In other words, by the time of finishing the speed decreases. Such dynamics of speed, in the opinion of V. M. Dyachkov and I. A. Ter-Hovhannisyan, is undesirable, such a tempo-rhythm structure of run-up is irrational.

The decrease in speed, in our opinion, is associated with the fixation on finishing, which, as our study has shown, increases the value of running activity. As a result, the duration of the flight phases of the run increases, which does not contribute to the implementation of effective repulsion. In our case, running activity in the last 6 steps is less similar to running activity in a competitive exercise in running from a low start than in running from a high start. In running from a low start, the differences in running activity are 27.2%, and in running from a high start — 19.2%. These differences between competitive exercise and running from a low start allow you to “set” running from a low start in the hierarchy of running exercises after running from walking and running from a high start.

Thus, the data obtained by us on the differences between the competitive exercise and the long-distance jogging tools made it possible to rank the latter in terms of significance in the following order: I — running from walking, II — running from a high start, III — running from a low start.

Our study of the structure of special jump and running training exercises that are most often used by long jumpers, their kinematic similarities and differences with competitive exercises allows us to more purposefully influence the technical preparation of a long jumper in a year-long training cycle and in multi-year planning.

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DEVELOPMENT OF FLEXIBILITY OF CHILDREN ENGAGED IN TAEKWONDO

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Abstract. Physical education of children in taekwondo. The development of special physical qualities. The effectiveness of the use of specific exercises in increasing flexibility contributing to the growth of competitive activity of children involved in taekwondo.

Keywords. The specificity of the exercises. Flexibility in Taekwondo. The role of the amplitude of movements in technology. Control exercises. Physical fitness.

Any movement of a person is due to mobility in the joints. In some joints - the shoulder, hip - a person has greater mobility, in others - knee, wrist, ankle - the range of motion is significantly limited by the form of the joints and the ligamentous apparatus. Usually, in everyday life, a person rarely uses the maximum mobility that he has in his joints, however, in sports practice in many sports, work is underway to increase its level.

Lack of mobility in the joints limits the level of manifestation of strength, negatively affects the speed and coordination abilities of children involved in taekwondo, reduces the efficiency of work, affects their technical readiness.

At the current stage of taekwondo development, athletes are more likely to use complex attacking actions, in particular, shock actions with spins. The effectiveness of the methods for performing these techniques in the process of competitive activity is largely due to the level of development of flexibility [2, 3].

Over the course of a person's life, the size of articular surfaces, the elasticity of muscles and ligaments, and intervertebral discs changes significantly, which determines the amplitude of mobility in joints and well-being towards the development of flexibility. According to many authors who studied the change in flexibility at different age stages of teaching children at school, they noted that its most favorable development is observed in

the periods of 8–11 and 14–15 years, with its slight decrease in the period of 12–13 years, when marked morpho - functional changes in the musculoskeletal system in boys.

In connection with the existing fluctuations in the dynamics of changes in the level of flexibility in adolescent boys involved in taekwondo, and the importance of manifesting it in this sport, this topic is relevant.

The objective of the study was to identify a set of tools and methods for the development of flexibility in children 12–13 years of age involved in taekwondo, corresponding to the structure of this sport and experimental verification of the effectiveness of the exercises on the development of flexibility in children of the studied age.

Object of study, the process of physical preparation of adolescent children specializing in taekwondo wrestling.

Subject of the study, checking the effectiveness of special exercises on the flexibility of adolescent children engaged in taekwondo.

Hypothetically efficacy was assumed of the positive impact of specially targeted exercises on the development of flexibility in children 12–13– years of age involved in taekwondo, changing the methods of performing the techniques of this martial art and the effectiveness of participation in competitions.

According to a literature review, coordination abilities, as well as the accuracy of strikes in taekwondo, depend on the motor preparedness of the athlete himself. The greater the stock of motor skills an athlete owns, the faster and more efficiently he solves problems that are difficult in a coordinating sense. The main criterion for technical skill should be recognized as the effectiveness of actions and their high stability. However, it is necessary to take into account the basic factor - physical fitness, the level of development of special motor qualities that determine the athlete's potential to achieve high results [1].

Essentially, this is the main principle underlying the management of the process of improving sportsmanship. The solution to the question of optimizing the relationships of many variable factors determines the training effect.

The experiment was conducted on the basis of SBEI secondary school. The experiment was attended by students of grades 6-7. Experimental group "E" consisted of 15 boys who, in addition, during extracurricular time, were engaged in the taekwondo section. Training sessions were held at the school in which the children studied. The control group "C" also consisted of 15 boys of the same grades who were engaged in physical education three times a week, but did not attend the section. During the lessons in the

section, children of the "E" group performed a large amount of exercises aimed at improving physical fitness, for this we selected a set of exercises that carry actions aimed at flexibility. Taekwondo is a type of martial arts in which most of the techniques are performed with the feet and at the same time, movements are performed with a wide amplitude.

Children of the control group "C" during the lessons of physical education used the proposed exercises taking into account their orientation in addition to the program on physical education. The experiment continued during the school year.

All children were tested at the beginning and end of the experiment.

The block of tests consisted of a group of exercises characterizing the level of physical fitness, and tests characterizing the level of flexibility (mobility) of the joints involved.

Tests characterizing the GPT: shuttle run 3x10 (sec); 30 m run (sec); 1000 m run (sec); long jump from a place (cm); jumping rope (number of times in 30 seconds); pulling up from the position of the hang (number of times).

Flexibility tests:

- leaning forward from a sitting position, with the floor touching beyond the level of the heels of the legs;
- cross leg spreading. From the starting position, standing with his back to the gymnastic wall, at a distance of 0.5 meters, one leg was set against the gymnastics bench, the other without emphasis and could freely slide on the floor. Measurement of the amplitude of movement was carried out from the inside between the heels of the legs bent to the sides. The participant must observe the vertical position of the torso, do not take the pelvis back. Hands were allowed to adhere to the gymnastic wall to maintain balance. In the process of performing flexibility exercises, it was allowed to use a leg that was comfortable for the student.
- Side leg swing. The student stood with his back to the gymnastic wall, leaning his hands. A circle 2 meters in diameter was drawn on the wall and dividing it according to degrees (360º). The student performed lateral swings (preliminary 2-3 swings, and the next he tried to do with greater amplitude). The trainer, who is also a teacher, controlled the achieved degree of the leg (on the heel on its inside) and noted the result shown;
- Direct forward leg swing. It was performed from a standing position sideways to the wall, opposite the vertical diameter of the circle. After 2–3 preliminary leg swings, performing the task, the subject performed an active forward leg swing up and down. The trainer (teacher) monitored the level of swing with the foot on a circle scale with degrees.

All tests were performed according to uniform rules, which placed subjects in equal, standard conditions when performing control attempts.

To create an idea of the technique of performing taekwondo techniques, we used a computer and a TV with which we could demonstrate the exercises. This method contributed to the rapid understanding of the order of actions, which helped in teaching children the technique.

We have chosen exercises, on the basis of which we made complexes for using them in training sessions. We included certain exercises from our list in physical education lessons: in the preparatory, main, or final parts of the lessons, and the complete sets of exercises were used with young men in training classes that were held outside of school hours (in sectional classes).

Thus, all children had the opportunity to get the load from a series of exercises aimed at developing flexibility and at the same time, children engaged in taekwondo received a higher load aimed at increasing the level of flexibility corresponding to the taekwondo that they did in the school section.

The data obtained by us on testing children of the experimental and control groups by levels of flexibility indicate positive changes in both groups.

In the forward bend, from the sitting position, for the young men of the “C” group, this shift was 15.43%, while in the “E” group the result increased to 49.75%, which is 34.32% more than in the group "C".

In the second test - transverse leg spreading - in the control group, the shift was 9.68% (from 126.14 to 138.36 cm), while in the experimental group it changed to 24.46% from 127.29 to 158.42 cm. The difference between shifts amounted to 14.78% in favor of group “E”.

In this case, we see that in both groups for four tests positive results were obtained in the development of flexibility, but a more detailed comparative analysis showed a greater increase in this physical quality in children of the “E” group.

In terms of the amplitude of the lateral swing by the foot of students in the “C” group, this indicator improved by 18.26%, and in the “E” group by 44.66%, i.e. the increase in the “E” group for this test is more significant - 26.40%. In this case, you should pay attention to changes in the results in this test exercise. If in the other three exercises the actions shown by the performers are most often encountered during physical-sports practice, then the lateral leg swings are less often offered to children, both during the preparatory parts of the lessons and in its main part. Thus, the increase in the development of mobility in the hip joint, aimed at actions in the lateral plane, very well demonstrates the effect of specially directed exercises on changes in amplitude. At the same time, we note that in Taekwondo lateral leads and with increased amplitude are quite common.

In the fourth test, the amplitude of the swing of the foot forward and upward, the trend in increasing flexibility remains the same. In the “C” group, the Mach movement improved by 8.09%, and in the “E” group by 24.37%, which is 16.28% higher than the “C” group. It should be noted that this action - max forward - is most often given to children in physical education lessons both in general developmental exercises and in the study of gymnastic exercises.

Paying attention to the results obtained during the lessons, we again see more clearly that the use of specially designed exercises to increase flexibility (joint mobility) at the age (adolescent) stage contributes to its growth, and the selected exercises for the development of flexibility also favorably affected students of "C" group and all students attending physical education lessons.

And at the same time, we emphasize that the sets of exercises used by us in the training process had a positive effect on the growth of flexibility, which is important for the sport of taekwondo, which children, defined by us in the “E” group, practice.

In the process of learning and training sessions, changes in the physical fitness of students at the same time occurred. The exercises on flexibility (joint mobility) included in the lessons involved all morphological and functional systems, and the difference in the degree of impact on the children of the “E” and “C” groups was manifested in connection with the different orientation of the classes themselves.

Considering the results obtained by testing all participants in the experiment, we can say that the level of results in children has increased, i.e. they began to better perform actions related to the manifestation of the amplitude of movements.

In each of the 7 tests in the “E” and “C” groups, an increase in the level of physical qualities is visible. So, in the 3x10 shuttle race in the “C” group, the improvement was 2.18%, in the “E” group the result increased by 7.03%, which is 4.85% higher than the “C” group.

In the 30-meter run, characterizing the quality of “speed”, in the “C” group the growth was 5.72%, while in the “E” group it improved by 14.4%, i.e. the results of the “E” group on the run got better. In the endurance test, running for 1000 meters, in children of the “C” group the improvement was 9.87%, and in the “E” group - 15.75% i.e. children engaged in taekwondo have become more resilient.

In the long jump from a place that reflects the level of speed-power abilities, students of the “C” group improved their performance by 5.08%, and taekwondo practitioners – by 18.61%, which is higher than group “C” by 13.53%.

In jumps with a jump rope depending on children's speed-strength and coordination abilities, the improvement in the control group was 25.87%, and in the “E” group 53.06%, which is 27.19% higher than the shifts of the “C” group.

In two strength exercises: "torso lift" for the muscles of the back and abdominals; "pulling up" for the muscles of the hands, the increase in results is also high.

As a result, in the “C” group for raising the torso, the result increased by 10.31%, in the “E” group – by 46.44%, the difference was 36.13%. by 46.20%, at the same time in the “E” group the increase was 110.06%, while the difference in results between the groups was 73.86% in favor of the “E” group.

As a result of a comparative analysis of changes in levels of physical fitness between groups “E” and “C”, higher changes in the “E” group can be noted due to the fact that children with great desire additionally studied in the section and increased their physical fitness, which is necessary for taekwondo. At the same time, it should be emphasized that exercises for flexibility and GPT in the “C” group, which were partially changed at physical education lessons, helped to increase physical fitness in children as a result of three-time physical education lessons.

Summing up the results of the experiment, it should be said that the children of the “E” group, increasing the complex of physical qualities, as well as the level of flexibility, more easily began to master complex taekwondo techniques, manifesting themselves more actively in sparing, thereby demonstrating an increased level of their physical and technical readiness.

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«LONE WANDERER» OF RUSSIAN LITERATURE

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Abstract. The article considers the role of the Russian novelist of the 19th century Nikolai Semyonovich Leskov, who pushed his hard way into the "big" literature through a "folk" topic, the interpretation of which was not always positively evaluated by critics. In this regard, we attempted to analyze the early works of the writer. The authors substantiate the position that Leskov is a true Russian patriot, who was one of the first in Russian literature to show the national identity and Orthodox worldview of a Russian person.

Keywords: Russian writer, philosophical maxims, rejection by critics, female images, folklore motifs, characters - the righteous.

Russian novelist Nikolai Semyonovich Leskov has come a long, very difficult life and literary path. Neither his contemporaries nor the majority of readers of the modern world appreciated his work. Leskov's works, although enchanting with their bizarre language, seemed to many readers too fanciful. Therefore, they are not for popular culture, and cannot be bestsellers. Leskov's works were created for a different type of reader: serious, thoughtful, understanding, reflective about someone else's pain and suffering.

Leskov surprises us with his ability to tell the bitter truth about a Russian man, sometimes impartial, turning out vile things and abominations, from which he is not free, like any other people, but at the same time always believe in his "cleansing", natural and moral strength.

The writer's maximalism manifested itself in a special look at the fate of Russia and its history. "Weirdies, right, weirdies! They are bothering about Russian people, but they don't know the Russian people. Here, you see, faith is inborn, and it lives with a person at home, in clover... Those

who have nobody to rely on like we do, the God is the helper…» [1, p.10] – these words belong to one of the Leskov's characters and can be taken as a philosophical maxim of a Russian person' soul. Leskov was one of the first in Russian literature who managed to show the national identity and Orthodox worldview of a Russian person, in which mind and faith, will and humility, obedience and audacity, mercy and love merged. Leskov belongs to the idea that he did not study the people in conversations with the St. Petersburg cabmen, but lived among the people [2].

The 60s of the 19th century were a turbulent and difficult time in the public life of Russia: government reforms, political clashes, and the growing authority of revolutionary democracy, a split in all spheres of public opinion, confusion of minds and confusion of thought. Russian literature experienced these circumstances very painfully. Almost every writer chose his/her niche in the literary stream, divided into movements and currents.

N. S. Leskov stood apart in this historical period of Russian literature. He was outside of any literary movements and currents. Either the right wing or the left wing did not accept Leskov, and he continued to be himself: neither a Narodnik, nor a Slavophile, nor a Westerner, nor a liberal, nor a conservative. A future connoisseur of the soul and life of the people comes to literature in adulthood as a journalist. He is concerned about topical issues related to the life of a simple people living in conditions of public evil. Moreover, exposing it, the writer did not share the ideas of revolutionary transformations, he believed that it was necessary "not to protest, but to do something" [4, p. 96].

The motives of his work do not have an expansion paradigm; he was completely faithful to his favorite topic - the people. The Russian way of life, Russian folklore, Russian original language, Russian outlook and worldview gave the writer the opportunity to deeply and thoroughly study folk philosophy and find it to be used in his work.

In all the ugliness, Leskov's works show the cruel customs of serfdom, ruined fates, and the "deaf" life of a merchant or peasant family. "The Hairdresser", "Sarcastic" and "The Life of a Peasant Woman" – these novels amaze with the brutality of morals generated by serfdom and the talent of a writer who showed his difficult attitude to the problems of the people. As a journalist he is concerned about topical issues related to the life of a simple people living in conditions of public evil. Leskov's characters from the people appear in Russian literature, possessing amazing internal beauty and spiritual strength, despite the imperfection of the surrounding life. N.S. Leskov shows that people are led to hard labor by both their ignorance and their pride. The writer accepted the desire of progressive forces to sow

distrust of the authorities, to aggravate relations between different sectors of society, to shake people's faith in God for evil no less than serfdom. Considering the only correct evolutionary improvement of Russian society through reform, he does not hide his attitude to all kinds of "nihilism" [2, p.21]. In his early novels, the main idea of his work is traced: the life of Russian people of different classes. Maxim Gorky correctly noted that Leskov did not write about a peasant, not about a nihilist, not about a landowner, but always about a Russian person [3].

Earlier, the democratic forces of society were dissatisfied with the way that I.S. Turgenev portrayed the nihilist Bazarov in his novel “Fathers and Sons”, considering his image to be caricatured. N.S. Leskov not only denies nihilism in his novels, but also shows its perniciousness, trying to analyze this phenomenon sufficiently objectively. The novel “No Way Out” (1864), “The Bypassed” (1865), “At Daggers Drawn” (1870-1871) belong to the category of genuinely anti-nihilistic novels. The "Progressists" met these works with indignation and declared Leskov's entire work hostile to the entire democratic movement. A real anathema to his work was an article by D.I. Pisarev's “Walks in the Gardens of Russian Literature,” in which the critic warned all of Russian journalism. “It was almost a murder” [3, p.792] - Maxim Gorky said after half a century. Leskov suffered such harassment that he was forced to leave the country. Twenty years later, in the article “On Whispers and Printers”, Leskov wrote: “For twenty years in a row ... I carried a vile slander, and it did not spoil much - just one life ...” [2, p. 28].

What did the writer Nikolai Leskov do that caused the anger of criticism (of a certain direction)? Over time, today's researchers note that in the art world of Leskov reflected the search for such a development in Russia, which allowed to rely on national traditions and cultural values. Through struggle and suffering, the idea of spiritual, indestructible staples, deep respect for the moral concepts that the people created, defended and passed on to subsequent generations was hatched.

He is increasingly attracted to complex, contradictory characters, not able to withstand the harmful influence and power of reality surrounding them, and hence subject to moral self-destruction. He especially succeeds in female characters: strong, passionate, capable of both sacrifice and crime. In Russian reality, “Shakespearean passions” were in full swing. Angelic patience often led to a diabolical rebellion, a reluctance to obey a formula that has been forged for Russian women for centuries: both about the “woman’s poor mind”, and about “marry first and love will follow”, and about “God suffered a lot and willed that suffering should be our lot”. Among these female characters can be referred two striking female im-

ages - Katerina Lvovna Izmailova, “Lady Macbeth of the Mtsensk District” (1865) and the carpenter’s wife Anastasia Prokudina, “The Life of a Peasant Woman” (1863). Readers were presented with incredible strength and meaning characters of the heroines, who contained the cause and effect of love-disaster themselves, and drank the full amount of their sinful love.

In the early 70s of the 19th century, the works of Leskov, including the novel “The Cathedral Clergy” began to be reprinted in the most famous magazine of the time “Patriotic Notes”. New characters appear - “fighters of the spirit”, the righteous, on whom, as you know, the Russian land rests. This is the main character of the novel "The Cathedral Clergy" Savely Tuberozov, who calls himself a Russian priest. The narrator’s “own voice” sounds in one of Leskov’s most remarkable novels, “The Enchanted Wanderer” (1873). Innocence and unselfishness, magnanimity and courage, kind-heartedness and peacefulness, firmness and patience are invariable features of Ivan Flyagin. At the same time, the testing of the soul, the most difficult test, leads him to achieve the character's early missing qualities. He acquires humility, a great virtue, which is associated with the knowledge of his sinfulness and unworthiness, his weakness and a sense of God's greatness. Thus, the whole life of Flyagin becomes a movement through humility and repentance to salvation.

“As an artist of words N.S. Leskov is quite worthy to stand next to such creators of Russian literature, such as L. Tolstoy, N. Gogol, I. Turgenev, I. Goncharov. Leskov’s talent is not much inferior in strength and beauty to the talent of mentioned creators of the sacred scriptures about Russian land. In terms of the breadth of the manifestation of life, the depth of understanding of its mysteries, his subtle knowledge of the Great Russian language, he often exceeds his predecessors and allies”- Maxim Gorky wrote about Leskov [3, p. 793].

However, as the novelist N.S. Leskov was not needed in his time. The "Lone Wanderer" of Russian literature Leskov reached the new century and turned out to be very popular. Among those who experienced his influence are F. Sologub, A. Remizov, E. Zamyatin, B. Zaitsev, I. Shmelev. Moreover, the new Russian literature responded precisely to that which was not accepted in N.S. Leskov’s time.

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LEXICAL INTERACTION OF THE MODERN GREEK LANGUAGE WITH GERMANIC AND ROMANCE LANGUAGES (WITH REFERENCE TO THE VOCABULARY OF ENGLISH, FRENCH AND MODERN GREEK LANGUAGES)

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Abstract. The article deals with the issues of lexical interaction of the modern Greek language with Germanic and Romance languages (represented by English and French). There were singled out two areas in which this lexical interaction is rather significant: the vocabulary related to food and drinks and the vocabulary used to designate objects and concepts of clothing, shoes, haberdashery and perfumery. The impact of Greek on Germanic, Romance and Slavic languages is given attention to. The issues of phonographic adaptation of French and English words in modern Greek are considered.

Keywords: modern Greek, Germanic languages, Romance languages, loanwords, lexical interaction.

The processes of lexical exchanges linking the Greek and Western European languages have a long and rich history. Greek, especially in its classical version (ancient Greek), along with Latin, is one of the main suppliers of lexical borrowings in Western European languages. It should be noted that between the Latin and ancient Greek languages there was an

intensive exchange of vocabulary, with an overwhelming preponderance of words of Greek origin (Grecisms) in Latin. So, for example, M.G. Nordkin, L.V. Tokmakova write: “Greek culture and science had a huge impact on the development of Roman science and culture. As a result, many Greek words penetrated the Latin language” (Nordkin Tokmakova: 141) and went through phonographic adaptation in it. The same fact is pointed out by Yu. F. Schulz and coauthors: “From the moment the Romans conquered Greece (in 146 BC) - a country of a higher culture - there was a mutual influence and enrichment of cultures and languages - Greek and Latin.” With a certain degree of conventionality, one can consider modern Romance languages, and, of course, to a much lesser extent, some Germanic languages (primarily English with its Latinized vocabulary), as continuers of the Latin tradition. The presence of a significant number of Grecisms (or Hellenisms) in many languages of the world is pointed out at by V.M. Pankin, A.V. Filippov (141). E.V. Marinova (71-72), as well as V.M. Pankin, A.V. Filippov (36) noted a large number of Grecisms in the Russian language (including in the field of proper names). There obtains a rather significant number of words of Greek origin in the Russian language, including those denoting everyday objects and concepts. O.V. Pogabalo, A.V. Ivashko, V.N. Catello in their Preface, dedicated to the memory of Fyodor Dmitrievich Stambulji (who, until his premature death, was chairman of the Donetsk Society of Greeks), write: “At our first acquaintance with the Greek language, we find in it a lot of similarities with Russian and Ukrainian ... because many Greek words have entered the common European vocabulary. ” (3) Among the European languages the largest number of borrowings from Latin and Greek are to be found in English and French. In particular, T.A. Rastorgueva comes to the conclusion that the bulk of borrowings from Greek came into English during the Renaissance (many of them through the Latin language) (Rastorgueva: 306). The corpus of Greek borrowings in English continued to be replenished with a huge number of new words and throughout the 17th-20th centuries. (Rastorgueva: 309). K. Brunner notes that in the English language “Next to borrowings from the Latin language came borrowings from Greek. Greek words penetrated into the English language already in the Old English and Middle English period...” (171). B. Ilyish writes: “Greek yielded English a number of terms of science and political life. Almost all of these are international words. Many of them came into English through either Latin of French. Here belong such words as epoch, anarchy, aristocracy, democracy, physics, geometry, etc.” (249). Many Grecisms in English are easily recognizable due to their spelling, which facilitates their identification. So, such borrowings often include the following combinations of letters: ph, pronounced [f], ps,

pronounced [s] and ch, phonetically equivalent to [k]: phonetics, psyche, psychiatry, scheme, archives (Rastorgueva :310). Practically at the same time, the processes of borrowing Greek vocabulary took place in the French language, which resulted in the presence in modern French vocabulary of a huge number of words of Greek origin, the distinguishing feature of which is also the use of the letter combination ph to denote the Greek sound [f] (photographie, bibliographie) and ch for conveyance of the Greek sound [x] (Christ, chrême, chœur). For its part, the Greek language is not inclined to borrow foreign vocabulary. In this regard, it can be compared with Hebrew, mostly preferring to deal with its own lexical material (Boichuk Eshchenko: 2014, URL) or the Hungarian language (Boichuk: 2010, 301-304). V.P. Neroznak among sources of borrowings in the modern Greek language mentions Romance, Slavic and Turkic languages (Neroznak: 1990, 119), not including English here.

At the same time, there are certain lexical fields in which the analysis of the empirical material reveals a rather significant proportion of borrowings from modern Western European languages - English and French. We believe that one of these fields is vocabulary related to food and drinks. Borrowings from English and French in this area can be divided into five main sections.

(1) Main dishes and side dishes: ροζμπίθ (roast beef) – roast beef, θρικαζέ (fricassee) – fricassé, ομελέηα (omelette) – omelette, μπιθηέκι (steak) – beef steak, ραγκού (stew) – ragoût, κρέπες (pancakes) – crêpes, ποσηίγγα (pudding) – pudding, γαρνιηούρα (garnish) – garniture, κοηολέηα (/chop / cutlet) – côtelette, etc.

(2) First courses: ζούπα-κρέμα (mashed soup) – soupe-crème, κονζομέ (/clarified/ broth) – consommé, ζούπα (soup) – soupe;

(3) Confectionery and pastries: κροσαζάν) – croissant, καραμέλα – caramel, δελέ (желе) – gelée or jelly, κεκ, κέικ – cake, μπιζκόηα – biscuits, μαρμελάδα (джем, мармелад – the origin of this word is Portuguese, but most likely it got into Greek from English) – marmalade etc

(4) Snacks and appetizers: δαμπόν (ham) – jambon, μπέικον – bacon, παηέ – pâté, ηζιπς – /potato/ chips, ζαλάηα – salade, ζάνηοσιης – sandwich, ροκθόρ – Roquefort (cheese), κροσηόν – croûton etc;

(5) Drinks, mainly spirituous liquors: οσίζκι – whisky or whiskey, ρούμι – rum, μπράνηι – brandy, αρμανιάκ – armagnac, μπύρα – beer, ηόνικ – tonic, νηεμι-ζέκ – demi-sec, ζέκ – sec, ζπράιη – Sprite®, Βοσργοσνδία– Bourgogne, νηδιν – gin, κόκα-κόλα – Coca-Cola®, κοκηέιλ – cocktail, κονιάκ – cognac, λικέρ – liqueur, πέψσ-κόλα – Pepsi Cola®, ζαμπάνια – champagne etc;

In addition, Greek borrowed a number of lexical units related to the organization of catering from the Western European languages - English and French: γκαρζόνι (waiter) – garçon, ζερβιηόροδ (server) – serviteur (fr. servant, cf. serveur server, μπαρ (bar) – bar, ρεζηωράν (restaurant) – restaurant (the word ρεζηωράν functions along with εζηιαηόριο). This section is notionally adjacent to the previous five. Thus, we see that in four sections out of five, both English and French borrowings are presented.

Among the names of drinks, words borrowed from the English language are clearly quantitatively predominant.

(In this area of Greek vocabulary there are borrowings from the other languages, for example, βόηκα – vodka, ρακί – turk. Rakı – raky). Gallicisms prevail among the borrowings for second courses. The borrowed names of the first courses are represented exclusively by Gallicisms. This fact can probably be explained by the great prestige of French cuisine. As for the second and third sections, then in them Anglicisms and Gallicisms are represented approximately equally.

The second lexical field, where borrowings from French and English are quite widely represented, are related sections of the vocabulary used to designate objects and concepts of clothing, shoes, haberdashery and perfumery.

So, there is great proportion of Anglicisms, and especially Gallicisms, denoting items of clothing and linen. Gallicisms are Greek words such as: κοστούμι (suit), κιλότα (women's pants), παλτό (coat), καλσόν (tights), μαγιό (swimming trunks), σουτιέν (bustier), μπλούζα (blouse),γραβάτα (tie), ζαρτιέρες (suspender belt), ταγιέρ (dress suit), κομπιναιζόν (garter), ρόμπα (bathrobe), μαγιό (swimsuit). One cannot omit the French origin of the word παντελόνι (pants). It is possible, however, that it comes from the Italian pantaloni. English vocabulary is much less massive in this area: πουλόβερ (pullover), σλιπ (men's underpants).

As for the shoes, Gallicisms also prevail here: παντόφλες (slippers), μπότες (boots), perhaps, κορδόνια (shoelaces).

In the field of vocabulary related to haberdashery, we found the following Gallicisms: πορτοφόλι (wallet, purse), βαλίτσα (suitcase), and Anglicism ομπρέλα (umbrella).

Among the vocabulary belonging to the field of perfumery, the following Gallicisms are revealed: λοσιόν (lotion), βερνίκι (nail polish), Κολωνία (eau-de Cologne), κρέμα (cream), κραγιόν (lipstick), πούδρα (facepowder).

Naturally, English and French borrowings are represented in the Greek language not only in the areas under consideration. They are available

in other thematic sections of vocabulary, for example: παρτι (party), βιτρίυα (showcase), αφίσα (poster), μπαλαρίνα (ballerina), μιζαμπλί (set), φαβορίτες (whiskers, hackles), τουρίστας (tourist), μασάζ (massage). There are also loan-translations: ουρανοξύστης (skyscraper).

Borrowings from English and French are subject to phonographic adaptation in the Greek language, expressed by the substitution of the sounds of the source languages by the acoustically closest Greek phonemes, followed by the writing of these words in letters of the Greek alphabet. Sounds that are absent in the Greek phonetic system are substituted with the help of more or less closely sounding Greek phonemes. So, for example, the French sound [ʒ] when adapting a borrowed word is replaced by [z], graphically conveyed using δ, the French ch [ʃ] is replaced by ζ [s]. French nasal vowels are conveyed using a combination of vowel + nasal consonant. English diphthongs lose diphthongization, but this does not always happen, it can often persist.

The English sound [dʒ] is changed into [dz], [tʃ] – into [ts]. The English and French sound [b] is conveyed with the help of the letter combination μπ, pronounced in the initial position and in the original Greek words like [b] (but, for example, Βοσργοσνδία – Bourgogne). To convey the English and French sounds, roughly corresponding to Russian o, both o, ό and ω are used.

In general, in the sphere of borrowing between English and French (as representatives of Germanic and Romance languages) on the one hand and Greek on the other, both qualitative and quantitative asymmetries are clearly observed.

Thus, Greek borrowings in Western European languages are represented mainly by scientific terminology and abstract vocabulary related to culture, art, music, philosophy, architecture, etc. The number of these borrowings is huge.

Greek borrowings in most European languages, including East Slavic, make up a significant part of the lexical fund of internationalisms.

Modern Western European languages also borrow modern Greek culinary and gastronomic vocabulary, for example, Eng. Feta, Fr. Feta – Φέηα, Eng. moussaka, Fr. moussaka – μοσζακκάς, pita - πίτα, ζέα - zea, saganaki - σαγανάκι. One cannot resume, however, that all these borrowings were included in the general vocabulary of the English and French languages and are known to all native speakers of these languages without exception.

As for borrowings from English and French in Greek, their number is very limited.

Anglicisms and Gallicisms are used mainly to refer to concrete everyday objects and concepts, and the vast majority of them are exoticisms.

Based on the analysis of the lexical composition of the modern Greek language, we can conclude that this language is distinguished by pronounced purist tendencies and the number of borrowings in it from both Romance and Germanic languages is very limited.

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TRANSLATION OF PROPER NOUNS IN VIDEOGAMES IN ENGLISH-RUSSIAN LANGUAGE PAIR[1]

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Annotation. The given article is devoted to the issues in translations of the onims functioning in the videogames area, from English into Russian. Authors have analyzed 5 type of translation of anthroponyms and toponimes: transliteration, transcription, transposition, loan translation, cultural adaptation. The conclusion is that for some elements it is not always possible to find an analogue in the translation language, therefore, units of approximately equal strength and value are used.

Key words: translation, localization, proper nouns, linguistics, philology.

Today videogames are a huge part of modern entertainment industry. With more than 2 billion of overall number of users, it is still not researched in terms of philology and linguistics.

In this field we will be using the term “localization” because it includes all levels of translation, from text to voiceover and visual interpretation. It is also worth to notice that in videogames there are no particular rules of translation.

Alexey Medov, the head editor in Inlingo Localization Studio, has pointed several levels of localization in videogames (Features of localization of games in foreign markets,2017). The rate was based on the depth and amount of translation units:

1. “Boxed localization”.
2. Localization of the interface.
3. Localization of all texts.
4. Voice localization (Voiceover).

[1]The study was supported by the Russian Foundation for Basic Research, projects № 20-012-00136

5. Graphical localization
6. Cultural adaptation

As we can see, translation of proper names is included in all the levels, given above. Based on its definition, proper noun should have no analogs and be unique. Proper name itself is " the name of a *particular* person, place, or thing that is spelled with a beginning capital letter"(Cambridge dictionary,2000). So, generally, there is no necessity in translation of this type of translation unit. But in most cases it is required to adapt an original name to the target language, because there might be phonetical, lexical inconveniences.

When talking about proper nouns, there are next categories: anthroponyms (proper nouns that mean first name or second name of a particular person or a name which is not associated with someone in particular in the collective's mind), toponymes and general names of companies, organizations etc. There are several mechanics for adequate language interpretation. These are transliteration, transcription, transposition, loan translation or a combination of all previous techniques (Solomykina A.S., Kashirina N.A., 2013). We should notice that it mostly depends on the translation or a translation department that are in charge for localization process on how will the final text look like and what tools they are going to use.

Transliteration means a complete rewriting using the source language alphabet, letter by letter. The written form of the name with this method of translation is distorted minimally, which is its main advantage. However, the sound envelope may be distorted, since very often during transliteration, the borrowing language imposes a pronunciation that matches its own reading rules. Therefore, it is better if the proper noun in the translated text is transmitted as close as possible to its original sound.

Altaïr (6 letters, 6 phonemes) ibn (3 letters, 3 phonemes) La-Ahad (2 letters, 2 phonemes- 4 letters, 4 phonemes) - Альтаир (7 letters, 6 phonemes) ибн (3 letters, 3 phonemes) Ла-Ахад (2 letters, 2 phonemes- 4 letters, 4 phonemes). [Assassin's Creed, 2007]

Arno (4 letters, 4 phonemes) Dorian (6 letters, 6 phonemes) - Арно (4 letters, 4 phonemes) Дориан (6 letters, 6 phonemes). [Assassin's Creed, Unity, 2014]

Nilfgaard (9 letters, 9 phonemes) - Нильфгаард (9 letters, 9 phonemes). [The Witcher, 2015]

In the given samples phonetical background was not affected by the transliteration and voiceover in the Russian version may be considered adequate. But it is not a common approach since there might be sound discrepancies, like in the game "A plague tale: innocence":

Amicia [Λ:mi:θi:ə] - Амиция [Λ:mi:tsiə]. [A plague tale: innocence, 2019]

The second method is transcribation/transcription (reproduction of the sound of an original word in the target language). Since the immersive factor in videogames requires players to receive information mostly by sounds, it is a very effective tool for translators. The phonetic structure is barely changed and morphemes are generally similar in both languages.

In the "Bioshock" game series translators used this method so in Russian localization all the phonetic features have been saved

I am *Andrew Ryan*, and I'm here to ask you a question.

Я — Эндрю Райан, и я пришел, чтобы спросить у вас. [Bioshock, 2007]

Cintra (location, mentioned in "The Witcher" game series) - Цинтра [The Witcher game series, 2007-2016]

In both sentences the pronunciation of the proper nouns will be the same. Nowadays, the leading method in localization practice is transcription with preservation of some elements of transliteration.

Some game studios can use the same method through years and others may change if from project to project. Ubisoft, a company that has made the Assassin's Creed series, has another successful franchise. Each part of Far Cry game has its own heroes and here we can observe so-called etymological equivalence or transposition. The point of this method is etymological representation in the target language. For example, name *John* (John Seed, antagonist of the "Far Cry 5", 2018) was translated as *Иоанн* in Russian version, though it is mostly translated as *Джон* while *И*оанн refers to the name *Ivan* and replicates in English as *Ivan.* The names of monarchs and religious figures are translated using transposition: *Robert de Sable - Робер де Сабле*, when literal translation of the name should be *Роберт* [Assassin's Creed, 2007].

The next type of discourse localization of proper nouns - loan or literal translation - often accompanies by various transformations (morphological, syntactic, etc.), for example, a change in the order of tracing elements. Of course, this method of translation is combined with others - transcription, transliteration. This method is called mixed (a combination of transcription and semantic translation) and is often used in cases where the name includes a meaningful word.

In general, it is important to consider a proper name of a videogame in the whole context (Domnina A., 2015). For example, in the game "Warcraft" the location *Tirisfal Glades somehow was translated as Тирисфальские Леса w*hich is not adequate in terms of representation, since the word *Лес means Forest* and cannot be considered as a synonym of *Glade* [Warcraft, 2004].

One of the most common translation methods is cultural adaptation. For localization it means translating all the visible elements, except the code: interface, cover, dialogues, subtitles, elements of the game like books, newspapers and etc. In terms of textual rewriting cultural adaptation means finding an equivalent in target language that will be perceived adequate. It may affect the phonetic and morphological similarity, though the cognitive function will grow. *Dandelion*, (The Witcher game) was localized into Russian as *Лютик* `buttercup`. [The Witcher game series, 2007-2016]. The Russian and English versions of the game are quite different. The original is English localization. But the localizers of the Russian version widely used Polish as the source - the original language of books and creators of the game, so in some places the translation more accurately conveys the meaning of names and titles (The Witcher 3: Wild Hunt: How Localizers Translated Names, 2019). In Polish version this character was named *Jaskier* which is buttercup in English.

In the game, based on a book series, The pillars of the Earth, the name *Aleina [Λleinʌ]* was replaced with a Turkic equivalent *Алина [Λlinʌ]*, because it is a well known name in Russia [The pillars of the Earth, 2017]. Name *Vitalis [Vi:tΛli:s]* of a protagonist is adapted into Russian with the word *Виталий [Vi:tΛlei].* [A plague tale: innocence, 2019].

We have observed the next methods of translation: transliteration, transcription, transposition, loan translation, cultural adaptation. In conclusion, we can note that all the given methods of proper names' translation in videogames are widely used nowadays. The result of translation is always differs depending on the chosen method (Fatkullina F.G., Kazantseva E.A., Elvira K. Valiakhmetova E.K., Almira K. Sulejmanova A.K., Anokhina S.Z., 2018). The result of localization may change the language unit on phonetic, morpheme and cognitive levels and should be translated as a part of the whole text and be a part of a particular videogame discourse.

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METALANGUAGE SUBSTANTIALITY GERMAN AND RUSSIAN FAIRY TALES

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Abstract. The article deals with the features of such type of German and Russian folklore as a fairy tale – a literary work, which is heterogeneous in content and form. The peculiarities of its origin, the genetic relationship with myths, the formation of German and Russian linguocultural community in different epochs as well as the issues of its relevance in modern study are considered.

Keywords: folklore, fairy tale, genre, motive, plot, linguocultural community, comparative mythology.

One of the most popular types of oral folk art of the German and Russian peoples is a fairy tale, which is a heterogeneous work, both in content and in form, which were originally associated with myths, and subsequently underwent artistic processing and became part of folklore prose.

In modern linguistics, the questions of studying the fairy tale itself and its linguistic features remain, as is known, still open, due to the lack of a clear definition of its genre up to our days.

According to sources of different time periods, the term "fairy tale" in different languages is transformed ambiguously. In Latin, it is “fabula”, which has many different meanings: *conversation, gossip, subject of conversation,* as well as a *story*, including a *fairy tale* and a *fable*. In the meaning of the latter, it is also used in German. And only in XVII the word "fairy tale" first begins to be used as a term denoting those types of oral prose, which is primarily characterized by poetic fiction.

In the Russian language until the XVII century, the terms *баснь* or *байка* were used to name this genre of folk art. In German, the term *Märchen*, is used, that is, a short story (kurze Erzählung), the origin of which is associ-

ated with the word *Mär* or *Märe* (*high, obsolete,* tale, legend; an incredible story) with the addition of the diminutive suffix *-chen*. Its meaning is interpreted by Duden's dictionary as the news of *Nachricht*, the legend of *Sage*. In the same form, this word begins from the XIII century to gradually become fixed in the meaning of "fairy tale".

Currently, in German linguistic culture, among others, we note the following definition of the concept of "fairy tale": "Ein Märchen ist eine ursprünglich überlieferte Erzählung, die wunderbare Begebenheiten schildert. Unter Märchen verstand man unwahre, wunderbare Geschichten, die man sich zum Spaß und zum Zeitvertreib erzählte [10]. That is, a fairy tale – is an initially verbally narrated story that describes miraculous events and incidents. Under "fairy tales" they understood fictional amazing stories that were told for pastime and fun.

In the S.I. Ozhegov dictionary of the Russian language, we also note a rather concise and capacious definition: A fairy tale is a narrative, usually folk-poetic work about fictional faces and events, mainly with the participation of magical, fantastic forces [4].

According to the largest collector and researcher of the tale A.I. Nikiforov: “Tales are oral stories that are popular among people for the purpose of entertainment, having events that are unusual in the everyday sense (fantastic, miraculous or everyday) and are distinguished by a special compositional and stylistic structure” [3].

A comprehensive study of fairy tales was carried out by many German linguists, including the brothers Jacob and Wilhelm Grimm. Over their entire lives, they have managed not only to collect and process more than two hundred fairy tales, but also to preserve the language and spirit of the people in them. They own, for example, the fairy tales “Snow White and the Seven Dwarfs”, “The Golden Goose”, “The Brave Tailor”, “Town Musicians of Bremen”, “The Twelve Brothers”, “Hansel and Gretel”, “King Thrushbeard”, “Snow Maiden”, “Golden Key” and many others.

By the beginning of the XIX century, a huge number of fairy tales had been collected and the urgent need was introduced to introduce a certain orderliness in this genre of folk art. To give a definition of the concept of a fairy tale, an analysis of historical premises was required to carry out their classification. One of the first to begin this work was A.N. Afanasyev, who laid the basis of his classification as a plot principle, and the principle of typing a hero. According to the first principle, he identifies fairy tales-chains; tales of animals; fairy tales and everyday tales. A little later, the classification of V.M. Miller, who managed to group the tales into three types: tales with wonderful content; household tales: tales of animals.

Other German scholars, for example, physiologist, psychologist, philosopher and linguist Wilhelm Max Wundt, with his work Psychology of Peoples. Study of the laws of the development of language, myths and customs. " In this study, he divides the tales as follows: mythological tales fables (Mythologische Fabelmärchen); pure fairy tales (Reine Zaubermärchen); biological tales and fables (Biologische Märchen und Fabeln); pure animal fables (Reine Tier-fabeln); tales of "origin" (Abstammungsmärchen); humorous tales and fables (Scherzmärchen und Scherzfabeln); moral fables (Moralische Fabeln) [10].

In 1924, R.M. Volkov presented a slightly different vision of this issue in his book “Tale. Search for the plot of a folk tale. " In addition to his classification of plots of fairy tales, and he singled out 15 such: about the innocently persecuted; about a fool hero; about three brothers; about serpent slayers; about getting brides; about the wise virgin; about sworn and enchanted; about the owner of a talisman; about the owner of magical items; about an unfaithful wife, etc., he also presented an analysis of individual fairy-tale elements, calling them motives.

The motives, in his opinion, should include the personal qualities of the heroes (for example, “two brothers are smart, and the third's a fool”), and their number (“three sisters”, “three brothers”), and deeds and acts stipulated by the laws of the genre characters, magical creatures and items. Despite the extremely contradictory assessments of this work, this research nevertheless played a positive role. The concept of motive in the research of a fairy tale is still used by linguists in its understanding [1].

According to V.Ya. Propp all of the above classifications have their flaws, as they are based on not quite true signs and principles of division. As a differential sign, according to the scientist, it is necessary to use the structural principle. Defending his point of view, the scientist believes that all tales differ in certain structural laws and, regardless of the plot, the details of the tale have common types of structure. Actually, he considered a fairy tale only a fairy tale, justifying this by the fact that it is a story built on the alternation of functions in different forms, in the absence of some of them for each story and when repeating others [6]. From which it follows that a fairy tale should not be distinguished by signs of magic or miraculous, but by a completely clear composition. In principle, the beginning of a fairy tale is always associated with some kind of “trouble”, then a hero appears, he goes in search of, meets on the path a donor who passes him magic items, etc. At the same time, some actions can be omitted or changed, but the structural construction itself remains unchanged. In his work V.Ya. Propp isolates and descriptively represents 31 functions.

In their significance, for conducting scientific research, the most valuable material is fairy tales, which directly reflect the mental processes of the collective unconscious. Their archetypes, speaking in the most simple and concise form, present us with the key to understanding the processes that take place in the collective psyche.

It should be noted that the question of studying the fairy tale, its linguistic specificity, and especially genres in modern linguistics, is still open. The reason for this is the complexity in determining its genre.

A distinctive feature of a fairy tale is, as V.Ya. Propp notes, is fiction. Some of the fairy tales were also originally associated with myths and had magical meanings. This tale creates a special magical world that lives by its own laws. Events taking place in a fairy tale are impossible in real life. It weakly reflects real life, and everything that comes from reality is in the nature of “secondary formation” [7].

A character in a fairy tale can appear using to various transformations and magic, for example: "оборотился он волком", "в правое ухо зашел – умылся, в левое – снарядился и стал еще красивее прежнего", "превратилась она в лягушку", "Und so verwandelte der Schwan Gwidon mit einem Spritzer des Wassers in eine kleine Mücke", "Er trank und wurde ein Böckchen" and etc.

In both German and Russian fairy tales, not only space is unrealistic, but also the time of the event, for example: "*жили-были*", "*жил-был*", "*жил да был*", "*Es lebte einmal*", "*Es war einmal*", "*Einst lebte*", "*Es ging einmal*", "*Es war einmal" etc*., it is closed and exists only within the bounds of the tale itself. The space of a fairy tale, according to D.S. Likhachev, special, different from the "space of sleep" [2], it is unrealistic and arbitrary.

It is impossible not to notice that German and Russian fairy tales have great similarities. In both of them there are good and evil heroes. Evil is represented in them by unreal, terrible and vile monsters. This is, first of all, witches (Hexen): the most famous of them is the Brothers Grimm fairy tale “Hansel and Gretel / Hänsel und Gretel” (German diminutive names from Johann and Margarita). The story of a teenager brother and sister who is threatened by a cruel cannibal witch, living deep in the forest.

In German mythology, it was believed that once a year in Walpurgis Night from April 30 to May 1, witches on brooms and forks flew to Mount Brocken. It was believed that at this time, when the herbs were gaining miraculous power, a witches' sabbath was arranged.

In Slavic mythology, the night on Ivan Kupala was considered the time of a gathering of witches. In addition, witches gathered at the solstice in

Kolyada and at the meeting of spring, that is, on the most important pagan holidays. The mountains of the pagan Slavs were sacred places of sacrifice and merrymaking. Flying on Bald Mountain, witches were believed to indulge in wild revelry and love affairs, eat, drink, sing songs and dance to the sounds of inharmonious music [8].

In a negative aspect, the Witch is secretive, aggressive and insidious. Therefore, in fairy tales, witches often live away from people as hermits - in a forest or in a swamp. Witches are the sorceress in "Jorinde and Yoringel / Jorinde und Joringel", the godmother in "Rapunzel / Rapunzel", the cook in the "Found / Fundevogel". The witch's image and actions include the stepmother from Snow White / Das Schneewittchen and the fairy tale Brother and Sister / Brüderchen und Schwesterchen, the evil Wolf from the fairy tales "The Wolf and the Seven Young Goats / Der Wolf und die sieben Geißlein" and "Little Red Riding Hood / Rotkäppchen". Two characters of the fairy tale "Bluebeard / Blaubart" and the evil wizard from the fairy tale "Fitcher's Bird / Fitchers Vogel" are especially bloodthirsty.

Our observations indicate that even in those days, the German Witches (Hexen) lived in tidy, pretty, neat little houses. Their houses are made of cookies, pies and sugar, for example, in the fairy tale Die zwölf Brüder: "... es war aber ein kleines Gärtchen an dem verwünschten Häuschen, darin standen zwölf Lilien Blumen / And there was a small garden behind the enchanted house, and twelve lilies grew in that garten. " They are predictable, consistent and, of course, responsible. They always have the order "Ordnung muss sein", "Ordnung ist das halbe Leben" in their house, cleanli-ness, everything is highly organized, everything has its place. All this sheds light on the process of the emergence and preservation by the German nation of their mentality.

The world of fairy tales is wide and diverse: Soulless, White Wolf, Benedict and the lord of the dwarves; Thrifty and wasteful; Pied Piper of Hamelin; Talking donkey; Golden lambs How a boy learned to conjure; Royal shepherd; Swan Lake; Lord of the Dwarves and his bride; Tailor Hans and the smarty beasts; Mermaid; Ryubetsal and Anna; Strongman Gottlieb; Invisible hat and many others.

The Russian fairy-tale world is replete with no less wealth of characters: Babayaga, White duck, Vasilisa the Beautiful, Magic pipe, Magic ring, Geese-swans, Enchanted queen, Ivan Tsare-vich and gray wolf, Kroshechka-Khavroshechka, Boy with a finger, Frost, Sea Tsar and Vasilisa the Wise, Nikita Kozhemyaka, Sister Alyonushka and brother Ivanushka, Sivka-burka, The Tale of Re-juvenating Apples and Living Water, Snegurochka, The Frog Princess, etc.

The traditional element of the tale is the conception, which most often begins with the words: “Жил – был; жили – были…"," В некотором царстве, в некотором государстве жил – был царь… "," Vor einem großen Walde wohnte ein armer Holzhacker mit seiner Frau und seinen zwei Kindern ". In fairy tales, the beginnings are more detailed: “В некотором царстве, в некотором государстве жил был царь…” But often, fairy tales begin directly with a description of the action: "Попался было бирюк в капкан…", "Hinter dreimal neun Ländern, im dreimalzehnten Zarenreich, in einem berühmten, mächtigen Staat lebte einmal ein mächtiger Zar", "In alten Zeiten, esange schon her, hatte ein Zar drei Söhne ”etc.

In fairy tales, there are also peculiar endings that summarize the development of a fictional action. "Живут, поживают и добра наживают" "Da hatten alle Sorgen ein Ende, und sie lebten in lauter Freude zusammen / И настал конец их нужде и горю, и зажили они счастливо все вместе", "Danach lebten Zar und Zarin mit dem Böckchen herrlich und in Freuden, wurden reiche Leute und tranken und aßen zusammen wie früher / После того царь с царицей и с козленочком стали жить да поживать да добра наживать и по-прежнему вместе и пили и ели", "und von nun an lebten sie vergnügt und wurden reich, und ihr Lob war in aller Munde / И стали они жить дружно, в любви и согласии "and so on.

Fairy tales also abound in the presence of repetitions (quite often they are not verbatim). In each new one, you can find individual details that not only help bring the fictional action closer to the denouement, but also enhance the reader’s impression of the action, for example: "Sie gingen und gingen und gingen ... / Сестрица Аленушка и братец Иванушка шли, шли, шли…" and so on.

One cannot but touch upon the fact that in all fairy tales, both in German and in Russian, the reader will see the inner, emotional life of the people. By drawing pictures of the life of the people, fairy tales fix the relationships of people, sharply ridicule the vices of society, protect the oppressed and destitute, and also express the aspirations of the people about justice and the triumph of good over evil.

In German fairy tales, we observe the close proximity of the miraculous, the fantastic with the worldly, real. Before us are pictures of genuine events, cities, kingdoms, forests and provinces. Closely interwoven, these paintings create a vivid image of old Germany, its history and nature.

Thus, the world of fairy tales is very diverse, and the fairy tale itself is one of the oldest forms of verbal art. This is the most popular and most democratic form of verbal art among all the peoples of the world. Each nation invests in it its specific life and social philosophy, determined by life

and history. Meanwhile, everyone understands the tale decisively. It freely crosses all language bounda-ries, from one people to another, and has been kept alive for thousands of years [5].

However, despite the difference between German and Russian fairy tales from each other, there is much in common, for example, the similarity of aspirations, desires and hopes, which also indicates the coincidence of ideals and conflicts in the lives of both peoples, that is, the opposition of poverty and wealth, intelligence and stupidity, industriousness and laziness. It should also be noted that the German and Russian languages created special terms to denote this concept.

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THE PERSON AS THE REPRESENTATIVE OF REGIONAL CULTURE OF TRANSBAIKALIA IN TERMS OF OBJECTIVISTIC APPROACH

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Summary. in article the analysis of objective factors of formation of the personality in regional conditions of the Transbaikal culture is made. Formation of the personality is represented process in which at the same time typical and specific cultural contents in which aspects of daily culture, both material, and spiritual where norms, customs, values enter are reflected is expressed.

Keywords: Regional culture, cultural space, formation of the personality, factors of culture, identity of the objectivistic direction.

Draws A.V. Spiridonov's attention according to which today in the territory of the region there is a process of formation of the mixed population needing the symbols integrating people to the positive nature of influence of regional culture [4].

One of consequences of this interaction is change of cultural traditions, valuable orientations and reconsideration of ideas of itself at the population of Transbaikalia. However, the traditional regional culture created because of long interaction of the Transbaikal people is an essential factor of nationwide cultural policy, which provides sustainable and peaceful development of traditional ethnic cultures in the changing conditions [8]. Today the cultural space of Transbaikalia represents a unique sample of the multi-cultural originality, which does not have analogs in our country [4]. At the same time, as writes V.S. Morozov, action of this variety, despite distinctions, favorably affects process of interaction of regional cultures. She writes that cross-cultural interaction in the territory of Transbaikalia happens not in the form of opposition, and in the form of boundaries of civilization dialogue of a necessary condition for development of regional cultures within the uniform cultural field [4]. According to this point of view, the regional culture of Transbaikalia is reflection of sociohistorical experience of the people living in the territory of this region among whom there are representatives of

various people, religions, and social groups [7]. Conditions of their interaction promoted formation of such historical space within which even during various eras there took place the similar processes connected with formation of the communities based on a certain language unity, ethnic likeness, proximity of economic way [5]. Thanks to influence of these factors, the population living in the Transbaikal conditions characterizes a certain way of thinking, valuable orientations, consciousness installations, moral stereotypes, "the code of behavior" [10].

During the historical period of development of Transbaikalia under the influence of objective factors the type of the person, specific to Transbaikalia, which is in space of the Transbaikal culture, was formed. Among the Transbaikal authors, the greatest influence has the description of this person, which M.V. Konstantinov according to whose opinion, all population Transbaikalia, regardless of ethnic origin and a social status is united by the concept "residents of Transbaikal" [3] gave. The researcher of Transbaikalia believes that the leader for all representatives of the people living in Transbaikalia among whom Russians, Evenks, Buryats, Tatars, Bashkirs, Poles, Germans, Jews and others, understanding of their community is [3]. This community assumes presence of the people who are not simply living in one territory, and having similar mentality, that is especially developed social psychology at the heart of which there is an attitude synthesizing aspects of perception of Asian and European cultures, becoming a point of resettlement of various traditions and priorities [3]. As M.V. Konstantinov believes, the base of mentality of residents of Transbaikal is founded on their priobshchennost to the solar or star sky opened, prevailing on time, which connects the person with infinite space. M.V. Konstantinov's thought is continued by N.V. Sverkunova who turns on such signs of mentality of residents of Transbaikal as peacefulness, mercy, hospitality, generosity, hospitality, morality, diligence, religiousness, prosperity, independence, pride, mockery, self-respect [6].

Significant effect on mentality of residents of Transbaikalia as A.V. Zhukov writes, the heterogeneity, tolerance, compromise nature, cultural and religious syncretism which are shown on the regional field to culture [1] render.

Such characteristic of mentality of residents of Transbaikal represents the most general parameters in which the person as the representative of regional culture of Transbaikalia in terms of objectivistic approach is estimated. However carrying out the analysis of objective factors of formation of the personality in regional culture does not give a picture of personal, spiritual human life in regional conditions of the Transbaikal culture.

The fact that the objectivistic look focuses attention only on an external explanation of cultural behavior of the person as the behavior conforming to these or those the requirements of a natural and social environment standard by rules is the reason of it. At the same time, these researches do not reflect an internal look of the person, neither on the standard rules, nor on themselves. Transfer of external factors, as a rule, assumes that the person mechanically perceives those rules and standards of behavior, which demand from it these factors, at the same time there are no authors who would write how the sense of these rules and norms is understood. Thus, in regional researches of culture and the identity of the objectivistic direction, the question of deeply personal differences of each person, and volume as the moral and spiritual bases of the personality who in terms of objectivism has to represent an example of harmony of the external and internal unity understood, certainly, as manifestation of external dominants are transformed was not raised. Certainly it is necessary to agree with what practically all culturologists differentiates the concept "person of culture", reflecting features of the cultural space surrounding it, and the "cultural person" understood as the developed personality after all richness of her outlook. However, also what means cult urologists have to use is important and use, forming an image of such personality as in most cases researchers of the objectivistic direction, providing lists of factors of cultural influence, create model of the person of this or that culture. At the same time tracing transformations of the specified models of the person of culture, cult urologists offer the arch of idealized portraits of the most characteristic representatives of this or that culture. Are distinguished with the Transbaikal researchers from such typified characters: Genghis Khan as representative of nomadic culture, Alexander Nevsky, archpriest Habakkuk, Varlaam Chikoysky, Innokenti (Veniaminov), Yefrem Selenginsky, tsar-passion bearer Nikolay, doctor Luka (Voyno-Yasenetsky), etc. representatives of orthodox culture; E. Habarov, P. Beketov as representatives of the Russian pioneers; G. Tsibikov; P. Badmayev, Ts. Zhamtsarano as representatives of the Buryat education; S.G. Volkonsky, I.I. Gorbachevsky, D.I. Zavalishin, etc., as representatives of decembrism; N.G. Chernyshevsky, A.A. Kosciusko-Grigorovich, V.K. Kurnatovsky, etc., as representatives of convicts, narodovolets, the revolutionaries living in exile and the settlement; S. Lazo, P.N. Zhuravlev, etc., the revolutions representing the period and civil war; P.G. Karelin, G.S. Kochetkov, etc. as representatives of culture of times of the Second World War, and besides enter heroes contemporaries, that is participants of military operations in "hot spots" this row [9]. In the life these people, certainly showed an example of personal and often heroic

behavior, we do not doubt that they had rich unique, inner, inner world and remained in memory of people as bright symbols of regional Transbaikal culture whose names called objects of culture, streets of the cities of the region [2].

Carrying out the analysis of objective factors of formation of the personality in regional culture does not give a picture of personal, spiritual human life in regional conditions of the Transbaikal culture neither in traditional, nor during the modern period of cultural development. The fact that the objectivistic look focuses attention only on an external explanation of cultural behavior of the person as the behavior conforming to these or those the requirements of a natural and social environment standard by rules is the reason of it. At the same time, these researches do not reflect an internal look of the person, neither on the standard rules, nor on themselves. In regional researches of culture and the identity of the objectivistic direction, the question of deeply personal differences of each person, and volume as the moral and spiritual bases of the personality who in terms of objectivism has to represent an example of harmony of the external and internal unity understood, certainly, as manifestation of external dominants are transformed was not raised. In objectivistic concepts, pay mainly attention to how accessory creates to regional culture conditions for formation of typical lines which characterize lines of their consciousness and behavior.

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FROM "THE RISK SOCIETY" – TO THE SUSTAINABLE DEVELOPMENT MODEL

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Abstract. The issues of the transition of human civilization from a "risk society" to the noosphere by implementing the concept of sustainable development in the interpretation of N.N. Moiseev are considered.

Keywords. Society, civilization, sustainable development, biosphere, genome, noosphere, biosphere-centrism, co-evolution.

The current stage of development of society is often called the "risk society". Risk has become an attribute of modern unstable society. Uncertainty and instability began to grow since the speed of technological development began to exceed the speed of human society's awareness of the causes and especially the consequences of this development. Our society can be called a society of dangers and disasters, and the main dangers today do not depend on nature, but on actions and decisions taken or not accepted by man. Risk is often directly related to the dangers of modern technology that threaten planetary civilization. Evaluation of the consequences of the impact of a technology on the environment is often hampered by a lack or generally lack of knowledge needed to solve. The decision is made, which increases the risk of negative consequences of new technologies and the technological risks associated with their implementation. According to K. Sagan: "even good intentions can lead us to trouble, because we lack the wisdom to foresee all the consequences of our actions." Therefore, today technical and environmental risks are of paramount importance. For the first time in history, society is dealing with the artificially created prospect of self-destruction [1].

The current model of development of the world community after the United Nations Conference on Environment and Development in Rio de Janeiro in 1992 is called the model of unsustainable development. This model is fraught with dangers and disasters that threaten even a global cataclysm in the current century. It provides neither the survival of civilization, nor the preservation of its natural foundation - the biosphere — and should be replaced by a new model - the model of sustainable development, the implementation of which will solve the global problems facing humanity.

The anthropogenic impact on the biosphere is a unidirectional process of change in the atmosphere, surface waters, soil, and the concentration of basic biogens - elements necessary for maintaining life. It leads to a rapid reduction of biodiversity, destruction on vast areas of ecosystems and sustainable communities of organisms [2]. In 2007, a report by leading environmentalists of the world to the UN noted that 73 thousand square kilometers of forests disappear annually, 30% of amphibians, 23% of mammals, 12% of birds are threatened with extinction. Between 1970 and 2007, the biodiversity index on Earth decreased by almost 30% [3]. The load exerted by human activity on the environment, according to Academician N.N. Moiseev, not only turns into a factor determining its evolution, but also grows so fast that we no longer can talk about some kind of equilibrium of the biosphere and maintaining homeostasis of the Homo Sapiens species [4]. Degradation of the environment, the rapid decline in environmental quality exacerbate the problem of preserving the human gene pool. The current birth rate of children with genetic injuries reaches 17%. Interpolation of the growth of genetic damage shows that if this process continues at the same pace, then extinction of people will require only a few generations, since gene damage in 30% of the population leads to its death [5].

The rapid destruction of the natural environment suppresses the creative tendency of mankind and deprives industrial society of development prospects. Man as a biological species belongs to the biosphere. Biological studies show that the mechanisms of constant change of species incorporated in the evolution of the animal world ensure the existence of one species in the biosphere for an average of about 3.5 million years. Therefore, modern man - Cro-Magnon, which appeared about 60 thousand years ago as a biological species — is at the initial stage of development. However, with his activity in a relatively short period of time, he opposed himself to the biosphere and created the conditions for an environmental crisis and his own destruction. According to K. Sagan, "man has become a unique biological species, because we invented a way to destroy ourselves."

Global problems highlighted the phenomenon of unity and interdependence of the modern world, which has long been ignored from the standpoint of the "class approach", the confrontation of the two systems, although many scientists and political figures, representatives of public organizations emphasized the planetary spread of the environmental crisis, the interconnectedness of world processes. Already in 1945, in the manifesto of Russell-Einstein there were calls for a global vision of the world, rejection of confrontation.

According to S. A. Pegov, the results of studies on the International Geosphere-Biosphere Program, the International Program "Human Dimensions" and the Russian program "Global Changes in the Natural Environment and Climate" suggest that "currently the Earth's natural system is at the bifurcation point: the climate structure is changing, and after that, the natural conditions in many regions of the planet... In accordance with the theory of catastrophes at bifurcation points, any complex system goes through the so-called adaptation period, when parameters are formed that provide a new stable (sustained) state for this system. The complexity of the adaptation period lies in the fact that all the characteristic times of changing the parameters of the system are sharply reduced (under ordinary conditions, these changes are quite monotonous and long-lasting) [5].

Recently, the frequency and level of impacts, primarily weather, on the human body have sharply increased under conditions where the possibilities for adapting the body to environmental influences are narrowed. Degradation of the environment affects the activation of hazardous natural processes. In 1995-1999, the average annual number of natural disasters in the world more than tripled compared to 1965-1969. Material losses from natural disasters are now estimated at about 150 billion dollars.

Natural sciences about wildlife have come a long way from the naive ideas of ancient philosophers to molecular biology and genetic engineering. On this path, biology knew the times of recession and stagnation, which were replaced by a rise and a rapid ascent, bold hopes were replaced by doubts and disappointments. The most important component of the biosphere is human society, and man is the crown of evolution. Man exerts an influence (usually negative) on almost all ecosystems of the Earth. From the point of view of biology, man is a biological creature, one of the species of wildlife. But the human psyche has developed to the level of reason, the most important feature of which is reflection - the ability of consciousness to know itself. This ability distinguishes man from all living beings.

Global models and forecasts of the development of human civilization allowed not only to see the real situation of the global crisis, but also raised the question of the need to develop a strategy for the further development of mankind. Academician N.N. Moiseev thus expressed his vision of the current situation of the global crisis: "Gradually, we begin to understand that society is now on the verge of a catastrophe, requiring the restructuring of all the foundations of its planetary being. I even think that we are on the eve of a change in the nature of the evolution of the biological species homo sapiens. Maybe even on the threshold of a new stage of anthropogenesis... I absolutely do not exclude the fatal outcome of human history" [6].

The successes of genetics and medicine in the XX-th century have significantly increased the average life expectancy in developed countries. Medicine and genetic technologies have come to the point where mass replacements of some human organs by others, including those grown from stem cells, become real. Mankind has entered the era of artificial conception, more and more “test-tube children” are being born in the world [3]. In connection with the sequencing of the human genome, the successes achieved when working with the genomes of laboratory and farm animals, the question inevitably arises of artificial intervention in the human genome. The time has come to think about using knowledge about the human genome for practical purposes, primarily for the treatment of various hereditary diseases. Unfortunately, the consequences associated with manipulations with the human genome are currently unpredictable.

At the turn of the millennium, another serious problem arose related to artificial manipulations with the human genome, — human cloning. This problem is actively discussed by various sectors of society: from ordinary inhabitants to the parliaments of many countries, from scholars to church hierarchs. Today, human cloning is feasible with the help of existing technologies, but the ethical issue plays the main role here.

Much in human biology depends on the environment. This is one of the main reasons why full human cloning is not possible. Clones will never be completely identical to their ancestors [7]. Any cloned organism does not inherit the mitDNA genes of its “parent”; it will carry the mitochondrial genome of the organism that provided its egg for cloning. Hopes that with the help of genetic engineering it is possible to create and clone people with certain properties are not yet clearly justified. The biggest obstacle to human cloning is the uncertainty of the result and insufficient assessment of the dangers that are possible in this procedure. Cloning can lead to depletion of the human genetic fund, repeating defects in the genome and not giving it any new qualities [7]. As a result of manipulation with the cells of embryos, human freaks can appear. The technology of cloning has been worked out so far only on animals, but even here numerous freaks, organisms that carry various pathologies often arise.

The successes achieved as a result of the successful implementation of the "Human Genome" project, at the same time as rosy expectations, gave rise to well-founded great concerns of both scientists and the wider international community. In addition to purely scientific problems and concerns, numerous moral and ethical problems arise related to the human genome, artificial manipulations with it, and human cloning. Professor Jean Dosse, winner of the Nobel Prize in Physiology and Medicine, warns: "In the field

of human genetics, the unreasonable use of new technologies can lead to disastrous consequences."

On the initiative of the organizers of the Human Genome project, a broad study of the moral and ethical problems that could arise in connection with sequencing of the human genome and attempts to change it was launched. Obviously, studies of the human genome can bring both great benefits and great harm to humanity. It is necessary to prevent the slightest possibility “that artificial intervention in the human genome leads humanity to the genetic "Hiroshimas" and "Chernobyls" [7]. Today, there remains a need to develop internationally recognized ethical standards governing artificial intervention in the human genome. International organizations are actively involved in this: UNESCO, WHO, Council of Europe, etc. In 1997, the UNESCO General Conference adopted the World Declaration on the "Human Genome and Human Rights". In it, in particular, it says: ""No impact on the human genome (whether for scientific, therapeutic or diagnostic purposes) can be undertaken without a strict preliminary assessment of the possible consequences, as well as without the preliminary free consent of the person concerned... Research in biology and genetics entails special responsibility for themselves, they require scientists to be thorough, careful and intellectually honest" [Cit. on 7].

Today, scientists are faced with the task of studying the subtlest mechanisms of the human genome, a huge number of genes and a variety of gene networks, all the complex interactions of numerous compounds and processes in the cell, which ultimately should lead to a complete understanding of the functioning of the cell and the essence of living things. According to V.Z. Tarantul, when deciding on the biological hazard of artificial genomic manipulations for the homo sapiens species, “we have to rely not only on the knowledge that science reveals, but also on what we humans consider morally permissible in influencing the human genome. It seems that wisdom and common sense are enough for humanity to turn to their advantage the results achieved in the study of the human genome” [7].

At present, the point of view is being affirmed that for optimal noospherogenesis as a planetary process, it is necessary to preserve the biosphere and ensure its maximum possible natural evolution. It is the biosphere that is the foundation for the existence of all life on the planet and the further development of the mind, if the latter creates mechanisms to significantly reduce anthropogenic pressure on the natural environment. The transition of the biosphere to the noosphere is possible through the implementation of the concept of sustainable development in the interpretation of N.N. Moiseev, based on the concept of three most important principles [8,9]:

1. The principle of biospherecentrism. The transition in the relationship between man and nature is from the principle of anthropocentrism (assuming a dominance of man in relations with nature, a purely consumer attitude to nature, which inevitably leads to ecological disaster) to the principle of biosphere centrism (the formation of new spiritual and moral values of a person aimed at reorienting the development center from a person on the biosphere as a whole).

2. The principle of co-evolution of man and the biosphere. It is aimed at providing basic human needs while maintaining the adaptive capabilities of natural ecological systems both locally, regionally and globally. Production, economic and socio-cultural activities of people should not lead to the degradation of natural ecosystems.

3. The principle of optimizing needs. The resource potential of the biosphere is limited. Therefore, the currently growing intensive growth of social needs should be significantly limited due to the threat of ecosystem degradation. The norms of consumption of material goods should be optimized. A rational approximation of the consumption norms of developed and developing countries is necessary, taking into account national traditions, climatic features, etc.

Knowledge of the laws of development of living communities, knowledge of the causes of environmental and other global crises that threaten civilization, allow humanity to navigate in the choice of the development path of human society that ensures the survival of both individuals and civilization as a whole. The concept of sustainable development, based on the principles of biospherocentrism, co-evolution of man and the biosphere and optimization of needs, involves a transition to a new type of civilization functioning, a radical change in historical guidelines in economic, social, environmental, cultural and other areas of human activity.

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THE BALANCE OF THREATS IN THE NATO-RUSSIA RELATIONS DURING THE POST-BIPOLAR PERIOD

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Abstract. The article considers the dynamics of the Russia-NATO military cooperation since the end of the Cold War, identifies the modification of bilateral cooperation prior to and following the reunification of Russia with the Crimea and Sevastopol. The common areas of interests creating a negotiation domain such as the reduction of offensive weapons and resistance to the audit of international agreement system between Russia and Member States of NATO are being stated.

Keywords: IRNFT, Russia, NATO, cooperation, partnership, confrontation, deterrence, perspective.

The NATO-Russia relationship date back to the moment when Russia joined the Euro-Atlantic Partnership Council (EAPC) in 1991. Later the parties signed the global framework document of the "Partnership for Peace" programme, and also added to that an individual programme under the instrument. The PfP has proven to be a suitable solution for Russia as one of the Warsaw Pact members' countries and allowed to execute a whole range of objectives among which were both the transparency of creating the defence budget and achieving the level of forces and means preparations necessary for humanitarian operations carried out under the auspices of UN. One of the purposes of implementing the individual programme under the PfP was to enhance military and political cooperation at a European scale and to improve stability in the world; attention was paid to the cooperation between Russia and the USA in dealing with situations rooted during the bloc confrontation among the parties. After the application of those measures it became possible to consider initiating a dialogue at the political level. The further development of the relationship predetermined the signing of the NATO-Russia Founding Act in Paris allowing Russia to secure its borders, since one of the commitments by signing the act was a ban on the deployment of Allied Forces on the Russian border. However, the parties viewed each other with suspicion and kept a distance in cooperation.

The bringing of parties together to resolve shared dangers could be used as an example of the establishment of an integral action plan of NATO-Russia counter-terrorism Council. In conformity to this plan it was possible to perform an anti-terrorism operation in the Mediterranean region, and also the joint training exercises “Avaria-2004” had been successfully implemented in the area of Murmansk. [4, p. 80].

In the area of the missile defense cooperation the development was also observed over the years. Russian and NATO delegations participated in elaboration of the missile defence concept which would take into account the interests of both parties. In terms of geopolitical situation of 2004 when the young State had been struggling, the command post exercise for the operational unification of russian and NATO missile defence systems were organized until 2006. If successfully implemented, such a measure could turn out to be a win-win in terms of the balance of forces and interests, given that it would shield a significant part of Eurasia from external threats. Nevertheless, the project was shelved because of the fact that the US had decided to deploy its global missile defence systems in Poland and the Czech Republic. This move predetermined Russia’s participation in the project which it considered as inappropriate.

Russia has also serious concerns about NATO’s gradual eastward enlargement which continues despite the “gentlemen’s” agreement. Since the days of the dissolution of USSR and the Warsaw Pact the expansion of NATO was performed in several steps resulting in an increase in the number of the Alliance participating countries from 26 to 29.

Later Russia-NATO relations deteriorated due to the the conflict between Georgia and Ossetia in august of 2008. The fact that despite the difference in opinions on the conflict the cooperation concerning Afghanistan hadn’t been suspended was illustrative. The drug trafficking from Afghanistan is still perceived as one of the important points of potential interaction between Russia and NATO, because the parties are equally affected by the negative consequences. [2]

The regular NATO Lisbon Summit in 2010 had become a new milestone in the parties’ relations where the new the Strategic Concept provided for the wider involvement of Russian Federation in the resolution of security issues was adopted. [1] As a result, the parties addressed confrontational issues for the first time and ralied their forses for the sake of building a sustainable European security architecture. At the same time the NATO-Russia Council had been restated which made him a coordination mechanism for interaction in all areas of cooperation. The parties expressed their intention to establish collaboration in such spheres as:

1) logistics;
2) fight against terrorism and maritime piracy;
3) military and academic exchanges;
4) rescue at sea;
5) missile defence (the development of missile defence systems) [6, p. 76].

With the outbreak of the Ukrainian political crisis in 2014 Russia was accused of aggression and during the referendum in Crimea the NATO leadership announced the suspension of the cooperation with Russia. In September 2014 В сентябре 2014 г. the third NATO summit was held in Great Britain. One of the major themes on the agenda was the situation in Ukraine. In this regard the Wales Summit was a demonstration of NATO's intention, given that the Russian delegation wasn't invited there. Russia wasn't acknowledged as a potential aggressor and in case of Russian attack on one of the Alliance countries a special task force had been created for the possible retaliatory operations. [9].

Over time, the parties started to look for the points of convergence to promote dialogue. In 2016 several meetings of the Russia-NATO council were held, where the necessary synergies in coordinating the efforts and common fight against ISIL as well as the Ukrainian crisis were discussed. One year later military contacts between the Russian general headquarters and the NATO Military Committee were re-established, however a consensus hadn't been reached by the parties and the negotiations came to a deadlock. As emphasized in the Russian Ministry of Foreign Affairs analytical note, the Russia-NATO relations remain mired in a protracted crisis. An abandonment of the main agreements that guarantee the military restraint with the tacit consent of the majority of the Alliance members is fraught with development of a new arms race for which the situation concerning INF Treaty is an illustrative example [3].»

The Intermediate Range Nuclear Forces Treaty (INF Treaty) halt serves as another example of a collapse of the European security architecture and the rules of international law. The treaty that had been an important deterrent for arms build-up in Russia as well as in USA for three decades lost its power which contributed to a tension between the parties. The fact that the treaty had been gradually losing its power up until its avoidance is worth taking into account, because the scientific-technological revolution (STD) allowed to circumvent some of its articles with the help of new type of missiles [7, p. 2]. Moreover, the treaty concerned only the land-based installations that allowed to launch water rockets of which many countries took advantage. The main one are "Kalibr" from Russia and "Tomahawk" from the USA.

Parties to the agreement presented mulual claims concerning their compliance to the treaty terms. The United States' claim focused on the Russian missiles 9M729 "Novator". In turn, Russia accused USA of a violation of article 1, paragraph VII of the treaty concerning the nuclear facilities and their missile testing. These facilities should have been located in Poland and Romania which would be contrary to the treaty.

Therefore, the Russia-NATO cooperation on a range of important issues includes certain contradictions. Since the collapse of the USSR in 1991 and the relatoinship establishment the parties have made progress in the area of the security matters in general and the fight against terrorism in particular. Many issues remain unresolved and beget new hotbeds of tension due to events of 2014 resulting in the suspension of relations. Nevertheless, Russia and NATO still have a cooperation field and also the interaction points among which there are possibilities of joint anti-terrorism military operations as well as development of new technology tools aiming to prevent terrorist acts which had been performed by the parties before the crisis. In a transformation of the global players' relationship, the opportunities of forming the new international legal regimes and modification of the old ones are surfacing at the horizon not only in the area of the missile defence but also in the area of restraint in military production of certain classes of weapons. Without collective action of Russia and NATO it is impossible to build an efficient system of international agreements and preserve the current European security architecture. It is necessary to re-establish an open dialogue concerning the parties' mutual issues.

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THE ROLE OF THE UNITED NATIONS IN THE PROCESS OF SETTLEMENT OF THE SYRIAN CONFLICT

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One of the most important and controversial issues related to the Syrian settlement is the role of the United Nations (UN), designed to organize the interaction of members of the international community to resolve conflicts based on the principles of its Charter and international law. It is the UN that is the "custodian" and guarantor of such important principles as the sovereignty and independence of states, the renunciation of the use of force in international relations, and non-interference in internal affairs, recorded in the UN Charter.

The founding countries of the United Nations, developing the legal framework of the Organization and looking ahead, tried to create a strong and durable foundation for a new world order that would ensure freedom and independence of peoples, outlawing war as a means of resolving interstate disputes. The basis of the new architecture of the world order was laid on the principle of sovereign equality of all peace-loving states. It was precisely its fulfillment that was supposed to guarantee peace and security, and it was he who remained the basis of modern international law. One of the key norms is non-interference in the internal affairs of states. Its observance guarantees a stable, progressive development of countries in the legal field, insures them from unconstitutional shocks and ultimately serves the interests of resolving the most acute global and regional problems [1].

The UN should be a barrier to those who promote the concept of unilateral interference in the internal affairs of states, direct various kinds of "democratic revolutions" from the outside, leading in practice to widespread violations of human rights and destabilizing the situation in entire regions.

UN Security Council - a traditional tool of the so-called. Yalta-Potsdam world order, which is based on the principle of consensus of five permanent members - Russia, Great Britain, China, the USA and France. The

rules of procedure of the Council objectively corresponded to the post-war alignment of forces in the international arena. Trends in the transformation of the system of international relations towards polycentricity and, as a result, the objective strengthening of new centers of power have raised the question of the advisability of adapting UN Security Council methods to new conditions [2].

In this sense, consideration of the activities of the Council in the Syrian direction is of particular importance. In conditions when the countries of the region, which are not members of the UN Security Council (Iran, Turkey, KSA, Qatar, etc.), played an increasingly active role in the events in the ATS, the question arose of how the discussions within the Council and the decisions taken in it correspond to the political alignment of forces in the international arena and, accordingly, how this affects the possibilities of their implementation, the possibility of their implementation [3].

The UN Security Council played an important role in resolving the crisis in the ATS. From 2011 to the end of 2017 he adopted 22 resolutions on various aspects of the Syrian dossier: on chemical demilitarization of the ATS; cessation of hostilities; modalities of the political process under the auspices of the UN; humanitarian assistance to the population; the fight against terrorism, etc. It is worth noting that the Council went beyond its mandate and - with the filing of the Western "troika" (UK, USA, France) - considered issues not directly related to peace and security (human rights, humanitarian issues, etc. .). This was a reflection of the common policy of Western countries to erode the mandate of the UN Security Council. In this context, it is worth mentioning the “Arria formula” meetings - informal consultations of the Council using flexible procedures, including experts from the Independent Investigation Commission in Syria, which Russia opposed in January 2013, were invited to attend. Another example is the regular briefings in the UN Security Council of the UN Under-Secretary-General for Syria on the delivery of humanitarian aid to the population. This aspect should be considered in the context of the West’s attempts to maintain its dominance in the world arena, which they acquired during the unipolarity period by creating the “link” of the Council with human rights and humanitarian organizations. Security Council resolutions 2042 and 2043 (April 14 and 21, 2012, respectively) were aimed at the cessation of hostilities and the beginning of the political process for a settlement in Syria [4,5]. The documents supported the Six-Point Plan developed by the UN / LAS Special Envoy for Syria K. Annan [6]. A UN Observer Mission in Syria was established to monitor the cessation of armed violence in all forms and by all parties. The Western members of the UN Security Council

insisted that the Mission be created for a short period of 90 days. At their insistence, the UN Secretary General was to present the report of the UN Security Council on the work of the Mission in two weeks - during this time it was not easy to determine what results its work brings. Even then, the West was distrustful of the idea of establishing an international monitoring mechanism in Syria. Over time, the United States began to lead the way to curtailing the Mission. Security Council resolution 2059 (July 20, 2012) extended the UN Observer Mission for a final period of 30 days [7].

The UN Security Council unconditionally rallied on a platform of the need to develop effective steps to combat terrorist organizations. UN resolutions 2170 and 2178 (August, September 2014), adopted on the initiative of UNSCR 2199 (February 2015) and France's resolution 2249 (November 2015), outlined a number of measures to counter the spread of terrorism, including the fight against financing and recruiting militants; measures against extremist ideology [8.9].

2017-2019, the UN and the three guarantor countries of the "Astana process" (Russia, Turkey and Iran) worked to launch the work of the Constitutional Committee on Syria. For the first time, the idea to create such a committee was voiced during the Syrian Congress of National Dialogue in Sochi in January 2018 [10]. Without them, the preparation of the committee, which includes 150 people - 50 from the government, opposition and civil society of Syria - would be impossible. The first meeting of the Syrian Constitutional Committee will be held on October 30 in Geneva. Before the meeting, the delegation of guarantor countries for Syria will hold meetings at the level of experts and foreign ministers. Under the auspices of the United Nations on October 29, new attempts will be made to resolve the Syrian conflict by political means.

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DIGITAL SOCIETY AND BLOCKCHAIN TECHNOLOGIES

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Abstract. The article discusses the prospects of using blockchain technology in the socio-economic sphere of the country in the aspect of their wide inclusion of the educational space. The increased attention of the state to the digitalization of various spheres of society requires the organization of targeted training in almost all areas, starting from pedagogical universities. The starting positions of blockchain technology, narrow and wide areas of its application are noted. The result of the analysis of technology levels was a condition to strengthen the fundamentality of mathematical training. The theoretical significance is determined by the direction of systematic studies of pedagogical ways of introducing blockchain technologies in educational institutions of different profiles and levels. This justifies the need to create educational programs that take into account the needs of specific specialists. The problematic issue of the lack of predictive assessments of the demand for the number of specialists associated with the use of blockchain technologies has been identified, which inhibits their systemic training. The considered pedagogical aspects, based on the practical experience of the authors, can be used to improve the elements of the educational process in the new digital environment of social development.

Keywords: technology, society, educational space, specialists, students, training, blockchain, digital technology, fundamental.

Introduction

The passport of the national program “Digital Economy of the Russian Federation” dated May 7, 2018 № 204 indicates “Six federal projects: legal regulation of the digital environment; information security; information in-

frastructure; digital technology; digital government; personnel for the digital economy" [2]. The ways of implementing these projects show that the blockchain technology, which in Russian official documents is called the distributed registry system, should find its natural place in all directions. National projects require specialized training of a large number of specialists who are ready to develop, apply, maintain and support objects and tools of digital technologies. The presence in the national program of the "HR" direction makes the development of elements of the educational system in terms of training relevant specialists particularly relevant.

At the time of its inception in 2008, the blockchain was focused on ensuring the operation of the cryptocurrency system. Today, the scope of technology has expanded significantly due to the high data security. Blockchain technologies are removing controllers and intermediaries from the chains of interacting entities. All actions become notifying, fundamentally changing the relationship of subjects within society. Such a situation predetermines a significant increase in the effectiveness of activities, but requires specially trained personnel. Educational systems, as traditionally inertial, have to make significant efforts, both in theory and in practice, in order to accept the basic characteristics of the digital space and integrate it flexibly.

The state of the problems

Modern research reflects the subject variety of topics and areas of development and application of blockchain technology. There is a discussion of mathematical issues, for example, the search for possible useful computational problems for realizing consensus in the proof of work algorithm [6], and the use of blockchain technology to solve various programming problems [8]. Issues related to various aspects of the certification procedure [10], automatic verification of smart contracts [9], openness and confidentiality of data [13], potentially serious hacker attacks on public mining pools [3], user trust in blockchain systems [7] are discussed. We should note the works analyzing various risks, both technical, for example, assessing risks to confidentiality [15], and economic [4,5]. There are works systematizing various approaches to the implementation of the blockchain platform and their capabilities in solving applied projects [12]. Studies of socially significant applications based on blockchain technology are especially indicative in the healthcare sector. The monograph [11] is generally devoted to an in-depth analysis of the transformative impact of blockchain technology on creative industries, including music, media, and art. At the same time, there are few studies devoted to assessing the needs of the economy and society in specialists focused on blockchain technology, which inhibits their systemic training across the entire spectrum of specialties.

Methods

Theoretical, methodological, and information-analytical methods were used to substantiate the requirements for the specifics of the content of educational programs. The research base was an analysis of the development trends of blockchain technology and its place in the training programs for specialists in the digital society. The domestic and foreign experience of the content of educational programs and pedagogical ways of their implementation in the educational space at different levels is analyzed.

Discussion

Blockchain is a continuous sequence of blocks containing information that has not changed in the past, in other words, it is possible to add new data, it is impossible to delete the old. Manufacturability is ensured by the distribution of registries, since the chain of transactions and owners are stored on personal computers, not necessarily interconnected, by users. This technology fell into the circle of wide public attention and discussion after the publication in October 2015 in the journal The Economist of the article “Machine of Confidence. How technologies after Bitcoin will be able to change the world ”[14]. Depending on the application, three levels of blockchain technology are distinguished. Bitcoin, in fact, represents the level of technology 1.0, which ensures the functioning of cryptocurrencies. Technology level 2.0 provides a much wider range of economic activities. It is personified by smart contracts and the Ethereum decentralized platform. Of the greatest interest, from the point of view of the educational space, is level 3.0, which supports the non-financial use of blockchain technology. In educational programs, topics related to blockchain technology appeared around 2014. You can find bachelor's and master's programs, short-term courses, summer schools and all kinds of seminars. A number of world universities in which and on the basis of which they have been implementing educational programs and various educational events for a long time, with an orientation on blockchain technology. First of all, these are US universities: Princeton, Stanford, Cornell University, Massachusetts Institute of Technology, Arizona State University, New York University, University of California. In addition to them, the University of Copenhagen, the University of Nicosia, the London School of Economics, the European University of Madrid, the National University of Singapore, etc. An analysis of the implemented educational programs shows that, to a significant extent, the study is aimed at deeply developing the fundamental foundations and software solutions that underlie technology 1.0, otherwise, there is some bias due to the history of the development of cryptocurrencies. Targeted programs are focused primarily on business structures with narrow competencies.

In Russian education, the subject of blockchain is also present, but the bias towards the training of lawyers and economists that arose in the nineties is also evident here. The training programs mainly reflect applied narrow departmental specificity. Among the universities, with the prototype of such programs, are: HSE, Plekhanov Russian University of Economics, The Russian Presidential Academy of National Economy and Public Administration, Financial University, St. Petersburg State University of Economics and others, in which these issues are addressed in the framework of the courses in economics, management and finance. A cross-cutting structure for a systematic study of blockchain technology, covering all levels and aspects, such as development, maintenance, and applications in various professional fields, has not been identified. There are practically no additional training and continuing education programs for teaching staff (of various qualifications) implementing training for specialists in blockchain technologies.

According to the “roadmap for “end-to-end” digital technology, the “distributed registry system”” [1] admits that there is a shortage of specially trained personnel. Specialist developers and practitioners with fundamental training in mathematics and computer science, software engineering are required. In the master's program in the field of information technology, the objectives of the course on blockchain technology are defined: the study of the reasons for the development of technology; consideration of the principles of functioning and building systems based on it; study of the mathematical structures underlying the technology, such as groups, rings, finite fields, hash functions. Cryptographic algorithms are also being studied, in particular, cryptography based on elliptic curves. However, the number of hours for mastering the fundamental branches of mathematics is constantly decreasing, and if students have heard about many mathematical entities, they practically do not know enough. In addition, the general level of mathematical preparation of applicants is low, which even with relatively high scores of the Unified State Examination, they do not have systematic mathematical knowledge and experience significant difficulties in mastering the basic set of mathematical disciplines, which further form the basis of blockchain technology. A selective express survey of teachers at the basic level of education showed that they lack an understanding of the fundamentals of this technology, its place in the new socio-economic reality, and the problems of school mathematics and computer science.

A number of Russian universities: Lomonosov MSU, ITMO University, MIPT, Voronezh State University, Novosibirsk State University and others, have carried out significant scientific and methodological work on introduc-

ing modules on blockchain technology into educational programs. Possessing a high scientific and pedagogical potential, having the opportunity to attract foreign specialists, they create a real opportunity to implement qualitatively new educational programs in the field of digital technology.

Conclusions

The digitalization of society has incorporated ideas that have arisen and developed over the course of half a century, both in computer science and in special sections of mathematics. Specialist training programs with a sufficient volume of interdisciplinary sections that form digital metacompetencies, provided by the corresponding didactic developments, have not been noted. It is important to organize continuous training with elements of the study of blockchain technology from the school level to the training of highly qualified personnel. The considered aspects, based on the analysis of information sources and the practical experience of the authors, can be used in studies to improve the educational process, in the activities of the leaders of educational programs.

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ASSESSMENT THE MOTIVATIONS OF THE OLDER (VETERANS ATHLETES) FOR DOING KETTLEBELL SPORT

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Abstract. Recent research has shown multiple motives for kettlebell sport participation derived from research on master (veterans) participants. The aim of this study was to provide insights into motives and specific aspects of the veteran kettlebell sports movement and to compare those findings with male and female veterans performing the same activity. The questionnaire was conducted with 26 veterans, comparing male veterans (40 – 75+ years) and female veterans (35– 65+ years) at 9 and 17 participants respectively. A mathematical analysis (by average scores) was done on the survey results. The questionnaire contained 92 questions which were grouped in the 11 motives and needs. Both gender groups reported the significance of motives development of character and mental qualities and physical development. Conceivably, this survey results might help to engage a big number of older people in a healthy lifestyle, namely kettlebell sports.

Keywords: kettlebell sports, psychological motives, veterans' sports, physical activity

INTRODUCTION

The aim of this study is to gather data on motivation for doing kettlebell sports groups within veteran age groups, namely male veterans (40 – 75+ years) and female veterans (35– 65+ years). There is not much research into the motivation of elder people to doing weight exercising activity. Moreover, it is the first examination of the motives and needs of elder people in the participation of kettlebell sports events. It really raises the question of what should be considered as a need for an active lifestyle in aging. The results of the study reveal that kettlebell sport for female veterans might target important psychological belief in yourselves by achieving significant results in competitions. Indeed, male veterans are mainly started to lift kettlebells by the chance after which they are continuing regular kettlebell sport training.

LITERATURE REVIEW

Motivation has been a very important object of study among sports and exercise psychologists. Achievement Goal Theory (Nicholls, 1989) and Self-Determination Theory (Deci and Ryan, 1991) are the most prominent current theories of motivation in the sport psychology literature and each has had considerable success in explaining motivational patterns in sport settings.

Motivation is recognized to be one of the most important factors related to engagement in physical activity during childhood and adolescence (Hagger and Chatzisarantis, 2007). Indeed, participation in kettlebell sport completion plays an important role in the socialization process to motivate older people towards a physically active lifestyle; kettlebell sports have the potential to provide positive physical activity experiences. Furthermore, competitions have an important role in the development of motivation toward the creation and maintenance of the social and psychological climate perceived by master's athletes through exercising with kettlebells as a necessary process of preparation for sports performance. Research on the older people's motivation toward physical activity has utilized two main theories namely the self-determination theory (Deci and Ryan, 1985) and the achievement goal theory (Nicholls, 1989) The self-determination theory constitutes an important approach in studying human motivation, particularly in achievement and participation contexts (Standage et al., 2007; Vallerand, 2001).

Competition is a defining feature of sport and is known to be a potent social motivator for sports participation. When competition is one-sided, the motivation to participate in sport is reduced, especially in unsuccessful participants. Classification in sport reduces the likelihood of one-sided competition thereby promoting participation. Age is a common unit of classification in sport, and the effect of an age classification system is to control for the influence of aging on the outcome of competition to increase the likelihood that successful athletes are those that have the most advantageous combination of physiological and psychological attributes and have enhanced them to best effect (Tweedy and Vanlandewijck, 2011)

RECEARCH DESIGN

Participants

In total 26 kettlebell sport veteran athletes were interviewed within the WKSF World Championship in Dublin, Ireland, May 2019 from 13 countries, in particular: USA, Netherland, Ireland, Canada, Spain, Italy, Scot-

land, Singapore, England, Denmark, Sweden, Taiwan and France (Figure 1). The differentiation of interviewed by gender were 17 female veterans (35-65+ years) and 9 male veterans (40 to 75+). Since most authors of previous qualitative works in the research field of kettlebell sports only included participants depending on the young age or professional sports athletes, excluding amateur master athletes (Simen, 2015), the number of 26 participants were considered a high number, especially for a homogenous group of participants from one activity. Participants were suggested to participate in the survey using a combination of purposive sampling strategies, namely criterion-based, maximum variation sampling (Patton, 1990). This approach ensured that participants had specific knowledge and experience of the phenomena of interest whilst allowing the analysis of age effects (Sparkes and Smith, 2014). The primary criterion was that athletes participated in the kettlebell sport competitions and had ranks ranging from Rank 3 to Master of Sport International Class. The general characteristics of the participants of the questionnaire are presented in Table 1. Veterans' athletes were participating at the World Championship or have been participating in the Kettlebell sport qualifier competitions in their countries. Those criteria were set to ensure experience and knowledge in the target group. Participants were informed about the study procedure prior to the survey and they received information notes about research on the questionnaire sheet according to the ethical guidelines of WKSF. Approval by the Board for Ethical Questions in Science of the World Kettlebell Sport Federation in accordance with the ethical code WKSF (protocol №002, 20 December 2017), was given prior to the study (No.019/A, Date 25.06.2019)

Procedure

A questionnaire that contained 92 questions was suggested to be filled by each participant of the veteran group within the WKSF World Championship in Dublin. A questionnaire instruction was used to ensure that each participant understood the criteria of assessment about their experiences. The participants were informed that their involvement in the study was voluntary and that their scores would be kept anonymous. A questionnaire structure was based on the methodology of the study of motives for doing sports by Tropnokova, V.I. (Glickman I.Z. 2008). Paper forms of the questionnaire were given to the country's representatives for further examination of team members. The average processing time of filling the answer shits for veterans was between 30 and 40 minutes. The questionnaire was conducted in English as the overwhelming majority of participants felt more comfortable speaking English than Russian.

Analysis

Before analyzing the data, all interviews were transformed into the data table. The data was then analyzed in several distinct stages using the methods of mathematical analysis.

Firstly, the author read the answers a number of times to immerse themselves in the data, whereas group allocation of participants was known. Secondly, an inductive hierarchical content analysis was carried out where raw data themes were given codes (e.g., “3”). Following this, similar codes were grouped into the main themes (e.g., kettlebell rank MS were grouped into the theme balance). In addition to this, the participants are indicated by numbers, allocation to gender (male or female), age (e.g. 45-54 years) and age of kettlebell lifting experience (5-9 years). The final step was to group the answer codes and main motives and needs categories (e.g., answers on a question to have more friends and acquaintances were grouped into the communication motive). The method of the arithmetic average of motives scores was undertaken, using a scale of significance from 1 to 5, in particular ranging from not significant to very significant.

RESULTS

Both male and female groups answered on the common questions which were grouped into the motives and need communication, learning, material goods, development of character and mental qualities, physical development, improvement of health and wellness, aesthetic pleasure and thrill, acquiring life skills and knowledge, approval need, increasing prestige and desire for fame and collectivist orientation. Development of character and mental qualities and physical development was named as a major motive for both genders in doing kettlebell sport. Whereas the motives of increasing prestige and desire for fame and approval need do not play a crucial role in kettlebell activities. The differences in motives were seen in the motive’s communication and aesthetic pleasure and thrill which were identified as not very significant for females. Indeed, for the male group, these motives were significant in defining kettlebell sport for a healthy lifestyle (Table 2). Based on matched estimates from the database, a table was composed presenting mean scores for each question, where was highlighted specific motives with higher scores in each master age group for males and females separately. The differentiation of interviewed by aged was based on WKSF master’s age group classification (protocol №036, 20 November 2019).

Female 35-44 age group

The motives of the development of character and mental qualities and physical development were rated on 4 scores from 5 as a significant criterion for doing kettlebell sports. Among 92 questions was highlighted and rated on 5 scores from 5 as a very significant the specific motive of choosing kettlebell sport 'because it is a sport where you can train individually and independently of others.' Other specific motives were estimated as significant: 'I think that I have good speed-strength skills and it is valuable for kettlebell sport', 'because in kettlebell sport you can clearly see and measure your own progress', 'I think I am physically strong which is valuable for kettlebell sport', 'started to lift kettlebell by chance' and 'I believe that in kettlebell sport I can achieve significant results'.

Female 45-54 age group

Contrary to previous age groups, improvement of health and wellness, aesthetic pleasure and thrill, approval need and collectivist orientation rated on 2 scores from 5 as a not very significant criterion for choosing kettlebell sports. It has been highlighted that this master group 'started to lift kettlebells by chance', estimated this specific motive on 4 scores as a significant criterion. Likewise, the motive 'because in kettlebell sport you can clearly see and measure your own progress' was rated on the mean 4 scores as a significant.

Female 55-64 age group

Differentiation in the assessment of basic motives and needs was not seen between 35-44 and 55-64 age group cohorts, even in specific motives.

Female 65+ age group

The results of the assessment of the female 65+ age group were correlated with the previous master group. In particular, the motives of the development of character and mental qualities and physical development was rated on 4 scores from 5 as a significant criterion for doing kettlebell sports. Vice versa the motives of acquiring life skills and knowledge, approval need, increasing prestige and desire for fame and collectivist orientation which was rated on 2 scores from 5 as a not very significant criterion for choosing kettlebell sports. Based on 92 questions from the questionnaire, the specific motive 'because in kettlebell sport you can clearly see and measure your own progress' was highlighted and rated on 5 scores from 5 as a very significant. Further 'my physique is suitable for doing kettlebell sport' was also marked as a significant criterion.

Male 40-49 age group

Differences between the female and male cohorts were seen in participants' assessment of their motivation about communication and aesthetics pleasure and thrill needs. According to male responses, these motives play a significant role in doing kettlebell sport. Further, the masters male rated the motives of development of character and mental qualities and physical development in the same way as a female group on 4 scores from 5. Interestingly, the specific motives 'because in kettlebell sport you can clearly see and measure your own progress', 'I think I am physically strong which is valuable for kettlebell sport', 'started to lift kettlebell by chance', 'I believe that in kettlebell sport I can achieve significant results' and 'I think I have stamina which is valuable for kettlebell sport have been highlighted as significant criteria, have been estimated on 4 scores; these responses coincided with the female master group results at 35-44 age group.

Male 75+ age group

In questionnaire took part one participant at the age of 75+, for whom the motives of development of character and mental qualities and physical development were significant at the same rate as for the male 40-49 age group. However, such motives as approval need and increasing prestige and desire for fame was rated on 2 scores from 5 as a not very significant criterion for doing kettlebell sports. There was no differentiation between the male 40-49 age group and the age of 75+ in the description of specific motives, except criterion 'because it is a sport where you can train individually and independently of others' which was highlighted and rated on 4 scores as a very significant motive of choosing kettlebell sport.

DISCUSSION

The purpose of the current study was to examine to identify the motives and needs of the older generation in doing physical activity, namely kettlebell sports and to compare those motives within male and female cohorts.

Descriptive results showed the highest mean values were for needs of the development of character and mental qualities and physical development and lowest for approval need and increasing prestige and desire for fame. These findings demonstrate that self-motivation of elder people tend to use more narrow self-interest to contribute task- involving values such as own development, be it physical or mental, hard training, and setting own goals than efforts to advance prestige or social approval in kettlebell communities. However, it is important to recognize that a higher perception of a task-involving climate rather than an ego-involving climate is considered to be beneficial for the development of older's motivation toward physical activity (Roberts, 2001).

This analysis revealed that both males and females are not interested in the desire for fame, be it increasing prestige or approval need. A pedagogical implication of this finding is that sports organizations, particularly kettlebell sports federations, should focus on putting effort toward increasing task-involving climate rather than trying to affect ego-involving climate.

Specific motives reported by both males and females were described as challenging oneself, experiencing the freedom of the activity and having measurements to results. The current analyzes revealed the major-specific motives of participation in kettlebell sport such as independently of others at individual training and measurement of own progress by the clear visualization of the result. Specifically, those motives could be interpreted as a satisfaction for the psychological needs of progress and autonomy. Kettlebell sports involve own decision making and as such satisfying the need for autonomy and supporting the development of competence.

The most important strengths of this study are that it 1) investigated the older kettlebell sport participants which are a barely unexplored research area, 2) examined motives of doing this sport and 3) had a much variable sample of needs for physical activity during the aging.

CONCLUSION

In conclusion, the present study provided factors evidence potentially explain why masters athletes are motivated to perform and participate in kettlebell sport competitions. This psychological-pedagogical study documents the tendency of older people to regulate their well-being more effectively, by maintaining physical activity with kettlebell sport. Furthermore, the major results highlight the possibility that perceptions of independent task-resolving climate rather than an ego-involving climate associated with doing kettlebell training.

In the future, it would be important to compare motivation among the older athletes in doing kettlebell sport with master athletes in other sports. In addition, further research should be undertaken with a broader range of kettlebell sports organizations and within different levels of events.

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Table 1. General characteristics of the participants of questionnaire (n = 26)

Characteristics of respondents (n = 26)				
Parameters	**Female**		**Male**	
	Categories	**Number of respondents**	**Categories**	**Number of respondents**
Age (years)	35-44 45-54 55-64 65+	5 6 4 3	40-49 50-59 60-69 70-74 75+	8 0 0 0 1
Training experience (years)	< 1 1-4 5-9 10-19 >20	0 6 7 4 0	<1 1-4 5-9 10-19 >20	0 5 3 1 0
Rank	Rank 1 CMS MS MSIC	6 7 3 1	Rank 1 CMS MS MSIC	4 2 2 1

Table 2. Assessment of motives and needs of male and female master athletes

Motives and needs	
'Not very significant' for female	**'Significant' for male**
communication	collectivist orientation
aesthetic pleasure and thrill	aesthetic pleasure and thrill
'Significant' for both gender	
development of character and mental qualities	development of character and mental qualities
physical development	physical development
'Not very Significant' for both gender	
increasing prestige and desire for fame	increasing prestige and desire for fame
approval need	approval need

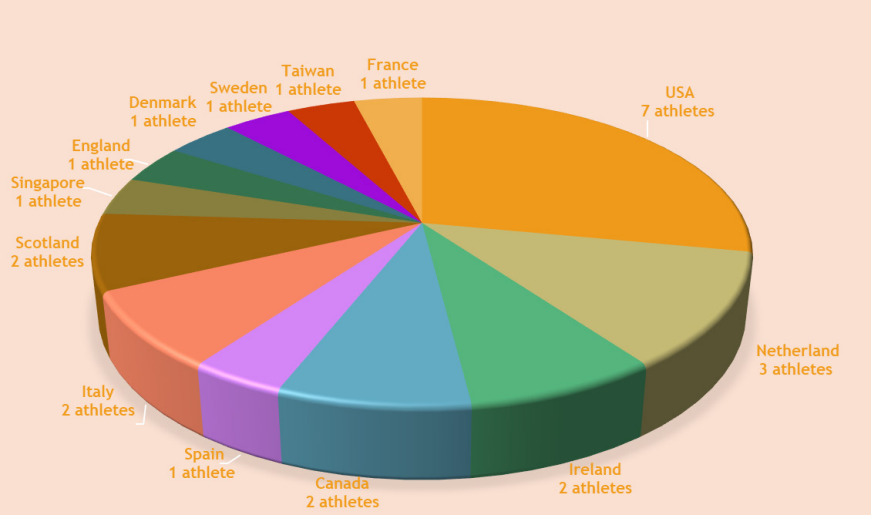

Figure 1 - The quantitative composition of the survey participants

ANALYSIS OF THE DYNAMICS OF DEMAND FOR COMPETENCY CLUSTERS (MANAGERIAL, COGNITIVE, ACHIEVEMENTS AND ACTIONS) FOR MIDDLE MANAGEMENT [1]

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Abstract. Modern practice of entrepreneurial activity shows the almost complete absence of analytical studies on the dynamics of the demand for relevant competencies for middle management. At the same time, improving the organization of production at enterprises in various sectors of the economy determines the need for this kind of research to predict the demand for existing and the emergence of new competencies in the field of personnel assessment, in particular, middle managers. The main objective of this study is to develop a methodological procedure for the classification of competency models used in empirical studies to evaluate middle management and analyze the dynamics of trends in their demand on the part of enterprise management. The object of the study was the activity of middle management at enterprises in various sectors of the economy of one of the major cities of the Russian region. As the subject of the study, we selected the competencies of middle-level managers and an analysis of the dynamics of their demand over time. To achieve this goal, we selected the method of cluster grouping of competencies used in 12 models during assessment centers during 2015-2019 by analogy with the well-known Spencer classification. In addition, a method of qualitative analysis was used to compare the names used by the authors and the content of competencies and their correlation with the corresponding competence clusters of the Spencers classification. As a result of an analytical study, the main content of the

[1]This work was partially supported by the Russian Foundation for Basic Research, project № 19-010-00214a, "Formation and development of the intellectual potential of Russian enterprises under the conditions of sanctions restrictions: an integrated approach, model development, and justification of tools".

competencies used in 12 models during the assessment centers during 2015-2019 was revealed, their correlation was carried out according to the 3 clusters of Spencer competency classification. Tables of correlation of competencies by clusters have been compiled, allowing analysis of the author's competency models and to reveal the dynamics of their demand for clusters and time periods.

Keywords: competencies, middle management, assessment center, Spencer classification, clusters, correlation table, dynamic aspect.

Introduction

In recent years, the rapidly changing reality has posed new questions for experts assessing the professional competencies of specialists in the framework of Assessment Centers. With such a fast emergence of new posts and types of work when evaluating a candidate for a new position, the emphasis shifts from the question of what characteristics are inherent in a person at the moment - to the question of what potential does a candidate for a position have for solving future tasks? One way to solve the problem of constructing competency models for assessing the future potential of an employee we see in attracting a dynamic approach to analyzing trends in the demand for competencies in models for evaluating middle managers used in previous years.

The aim of the study conducted by the authors was to identify the temporal dynamics (2015-2019) of the demand by customers (employers) of middle managers competencies using the cluster grouping method. The study involved middle managers working at enterprises in the following industries: clothing and woodworking, wholesale and retail trade; financial activities; service sector (culture and sports, information and communication).

The subject of competencies arose in research at the end of the 60s of the last century. One of the first was an article by Robert White “Motivation revised: the concept of competence” [1]. Subsequent years were marked by the appearance of a number of works on this subject, which later became classic. These include the work of Richard E. Boyatzis [2, 3], George O. Klemp, Jr. [4], Lyle M. Spencer, Jr. [5, 6], M. Lombardo and R. Eichinger [12] et.al. Attempts have also been made to classify competencies and combine them into clusters [3, 6, 7, 8]. The most significant milestone in the development of the classification of competencies was the work of L. and S. Spencer [5, 6]. We considered this model as the foundation for our research.

Materials and methods

During the period from 2014 to 2019, the authors have gained practical experience in using the Assessment Center (AC) method for assessing and developing the professional and managerial competencies of middle managers. For these purposes, in the framework of the AC method, at a number of enterprises in various sectors of the economy of one of the major cities of the Russian region, twelve models were used with respect to the assessment of professional competencies of middle managers.

To solve the problem, a special methodological procedure was developed for the cluster grouping of competencies, which allowed correlating largely different competency models, as well as analyzing the dynamics of the demand for certain competencies on the part of the customer over time. The classification of Spencers was chosen as the basis for this correlation. For convenience of description, those competencies that were used by the authors in the models during 2015-2019 to assess the competencies of middle management managers are designated as Author competencies. The latter were grouped into generalized groups / clusters, according to the classification proposed by Spencers. To make a decision about which cluster of Spencers classification belongs to one or another competence of the author's model, a qualitative analysis was used. Based on it, the tables of correlation of competencies were formed, which made it possible to substantively compare the competencies of Spencer's classification, on the one hand, and author's competencies, on the other. At the next stage, the frequency of repetition of the competencies of a particular cluster in the models by years was calculated, which was expressed in% of the total number of competencies used this year.

Results and discussion

The results obtained for the three clusters are presented in the table.

Table

Shares of competencies included in a particular cluster in models by year (in%)

Clusters	2015	2016	2017	2018	2019
Achievement and action	25%	14%	13%	18%	14%
Cognitive competencies	25%	21%	13%	27%	36%
Management competencies	44%	36%	50%	23%	36%

In the figure, the results are presented visually.

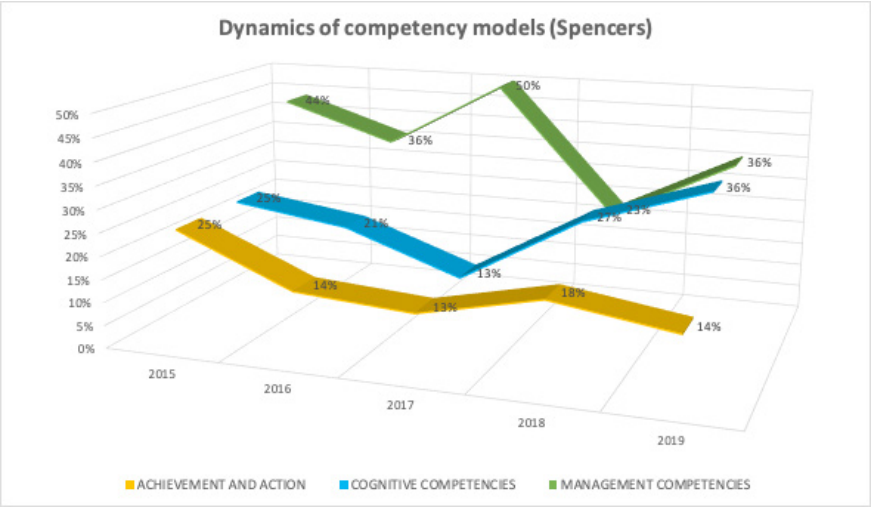

Fig. Cluster dynamics of Achievement and action, Cognitive competencies, Management competencies in 2015-2019

If we analyze the dynamics of the *Cognitive competencies* cluster, then a very heterogeneous dynamics of demand is noteworthy here - in 2015-2017 (see Fig.) It goes down, reaching thresholds of 13% in 2017, and then demonstrates a take-off, becoming actually in one row with the key for middle managers *Management competencies* and occupying 36% of the total. Let us turn to those competencies from the author's models, which, in accordance with the Spencers classification, are included in the *Cognitive competencies* cluster - *Work with a large amount of information, Systematic thinking,* (ability to work with data, regulate and organize; identify problems); *Orientation to developmen*t (initiates own training; ready to learn, change). The last competency can be attributed to the cluster of *Cognitive competencies* (in the view of Spencers) only partially. In content, in our opinion, it would most likely correspond to a cluster that includes the characteristics of a person's desire to develop himself. And this is one of those moments that creates difficulties when working with the Spencers classification: we found a similar characteristic in the *Cognitive competencies* cluster in the competence of *Technical/ Professional/ Management Expertise*. It must be added that this is not an isolated case. There have been several attempts to correctly correlate the competencies that we used in practical work with the classification of Spencer clusters. Therefore, the accuracy of some conclusions on the trends in the dynamics of competencies in accordance with the Spencers classification we chose for the initial analysis was in doubt.

In the first place in terms of demand for competencies is a cluster designated by Spencers as *Management competencies.* It is it that forms the core of competencies for middle management in all models that we used

in 2015-2019 (the exception is 2018, but about it separately - below). The value (share) of the cluster relative to other clusters varies over the years. It is most vividly represented in 2017 (see. Fig.), And all other clusters (except for the *Help and service of others* cluster) at the same time show an amazing identity - their values do not rise above 13%. It seems that the *Management competencies* cluster is "pulling" the shares of other clusters onto itself. In 2018 (see the figure), the *Management competencies* cluster shows the lowest value (23%), possibly due to the fact that the other two clusters - *Personal Effectiveness* and *Help and Service of others* gain 18% each (for the *Help and Service of others* cluster - this is an unusually high value). Thus, despite the fact that the *Management competencies* cluster is undoubtedly the leader in the dynamics of demand for competencies in middle management models, its significance varies from year to year and is determined, most likely, by external labor market conditions - economic, political and other environmental conditions, which influenced the real conditions of doing business by companies, thereby the requirements for the managerial level of companies. The picture of the distribution of relevance (demand) of the *Management competencies* cluster in 2019 is also interesting: 2 clusters - *Management competencies* and *Cognitive competencies* - seem to pull over the shares of other clusters, showing the same demand values - 36% of the total number of competencies requested. It can be assumed that middle managers are now expected to equally – have both competence in managing other people, and the ability to work with information, make decisions based on it, and plan the activities of its unit.

Conclusion

The results obtained in the course of the research made it possible to formulate the following conclusions.

The classification of Spencer competency clusters is one of the most developed classifications. Even after almost 30 years after its creation, it, with the exception of some cases, is relevant for analysis. This is, first of all, about the cluster of *Management competencies*, which, as Spencers predicted, still forms the basis in models for evaluating middle management. In part, the same can be said of the *Cognitive competencies* cluster, which is demonstrating its predictive capabilities, especially in recent years.

The competencies of the *Achievement and action* cluster show the greatest stability (in comparison with other clusters) in their time dynamics: their demand varies in a narrow range (from 13 to 25%), which is quite justified: whatever the market situation, in the company, no matter the scale and specificity of managerial tasks and teams, one way or another the

middle manager is expected to achieve a stable quality result and perseverance in achieving it, as well as the ability to work according to quality standards and ensure these standards in the work of subordinates s (this is typical of the requirements for middle managers hired in the labor market, who must work in accordance with the specific requirements, rules, standards set by the employer-organization).

As a result of the work done, the main key and substantive components of author's competencies are identified, their correlation with the competencies for Spencers classification is carried out, and their grouping by clusters is performed. Tables of correlation of competencies have been formed, which allow for the subsequent dynamic analysis of models of author's competencies and identify the main trends in the dynamics of demand for certain clusters of competencies.

The results of the analysis made it possible to determine current trends in the dynamics of demand for competency models for middle managers, and thereby achieve the initial goal of our study.

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ANALYSIS OF THE DYNAMICS OF DEMAND FOR COMPETENCY CLUSTERS (HELP AND SERVICE OF OTHERS, IMPACT AND INFLUENCE, PERSONAL EFFECTIVENESS) FOR MIDDLE MANAGERS [1]

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Abstract. Modern practice of entrepreneurial activity shows the almost complete absence of analytical studies on the dynamics of the demand for relevant competencies for middle management. At the same time, improving the organization of production at enterprises in various sectors of the economy determines the need for this kind of research to predict the demand for existing and the emergence of new competencies in the field of personnel assessment, in particular, middle managers. The main objective of this study is to develop a methodological procedure for the classification of competency models used in empirical studies to evaluate middle management and analyze the dynamics of trends in their demand on the part of enterprise management. The object of the study was the activity of middle management at enterprises in various sectors of the economy of one of the major cities of the Russian region. As the subject of the study, we selected the competencies of middle-level managers and an analysis of the dynamics of their demand over time. To achieve this goal, we selected the method of cluster grouping of competencies used in 12 models during assessment centers during 2015-2019 by analogy with the well-known Spencer classification. In addition, a method of qualitative analysis was used to compare the names used by the authors and the content of competencies and their correlation with the corresponding competence clusters of the Spencers classification. As a result of the analytical study, the main content of the competencies

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used in 12 models during the assessment centers during 2015-2019 was revealed, their correlation was carried out according to 3 clusters of Spencers competency classification. Tables of correlation of competencies by clusters have been compiled, allowing analysis of the author's competency models and to reveal the dynamics of their demand for clusters and time periods.

Keywords: competencies, middle management, assessment center, Spencer classification, clusters, correlation table, dynamic aspect.

Introduction

As the research on HR analytics by SHLRussia shows, one of the main obstacles to effective HR analytics in Russia is the lack of objective data. Only 3% of respondents indicated that they did not experience problems with collecting and processing data, only one company out of 7 had enough data to obtain objective results of HR analytics. Even in relation to such a standardized HR task as recruitment, in only one organization out of 4 HR specialists believe that they have all the necessary data for making decisions. The results obtained clearly indicate that in many cases, HR specialists do not have enough objective data even to solve the highest priority tasks and processes [1].

The aim of the study conducted by the authors was to identify the temporal dynamics (2015-2019) of the demand by customers (employers) of the competencies of middle managers using the cluster grouping method. The research involved middle managers in organizations related to the following sectors: clothing and woodworking, wholesale and retail trade; financial activities; service sector (culture and sports, information and communication).

The emergence of the topic of competencies and their classification in research works dates back to the late 60s of the last century. It deserved the attention of Robert White, “Motivation Revised: The Concept of Competency” [2], Richard E. Boyatzis [3, 4], George O. Klemp, Jr. [5], Lyle M. Spencer, Jr. [6, 7], M. Lombardo and R. Eichinger [10] and others. In Russia, we can point to the work of A.V. Ovchinnikov [8, 9].

As the main tools for conducting research, we used the Spencer competency model. For more than 30 years, many researchers and practitioners have been addressing it. And although this classification refers to the 90s of the last century, it enjoys it is widely popular at the present time. Now the third edition of this work has been published [7].

Materials and methods

During the period from 2014 to 2019, the authors have gained practical experience in using the Assessment Center (AC) method for assessing and developing the professional and managerial competencies of middle managers. For these purposes, in the framework of the AC method, at a

number of enterprises in various sectors of the economy of one of the major cities of the Russian region, twelve models were used with respect to the assessment of professional competencies of middle managers.

To solve the problem, a special methodological procedure was developed for the cluster grouping of competencies, which allowed correlating largely different competency models, as well as analyzing the dynamics of the demand for certain competencies on the part of the customer over time. The classification of Spencers was chosen as the basis for this correlation. For convenience of description, those competencies that were used by the authors in the models during 2015-2019 to assess the competencies of middle management managers are designated as author's competencies. The latter were grouped into generalized groups/clusters, according to the classification proposed by Spencers. To make a decision about to which cluster of Spencers classification one or another competence of the author's model belongs, a qualitative analysis was used. Based on it, the tables of correlation of competencies were formed, which made it possible to substantively compare the competencies of Spencer's classification, on the one hand, and author's competencies, on the other. At the next stage, the frequency of repetition of the competencies of a particular cluster in the models by years was calculated, which was expressed in% of the total number of competencies used this year.

Research results

The results obtained for the three clusters of competencies are presented in the table.

Table

Shares of competencies included in a particular cluster in models by year (in%)

Clusters	2015	2016	2017	2018	2019
Help and service of others	0%	0%	0%	9%	0%
Impact and influence	3%	14%	13%	5%	7%
Personal effectiveness	3%	14%	13%	18%	7%

The table shows the results of the authors' work on correlating the competencies of the 3 least demanded Spencer classification clusters, on the one hand, and author's competencies used in the 2015-2019 models and allocated to these three clusters, on the other. For convenience of description, those competencies that were used by the authors in the models during 2015-2019 to assess the competencies of middle management managers are designated as author's competencies.

To make a decision about to which cluster of Spencers classification one or another competence of the author's model belongs, a qualitative analysis was used. On its basis, the tables of correlation of competencies were formed, which made it possible to substantively compare the competencies of Spencer's classification, on the one hand, and author's competencies, on the other. At the next stage, the frequency of repetition of the competencies of a particular cluster in the models by years was calculated, which was expressed in% of the total number of competencies used this year.

The results obtained for three clusters are presented in the figure.

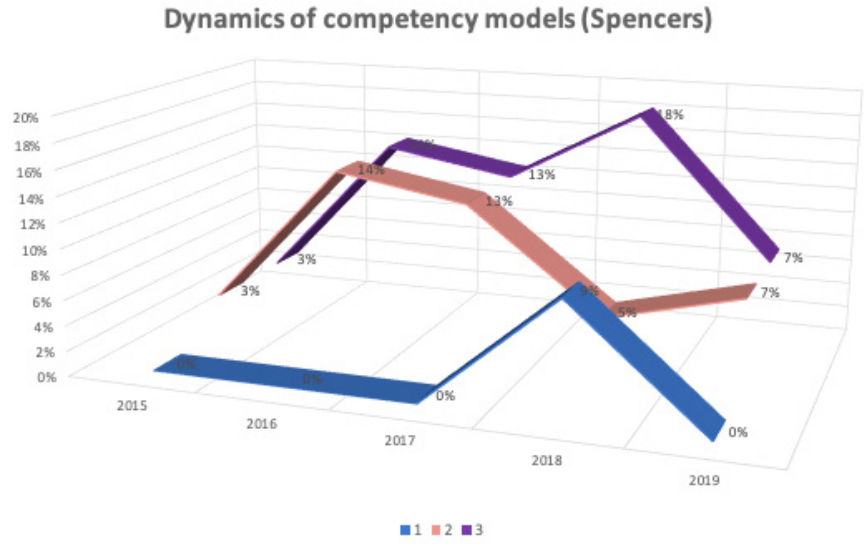

Fig. Competency dynamics of competency clusters (1-Help and service of others; 2 – Impact and influence; 3 – Personal effectiveness) by years

It was extremely problematic to correlate our competencies with the *Help and service of others* cluster. This cluster, as we can see from the table and figure, is represented mainly by zero values: in the overall picture of the dynamics of models according to Spencer's classification, it turned out to be practically unclaimed (the exception is the results of 2018). At the same time, we believe that this cluster in competency models 2015-2019 is clearly underestimated. In order to try to analyze such a result, we pay attention to 2 competencies that Spencers have in this cluster: *Interpersonal understanding* and *Orientation to customer service*.

According to many modern studies, “Interpersonal understanding” (the term “Emotional Intelligence” has been used in recent years) is a necessary competence of the 21st century, especially with regard to managers. “Human”, subtle emotional, empathic communication comes to the fore, because it is the most difficult to replace with the development of technology.

As for the 2nd competency of this cluster - *Orientation to customer service*, it was possible to correlate with only one competency from the author's models - *Customer focus*. On the one hand, it is clear that Customer focus is important, first of all, for service personnel who work directly with customers (and not for management). But on the other hand, the Customer focus of service personnel can be achieved, obviously, by translating this value and standards from above - from top management to middle managers, and then below, down to a specific official working with a client; In addition, it is important to build a customer orientation system in the company (and this is also a management task). In addition, it may be worthwhile to use the idea of an internal and external client to interpret the results. The fact is that the concept of “client” has expanded quite a lot in recent years: now, in addition to the concept of an external client, there is the concept of “internal client” - this is a unit or a specific official in the organization to satisfy whose needs the position of the subject is directed. If we consider the “Orientation to customer service” competency in this way, then its importance for middle managers is obviously increasing: after all, it is he (the manager) who works to meet the needs of: a) top managers - in order to clarify and fulfill the tasks assigned in a qualitative manner, b) heads of related departments - to establish effective interaction with them and provide some kind of “product” (for example, the head of the marketing department satisfies the needs of the sales department by planning and launching advertising campaigns opriyatiya that promote sales, etc.); c) subordinates - in order to identify their motives, to provide good working conditions, to use individual methods of motivation (however, the latter (p. “c”) is “wired” in the cluster “Managerial competencies”).

Thus, we can conclude that the importance of the cluster *Help and Service* in general among middle managers is very underestimated by the Customers.

Conclusions on the *Impact and influence* cluster were also very problematic for us - the competences from this cluster according to Spencer's description overlap with the characteristics of the competencies of the *Manager Competencies* cluster.

The third cluster of *Personal effectiveness* competencies analyzed here in the table and in the figure shows significant dynamics. At Spencers, it is represented by 4 blocks: self-control, self-confidence, flexibility, devotion to the company. In accordance with their classification, the competencies of this cluster have recently become less and less popular - in 2019 their share is only 7%. What can it indicate? It is possible that Spencer's understanding of self-control as, basically, stress tolerance, ceases to be relevant for the studied group of middle managers. Is self-confidence demanded? Hard to say. At least in the practice of recent years, it is not so common. At the same time, in author's models, the elements of the "Self-Confidence" competence are included both in the competence of the "Achievement and Action" cluster (as regards, for example, “a person’s faith in his own ability to carry out a task, overcoming difficulties and failures”) and the cluster "Manager Competencies" (for example, with regard to “make and implement decisions, despite the disagreement of other people with them”).

In general, the presence of such a situation in the *Personal effectiveness* cluster may indicate an underestimation of this cluster and the competencies included in the competency models requested by customers for evaluating middle management. But at the same time, it can indicate the loss of relevance of these competencies for employers - in relation to the assessment of middle managers.

Conclusion

The results obtained in the course of the research made it possible to formulate the following conclusions. The method of cluster grouping of competencies of middle management managers used in the course of the study showed its effectiveness: this made it possible to systematize author's work by competencies, and also to identify problems in correlating the competency models used in practice with the Spencers classification.

The Help and service of others cluster in the general picture of the dynamics of models according to Spencer's classification is practically unclaimed and, in our opinion, underestimated. This was shown by the example of the *Interpersonal understanding* competency (the concept of “*Emotional Intelligence*” has been used in recent years) for many modern studies is a necessary competence of the 21st century. The same can be said about another competency of this cluster - *Orientation to customer service*. According to the results of a qualitative analysis, it is close to the author's competence of *Customer focus*.

The competences from the *Impact and influence* cluster as described by Spencers intersect with the characteristics of managerial competencies, which made it difficult to analyze and formulate conclusions.

The competency cluster of *Personal effectiveness* demonstrates significant dynamics at the beginning of the analyzed period (2015-2019), but at the end its values are close to zero. In our opinion, this, as in the case of the *Help and service of others* cluster, may indicate that customers are underestimated of the competencies that make up the cluster.

In general, the results of the analysis made it possible to determine current trends in the dynamics of demand for competency models for middle management, and thereby achieve the original goal of our study.

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CLINICAL PROTEOMICS: NEW TECHNOLOGICAL PLATFORM FOR DIAGNOSTICS OF DIABETIC KIDNEY DISEASE

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Abstract. The aim of the study was to search for the relationship between standard indicators of renal function and expression intensity of new peptide and protein molecules in urine biosamples of patients with diabetes mellitus (DM) type 2 and diabetic kidney disease (DKD), which compiled molecular diagnostic profiles of urine for early detection, assessment of the progression of DKD and for the development of personalized treatment of DKD. The method of diagnosis and personalized treatment of DKD, including new technological platform for identifying of the subject as having DKD, an increased risk of developing DKD, or having no DKD or increased risk of developing DKD, where the measurement corresponds to measurements of at least one biomarker in samples from subjects. We spent personalized selection and use of hypoglycemic drugs depending on the patient being assigned to one of the groups - DM type 2, DN and CKD C 1-3a or DM type 2, DN and CKD 3b-5, characterized by molecular profile options urine.

Keywords: technological platform, diabetic kidney disease, proteomics

In the last decade of the 21st century, discoveries were made in the field of potential proteomic biomarkers that play an important role in the pathophysiology and pathobiochemistry of various kidney diseases [1]. Indications for the use of proteomic research methods in clinical practice of nephrologist are the identification of individuals with risk of the onset and progression of kidney disease and the prediction of response to therapy, especially in cases where there are serious adverse drugs effects. Despite

the fact that many proteomic biomarkers were detected in nephrology and proved prognostic value, most of them did not pass validation due to the lack of clinical studies with reliable endpoints.

One of main causes of mortality in patients with type 2 diabetes mellitus (DM) is diabetic nephropathy (DN), which leads to terminal renal failure [2]. Epidemiological studies have shown that true prevalence of DN is higher than the registered prevalence (8%) by 2-8 times in certain regional districts of Russia [3]. Microalbuminuria (MAU) is detected in 15–40% of cases upon first appearance of type 2 DM or precedes the diagnosis [4]. The question of the mechanism of the occurrence and development of DN in patients with DM type 2, trigger factors that determine the rate of its progression, remains open. Today the problem of the studying of mechanisms of the development of DN and their pharmacological correction has acquired new level of significance in connection with the introduction of the concept of diabetic kidney disease (DKD) [5].

Methods of proteomics are used to assess the profile of peptides and proteins in healthy subjects and to compare the proteomic profile of the urine of patients with DM with or without albuminuria. Diagnostic markers that are currently used to detect diabetic nephropathy (DN), such as urinary albumin excretion (AER) and glomerular filtration rate (GFR), are subject to significant variability [6] and have low prognostic value [7]. Accurate diagnostic methods are extremely important both for the development of preventive measures for DN and for the detailing of its molecular pathogenesis [8]. Recent studies have shown that analysis of urinary proteomic profile allows the recognition of biomarkers specific for CKD in DM [9]. As first step in the confirming of diagnostic specificity and sensitivity of these markers, controlled trial should be performed in several independent clinical centers. Such independent confirmation is required to determine the prognostic value of biomarkers before the next step necessary for their validation and to prove the reliability in statistical models [10]. The confirmation phase of disease-related biomarkers was often shortened or not performed at all. The goal of modern research is the validation of biomarkers identified in blind independent studies and the development of molecular models of the stages of CKD in DM type 1 and type 2.

Two key proteomic diagnostic panels have been identified for urine biosamples in patients with DM, which may be associated with the development of DKD: diagnostic panel characterized by independent multicentric validation and including 65 urine peptides (fragments of collagen, albumin, uromodulin, alpha-1-antitrypsin), identified with DN and characterized by 97% sensitivity and specificity [9]; diagnostic panel proposed for early de-

tection of DN before the appearance of MAU and pathological changes in DKD, including 273 biomarkers in the urine and validated in cross-sectional and long-term studies in large patient populations [11].

The aim of the study was to search for the relationship between standard indicators of renal function and expression intensity of new protein molecules in urine biosamples of patients with DM type 2, DN and CKD, which compiled molecular diagnostic profiles of urine for early detection, assessment of the progression of DKD and for the development of personalized treatment of DKD.

The study was prospective controlled randomized performed in 2 centers according to criteria for inclusion/ exclusion in the study: diagnosis - DM type 2, DN, CKD C 1-5; outpatients and inpatients of both sexes from 40 to 70 years; the duration of confirmed disease of DM type 2 is not less than 3 years; persons of control group without DM; informed consent to participate in clinical trial. The duration of the study was 6 months.

234 patients were included (men - 125 people; women - 109 people; 59.5 ± 0.3 years) with diagnosis of DM type 2, DN, CKD C 1-5. If the patient with DM is diagnosed with CKD (BMI, pre- and postprandial blood glucose concentrations, HbA1c, lipid profile, GFR based Chronic Kidney Desease Epidemiology Collaboration formula for calculating GFR [3], AER, serum creatinine, urea, potassium levels), patient belongs to one of two groups: the patient with DM, DN and CKD C 1-3a (GFR≥45 ml/min/1.73 m^2), the patient with DM, DN and CKD C 3b-5 (GFR<45 ml /min/1.73 m^2).

After inclusion in the study, 2 groups of patients were formed in which following regimens of hypoglycemic therapy were performed [4]: group 1 (n=119) - patients with DM type 2, DN and CKD C 1-3a (GFR ≥45 ml/min/1.73 m^2), AER – 0-300 mg/day were taken the inhibitor of SGLT-2 empagliflozin, sulfonylurea derivative (SM, glycazide MR), glucagon-like peptide receptor agonist (GLP-1, liraglutide); group 2 (n=115) - patients with type 2 DM, DN and CKD C3b-5 (GFR ≤ 45 ml/min/1.73m^2), AER>300 mg/day, were taken dipeptidyl-peptidase inhibitor-4 (DPP4, vildagliptin), long-acting insulin (insulin glargine). The stratification of treatment tactics is performed for each patient depending on the level of HbA1c in the debut: 6.5–7.5%, 7.6–9.0%, > 9%. The control group consisted of healthy individuals (n=30).

Primary endpoint of clinical study is the increase of GFR and maintaining this indicator on the level of at least 90 ml /min /1.73 m^2 in the group of patients with type 2 DM and CKD C1-2, at least 60 ml /min/1.73 m^2 in the group of patients with type 2 DM and CKD C3a and at least 30-45 ml/min/1.73 m^2 in the group of patients with type 2 DM and CKD C3b-5.

Secondary points of clinical study are the AER is less than 30 mg/day for CKD C1, 30-300 mg/day for CKD2-3a, 200-300 mg/day for CKD C3b-5, serum glucose-6.1 mmol/L and postprandial blood glucose-7.8 mmol /L, Hb1Ac-7-8% for CKD 1-3a and CKD C3b-5, respectively, total cholesterol-6 mmol/L, fibrinogen-3 mg/dl, protein C-90-110% activity, allowing to evaluate nephroprotective effect of the regimen of hypoglycemic therapy.

Patient with type 2 DM, DN and CKD C 1-3a (GFR ≥ 45 ml /min/1.73 m^2) is subjected to quantitative analysis of urine protein biomarkers based on the ELISA («eBioscience», США). When high concentrations of ceruloplasmin, podocin, matrix metalloproteinase 9 (MMP9) were detected in urine we used gliclazide MR 30–120 mg/day; if high concentrations of E-cadherin, cystatin C were detected in urine, empagliflozin is used 10-25 mg/day; when high concentrations of macrophage chemoattraction-1 protein (MCP-1), neutrophil lipocalin associated with gelatinase (NGAL) were detected in urine, the combination of liraglutide is administered subcutaneously in initial dose of 0.6 mg /day, followed by an increase to 3 mg / day, adding 0,6 mg in intervals of at least 1 week for 4 weeks and gliclazide MR 30-60 mg/day, either gliclazide MR 30-120 mg/day, and empagliflozin 10-25 mg/day.

Patient with type 2 DM, DN and CKD C 3b-5 (GFR <45 ml /min/1.73 m^2) is subjected to quantitative analysis of protein biomarkers of urine based on the ELISA («eBioscience», США). When high concentrations of transforming growth factor (TGF) β1, MCP-1, NGAL, type IV collagen in urine, vildagliptin is used 50 mg/day or 100 mg/day, or insulin glargine 100 IU/ml/day subcutaneously. The decision about the change of starting hypoglycemic is taken every 6 months of the treatment based on the assessment of all above-mentioned instrumental and laboratory tests.

Clinical study was approved by the Local Ethics Committee of Dagestan State Medical University (Makhachkala, Republic of Dagestan, Russia). Statistical descriptive analysis of clinical study included median, 25th and 75th percentiles. The significance of differences between independent groups was evaluated using the Mann-Whitney test, intra-group differences - the Wilcoxon test. The critical level of p significance was assumed to be 0.05.

Clinical and anamnestic characteristics of patients included in the study and healthy individuals in control group are presented in table 1.

Table 1

Clinical and anamnestic characteristics of patients with diabetes mellitus, diabetic nephropathy, chronic kidney disease and healthy individuals in control group

Parameters	Group 1 (n=119)	Group 2 (n=115)	Control group (n=30)
Gender (males/femals), n (%)	62 (52.1)/57 (47.9)	59(51.3)/56(48.7)	16 (53.3)/14 (23.3)
Age, years (Me, 25; 75 percentiles)	58(55;61) p=0.745	59(58;61) p=0.861;p1=0.934	59,5(55;62)
Масса тела, kg (Me, 25; 75 percentiles)	87(80;92) p=0.002	85(81;90) p=0.003;p1=0.121	81(79;83)
Height, cm (Me, 25; 75 percentiles)	176.5(170;182) p=0.150	175(172;179) p=0.292;p1=0.896	174(168;178)
Body mass index, kg/cm^2 (Me, 25; 75 percentiles)	31(27;34) p=0.002	30(28;32) p=0.003;p1=0.542	27(25;29)
Duration of DM[1] type 2, years (Me, 25; 75 percentiles)	8(7;9)	13(12;14)	-
Patients according to the score of combined risk of cardiovascular events and end-stage renal failure in patients with CKD, depending on the category of GFR and albuminuria (%):			
low risk	-	-	30
moderate risk	39.0	-	-
high risk	54.9	45.2	-
very high risk	6.1	54.8	-
Patients with risk factors (%):			
hereditary burden -			
DM type 2	100	100	6.7
history of the patient -			
impaired fasting glycemia	100	100	-
AH[2]	100	100	-
CD[3]	79.8	100	-
DLP[4]	79.8	100	23.3
PCOS[5]	8.5	9.5	-
gestational DM or the birth of large fetus	18.5	18.2	6.7
age ≥ 45 years	100	100	100
smoking	36.9	39.5	23.3
malnutrition	100	100	6.7
overweight and obesity	100	100	-
low physical activity	89	95.6	6.7

Table 1

Parameters	Group 1 (n=119)	Group 2 (n=115)	Control group (n=30)
Diabetic nephropathy (AER[6]) (%):			
A1- 0-30 mkg/day	39.7	-	-
A2-30-300 mkg/day	60.3	38.3	-
A3 > 300 mg/day	-	61.7	-
CKD[7], stages, %:			
CKDC1 (GFR[8] >90 ml/min/1,73m^2)	26.9	-	-
CKDC2 (GFR 60-89 ml/min/m^2)	47.1	-	-
CKDC3a (GFR 45-59 ml/min/1,73m^2)	26	-	-
CKDC3b (GFR 30-44 ml/min/1,73m^2)	-	40	-
CKDC4 (GFR 15-29 ml/min/m^2)	-	41.7	-
CKDC5 (GFR<15 ml/min/m^2)	-	18.3	-

Notes. The data are presented as Me (25;75 percentiles) – median (25;75 percentiles); n- the number of patients; p, p1 – probability of differences by the Mann-Whitney criterion, the comparison of values between control and the study groups, between groups 1/2; [1]DM-diabetes mellitus, [2]AH – arterial hypertension; [3]CD - cardiovascular diseases, [4]DLP - dyslipoproteinemia, [5]PCOS – polycystic ovary syndrome, [6]AER – albumin excretion rate,[7]CKD– chronic kidney disease, [8]GFR – glomerular filtration rate

The results of the analysis of hormonal and metabolic indicators of blood and coagulograms, functional activity of the kidneys, quantitative analysis of protein urinary markers in 2 groups of patients with type 2 DM and CKD C1-5 and in control group are presented in tables 2 and 3. The appointment of personalized therapy of patients with type 2 DM and CKD C1-5 in the "6" month of the study led to the achievement of primary research point - significant increase in GFR to the level of 90 ml/min /1.73 m^2 in group 1 and 60 ml/min /1,73 m^2 in group 2 of patients compared to initial values of the indicators, as well as the achievement of secondary research points - significant decrease in AER to 100 mg/day with CKD1-3a and 260 mg / day with CKPS3b-5, fasting glycemia on the level of not more than 7 mmol /l and postprandial blood glucose on the level of not more than 8 mmol/l, significant decrease of Hb1Ac to the level of no more than 7% in both groups of patients, fibrinogen to the level of 3 mg/dl, the increase of the activity of protein C to the level of 90-110% activity, maintaining the achieved level of total cholesterol in the blood (6 mmol/l) with the level of LDL cholesterol is not more than 2.8-3 mmol /l, as well as the decrease in the level of creatinine, potassium blood with the increase of activated partial thrombin time in groups 1 and 2 in comparison with similar indicators when included in the study (table 2).

The use of personalized therapy showed significant decrease in the concentrations of podocin, MMP 9, E-cadherin, cystatin C, NGAL, MCP-1 in the urine of patients of group 1, and significant decrease of TGFβ1, MCP-1, NGAL, type IV collagen in urine of group 2 of patients compared with groups 1 and 2 when patients were included in study (table 3).

Table 2

Parameters of hormonal and metabolic profile of blood and functional activity of the kidneys in groups of patients and control group of healthy individuals

Parameters	Group 1 (n=119) Me (25;75 percentiles) «0» Day	Group 1 (n=119) Me (25;75 percentiles) “6” month	Group 2 (n=115) Me (25;75 percentiles) «0» Day	Group 2 (n=115) Me (25;75 percentiles) “6” month	Control group (n=30) Me (25;75 percentiles) «0» Day	Control group (n=30) Me (25;75 percentiles) “6” month
Hormonal and metabolic profile of blood						
Fasting glucose, mmol/l	8 (7;8) 1)p=0.0002	6 (5;7) 1)p=0.000;2)T=0.000	8 (7;8) 1)p=0.000	7 (6;7) 1) p=0.000; 2)T=0.0007;3)p=0.004	5 (4;6)	5 (4;6) 2) T=0.233
PPG[1], mmol/l	9 (8;10) 1)p=0.000	6 (5;6) 1)p=0.000;2)T=0.05	10 (9;11) 1)p=0.000	8 (7;8) 1) p=0.000; 2)T=0.005;3)p=0.000	4,5(4;5)	4 (4;5) 2) T=0.06
HbA1c[2], %	7(6;8) 1)p=0.000	7(6;7) 1)p=0.000;2)T=0.228	7(6;8) 1)p=0.000	7(7;8) 1) p=0.000; 2)T=0.032;3)p=0.866	4,5(4;5)	4(4;5) 2) T=0.233
C-peptide, pmol/l	954 (950;957) 1)p=0.000	930(925;932) 1)p=;2)T<0.01	980 (975;983) 1)p=0.000	968(962;972) 1) p=0/000; 2)T<0.01;3)p=0.000	746 (744;748)	744 (742;745) 2) T=0.75
Cholesterol, mmol/l	6(5;6) 1)p=0.000	6(5;6) 1)p=0.000;2)T=0.824	8(7;9) 1)p=0.000	6(5;6) 1) p=0.000; 2)T=0.0004;3)p=0.929	4.5(4;5)	5(5;5) 2) T=0.08
LDL[3], mmol/l	2,5 (1,8;3,1) 1)p=0.001	2,8(2,2;2,9) 1)p=0.000;2)T=0.05	3,4(3,3;3,5) 1)p=0.000	3(2,9;3,2) 1) p=0.000;2)T=0.379;3)p=0.000	1,85(1,8;2)	2(1,8;2) 2) T=0.548
APTT[4], sec	31(30;32) 1)p=0.000	32(31;33) 1)p=0.002;2)T=0.001	29(28;30) 1)p=0.000	31(30;32) 1) p=0.000; 2)T=0.000;3)p=0.005	34(32;34)	33(32;34) 2) T=0.909
Thrombin time, sec	12(11;12) 1)p=0.001	13(12;14) 1)p=0.03;2)T=0.000	12(12;13) 1)p=0.087	12(12;13) 1) p=0.148; 2)T=0.855;3)p=0.000	12.5(12;14)	12.5(12;13) 2) T=0.419
Fibrinogem, mg/dl	3,1(3;3.2) 1)p=0.000	2,9(2.8;3) 1)p=0.0001;2)T=0.012	3,7(3.6;3.8) 1)p=0.000	3,0(2.9;3.1) 1) p=0.000; 2)T=0.000;3)p=0.006	2,8(2.8;2.9)	2,7(2.7;2.8) 2) T=0.063
Protein C, % activity	95 (94;97) 1)p=0.0001	105(104;106) 1)p=0.000;2)T=0.000	92(91;95) 1)p=0.000	99 (98;100) 1) p=0.000; 2)T=0.000;3)p=0.000	122,5 (121;124)	122,5 (122;124) 2) T=0.644
Creatinin, µmol/l	89(85;92) 1)p=0.000	84(83;85) 1)p=0.000;2)T=0.000	195 (194;197) 1)p=0.000	126(125;127) 1) p=0.000; 2)T=0.000;3)p=0.000	79(76;82)	81.5(80;83) 2) T=0.0028
Potassium, mmol/l	4.5(4.4;4.6) 1)p=0.000	4.2(4.1;4.3) 1)p=0.000;2)T=0.000	5.1(5.0;5.2) 1)p=0.000	4.3(4.3;4.4) 1) p=0.000; 2)T=0.000;3)p=0.000	4(3.9;4.1)	4 (3.9;4) 2) T=0.265
Laboratory indicators of functional activity of the kidneys						
AER[5], mg/day	155(152;160)	95(93;97) 2)T=0.000	326(322;328)	255(252;258) 2)T=0.000;3)p=0.000crea	-	-
GFR[6], ml/min/1,73m^2	82(81;84) 1)p=0.000	90(88;92) 1)p=0.000;2)T=0.000	58(57;59) 1)p=0.000	62(61;63) 1) p=0.000; 2)T=0.214;3)p=0.000	95(93;97)	95(94;97) 2) T=0.214

Notes. The data are presented as Me (25;75 percentiles) – median (25;75 percentiles); n- the number of patients; p – probability of differences by the Mann-Whitney criterion 1) the comparison of values between control and study groups 1/2 in “0” day, “6” month of therapy; 3) group1/2 – in“6” month of therapy; 2) T- intragroup differences by Wilcoxon test; [1]PPG – postprandial blood glucose; [2]HbA1c – glycosylated hemoglobin; [3]LDL – low density lipoproteins; [4]APTT – activated partial thrombin time; [5]AER – albumin excretion rate; [6]GFR – glomerular filtration rate

Table 3

Quantitative analysis of protein markers of diabetic nephropathy and chronic kidneys disease stages 1-5 in groups of patients and persons of control group

Parameters	Group 1 (n=119) Me (25;75 percentiles) «0» Day	Group 1 (n=119) Me (25;75 percentiles) "6" month	Group 2 (n=115) Me (25;75 percentiles) «0» Day	Group 2 (n=115) Me (25;75 percentiles) "6" month	Control group (n=30) Me (25;75 percentiles) «0» Day	Control group (n=30) Me (25;75 percentiles) "6" month
E-cadherin, ng/ml	12(11;13) 1)p=0.000	6(5;7) 1)p=0.000;2)T=0.000	-	-	4(4;5)	4(3;4) 2) T=0.061
Cystatin C, mg/l	5(5;6) 1)p=0.000	3(3;4) 1)p=0.000;2)T<0.01	-	-	1(0,5;1)	0,6(0,5;1) 2) T=0.09
Neutrophil Lipocalin Associated with Gelatinase, ng/ml	155(153;156) 1)p=0.000	100(99;102) 1)p=0.000;2)T<0.01	160(160;161) 1)p=0.000	111(110;113) 1) p=0.000; 2)T<0.01;3)p=0.000	9(8;10)	8,5(7;9) 2) T=0.07
Podocin, ng/ml	22(21;24) 1)p=0.00	17(16;18) 1)p=0.00;2)T<0.01	-	-	2(2;3)	2(2;3) 2) T=0.99
Matrix metalloproteinase 9, ng/ml	23(21;25) 1)p=0.00	16(13;19) 1)p=0.00;2)T<0.01	-	-	3 (4;5)	3 (4;5) 2) T=0.99
Macrophage chemoattraction-1 protein, pg/ml	1227 (1020;1440) 1)p=0.00	886 (785;986) 1)p=0.00;2)T<0.01	1219 (1009;1410) 1)p=0.000	990(890;1090) 1) p=0.00; 2)T<0.01;3)p=0.00	125(83;167)	123(101;140) 2) T=0.73
Transforming growth factor β1, pg/ml	-	-	2113 (1713;2460) 1)p=0.000	1825(1675;2020) 1) p=0.00; 2)T<0.01;3)p=0.00	16(10;22)	15(9;21) 2) T=0.54
Collagen IV type, μg/l	-	-	132 (128;137) 1)p=0.000	112(111;113) 1) p=0.00; 2)T<0.01;3)p=0.00	68(66;70)	69(67;71) 2) T=0.78

Notes. The data are presented as Me (25;75 percentiles) – median (25;75 percentiles); n- the number of patients; p – probability of differences by the Mann-Whitney criterion 1) the comparison of values between control and study groups 1/2 in "0" day, "6" month of therapy; 3) group1/2 – in"6" month of therapy; 2) T- intragroup differences by Wilcoxon test

The use of personalized therapy in patients with CKD 1-5 in DM type 2 contributes to significant stabilization of pre - and postprandial blood glucose concentrations, the level of Hb1Ac, the increase of GFR, the decrease of AER, creatinine, urea and serum potassium in comparison with the standard treatment. Significant positive dynamics of indicators is possible due to the decrease in urine concentration of podocin, MMP9 , E-cadherin, cystatin C, MCP-1, NGAL in patients with DM type 2 and CKD1-3a and the decrease of urine levels of TGF β1, MCP-1, NGAL, type IV collagen in patients with DM type 2 and CKD C 3b-5. This makes it possible to reduce the dose of hypoglycemic drugs, helps to reduce the hospitalization time and financial costs for the patient.

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DATA PROCESSING AND DECISION MAKING IN PSYCHIATRY BASED ON THE ANALYTIC HIERARCHY PROCESS

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Abstract. Modern approaches to solving the main problems of data processing and decision-making related to the diagnosis, classification of psychopathological conditions, treatment and rehabilitation of patients in psychiatry are based on the integration of clinical, psychometric, social and neurobiological characteristics of patients [1]. The fundamental heterogeneity of data hinders the correct coordination and integration of research results within these approaches. From the point of view of measurement theory, the characteristics of patients are determined using the corresponding measurement scales: psychometric (non-numeric) scales and relationship scales (numeric). Therefore, it is impossible to use even the simplest statistical operations to obtain integrated, correct models for evaluating patients ' states, and there is no basis for making informed decisions (see, for example, [2-3]).

Objectives. Using algorithms of the Analytic Hierarchy Process (AHP) [4-5] for processing initial psychometric (rank, dimensional) information in order to obtain processing results in numerical form and form informed decisions [2].

Methods. Methods of data analysis: statistical, rank methods, algorithms of the hierarchy analysis method.

Results. The effectiveness of algorithms for converting rank information into numerical (cardinal) information based on the hierarchy analysis method is shown using simple examples of a General medical nature.

Conclusions. A radical approach to the processing of rank information opens up the possibility of obtaining integrated ratings on different scales, which is of interest for clinical practice and research.

Keywords: data, rank, dimensions, psychometry, relationship scale, decision-making, analytic hierarchy process.

Introduction. Psychometric (dimensional, rank) scales are used in psychiatry to assess the severity of psychopathological states of patients, to assess neurocognitive, emotional and social disorders. Scales such as the mental status estimation scale (PSE), the PANSS scale, the compliance assessment scale, the social functioning scale, and many other scales are widely known. Rank scales are widely used in medicine, psychology, sociology, Economics, management theory, and other disciplines for integral estimation of the state of social and technical objects (from patients to social groups, from individual devices to industries and the economy).

In psychiatry, when evaluating a person's states and behavior, it is necessary to make decisions (for example, evaluating a psychopathological states, making a diagnosis, etc.) based on heterogeneous information. This information is organized hierarchically and includes both quantitative (cardinal) indicators (for example, age, duration of illness, frequency of hospitalization, results of bioanalysis) and non-numeric (psychometric, rank, and dimensional) indicators (for example, the severity of psychopathological symptoms, characteristics of social behavior and environment).

Ranks are placemarks between which only the operations of equality ("equal") and order ("less-more") are defined. For rank (dimensional) scales, it does not make sense to calculate the simplest statistical characteristics of rank samples, such as average (average score), variance, etc. These are well-known facts (for almost 50 years) from the measurement theory [6], which are included in the manuals on mathematical methods of data processing. Let's recall a well-known example of a ranking scale of academic performance, in which grades are expressed by marks from "1" (very bad) to "5" (excellent). Some countries ' educational systems use 8-, 10-, 12-, 20-, 100-scores, and, for example, in the United States, scores are indicated by letters of the alphabet: A, B, C..., and in this case it is clear that it does not make sense to "calculate" not only the average value, but also the sum of such marks.

Similarly, rank scores obtained within other rank scales (ordinal, or dimensional) are not numerical (cardinal) scores. Rank information can only be processed correctly using non-parametric statistical methods that produce results, for example, in the form of a median score, also in the form of a rank.

Currently, the most effective method of decision – making for multi-criteria problems in which heterogeneous information (quantitative and qualitative) should be processed is the Analytic Hierarchy Process (AHP) [4-5]. To correctly convert the initial rank information into numerical information, we suggest using the AHP.

An important feature of the proposed approach is the formation of the results of processing rank information in the scale of relations (numerical scale), which provides further wide application of mathematical operations.

The number of applied articles with solutions to problems from different areas based on AHP is measured in thousands. Since 1988 the International Symposium on Analytical Hierarchy Process (ISAHP) is held every two years and focuses on the application and development of AHP, the last (15th in a row) was held in July 2018 in Hong Kong. An explanation of the application of the AHP device to certain problems in psychiatry can be found in [2, 7-8].

Results and discussion.

1. Traditional approaches to processing rank information.

Let's consider an example of processing rank information in the context of a contextual "accurate diagnosis" [9]. The initial information is obtained using the "instant estimation" technology. The states of patients is evaluated multiple times (during a day or other period) by one expert clinician (or by the patients themselves) on the basis of a rank (dimensional) scale.

This technology of instant estimation of phenotypes studies quantitative changes in the states of patients in response to changes in environmental factors, such as stress, sleep, medication and lifestyle.

Table 1 shows the number (N) of identical ratings of the states (obtained on a 5-point scale) for one symptom for two patients P1, P2. Scale levels: from 1 to 5 – by increasing the severity of the symptom.

Table 1. Estimation of patients ' states P1, P2 scale levels: from 1 to 5

Patients / N	P1	P2
N1 = 7	4	3
N2 = 4	3	5

That is, for patient P1 we have 7 ratings equal to 4 and 4 ratings equal to 3. Similarly, for patient P2 we have 7 ratings equal to 3 and 4 ratings equal to 5. Thus, 11 ratings were obtained for each patient, distributed accordingly.

Note that the data in table 1 can also be considered as estimates for two patients P1, P2, obtained as a result of a consultation of 11 experts (of equal qualifications), who were distributed in the corresponding groups N1 and N2.

Let's consider the following options for processing the received information:

1. From table 1, it follows that the absolute majority of ratings (7 out of 11) indicates that the final rank (dimensional) rating of the patient's states P1 (equal to 4) is greater than that of the patient P2 (equal to 3). The same results are obtained using median estimates that are correct when processing rank information [6].

Therefore, the final rank estimation of patients ' states P1 and P2 (4 and 3, respectively) have a fairly reliable justification, both on the basis of the "absolute majority" principle of decision-making theory, and in terms of using correct methods for processing rank information.

2. Suppose now that the ranking data from the table 1 are numbers that can be processed using any mathematical and statistical operations. Let's calculate the arithmetic mean of ratings for patients P1, P2. Denoting S1 and S2, we get the average ratings for P1 and P2 (with an accuracy of 0.01):

$$S1 = (7*4 + 4*3) / 11 = 3.64 ; \quad S2 = (7*3 + 4*5) / 11 = 3.73$$

Taking into account the standard error of calculating the average we get:

$$S1 = 3.64 \pm 0.15; \quad S2 = 3.73 \pm 0.30$$

Comparing the average scores leads to an uncertain situation at best, and at worst to the opposite conclusion compared to point 1: the average state score for P2 is greater than for P1. As a result, we get a contradiction both with the generally accepted principle of "absolute majority" decision-making, and with the results based on correct statistical processing of rank information. The way out of this uncertain situation is to reject the assumption of paragraph 2. This means that the information from table 1 – non-numeric (rank, dimensional) information for which the arithmetic mean calculation operation is incorrect.

Analysis of this simple example, which has General medical significance, leads to an unambiguous conclusion about the failure of the interpretation of rank information as numerical information.

The limitations of the rank approach have been known in decision theory for more than 60 years (the famous "impossibility theorem", proved by Arrow K. [10] in 1951 and for which he received the Nobel prize in 1972). The meaning of this theorem is that within the framework of the rank approach, there is no method for combining expert preferences that satisfies certain fair conditions and always gives a logically consistent result. With a cardinal (numerical) approach (within the scale of relations), this theorem has a solution [5].

Analysis of the problems of evaluating psychopathological States based on categorical and rank scales shows that these problems can be presented in the form of appropriate hierarchies, the structure of which must be taken into account when processing rank information. Therefore, the use of the AHP device in these situations is most natural. The implementation of AHP procedures is based on the use of the AHP normative approach [2, 4-5]. The normative approach in AHP is based on the use of expert pair comparisons of ratings of the rank scale to form a numerical scale of rating intensities.

2. AHP-Based approaches and algorithms for processing rank information

Let's consider the corresponding hierarchy (Fig. 1) of the problem of final estimation of the states of patients P1 and P2, who have 11 ratings (E1 – E11) on a 5-point scale.

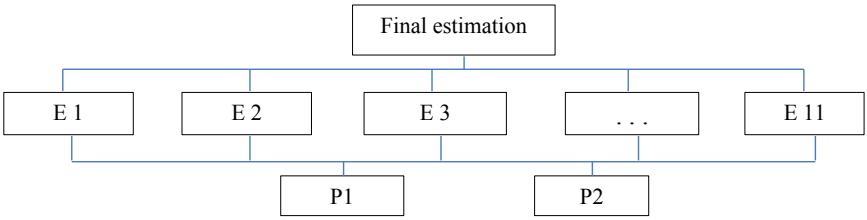

Figure 1. Hierarchy of the final evaluation procedure for patients P1, P2

Here is the matrix (table 2) paired comparisons of rank scale marks ("1",... ,"5"), using the main levels of the fundamental AHP scale, as well as the property of unevenness of the marks of the "closed" rank scale [2, 5, 11] to fix the results of paired comparisons. A school is called "closed" if it has a minimum grade ("1") and a maximum grade ("5"). The quality estimation of the obtained matrix of paired comparisons is based on the value of the coefficient of "consistency ratio", which is calculated from the matrix of paired comparisons. The critical value of the coefficient is 0.1, and the ideal value is 0 [4-5].

We will assume that the comparison matrix (table 2) obtained as a result of a collective agreement of experts. This is not a limitation. within the framework of AHP, each expert can form similar individual matrices of paired comparisons and then use them to calculate the intensity of marks, and then average the obtained intensities.

Table 2. Matrix of paired comparisons of marks ("1", ..., "5") rank scale

E	*"5"*	*"4"*	*"3"*	*"2"*	*"1"*
"5"	1	2	3	5	7
"4"	1/2	1	3	5	7
"3"	1/3	1/3	1	3	5
"2"	1/5	1/5	1/3	1	3
"1"	1/7	1/7	1/5	1/3	1

The matrix elements in table 2 are formed using the main numerical levels of the AHP fundamental scale, which have the appropriate semantic interpretation: 1-equal importance; 3 – weak preference; 5 – preference; 7 – strong preference; 9 – absolute preference; 2, 4, 6, 8 – intermediate cases. The scale also contains corresponding inverse values (for measuring the results of reverse pair comparisons): 1/2, 1/3, 1/4, 1/5, 1/6, 1/7, 1/8, 1/9.

Since the matrix (table 2) has a good consistency coefficient (it is equal to 0.04, which is less than the critical value of 0.1), then the calculation of normalized weights w marks ("1", "2", ..., "5") a rank scale can be performed using simple arithmetic algorithms (for example, [2, 4-5]). Further, by dividing the received normalized weights of marks by the maximum weight of the score "5"(equal to 0.415), we get the values of the intensity of marks: i ("1"), i ("2"),..., i ("5"). The results of calculations are presented in table 3:

The final stage of solving the example consists in calculating the weights of the final estimation of patients ' states P1, P2 based on the data in table 3, taking into account the equality of assessments E1 – E11. In the case under consideration, using the initial rank estimates from table 1, we get the weights (Wp1, Wp2) of the final estimates of the patients ' states:

Wp1 = (7 * i(*«4»*) + 4 * i(*«3»*) / 11 = **0,779**;

Wp2 = (7 * i(*«3»*) + 4 * i(*«5»*) / 11 = **0,705** .

Taking into account the standard error, we get: 0.779 ± 0.17 and 0.705 ± 0.17, respectively.

Thus, the patient's states P1 should be considered more severe, which coincides with the correct ranking decision of the example.

Conclusion. The fundamental difference between the obtained AHP-based solution and the rank solution is due to the fact that numerical estimates are found that can be used for any mathematical processing and construction of appropriate mathematical models of communication and prediction of patients ' states from external factors.

A cardinal approach to the processing of rank information opens up prospects for obtaining integrated assessments on different scales, which are of interest from the point of view of forming indicators of the effectiveness of psychosocial, rehabilitation and psychotherapy measures.

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THE IMPACT OF THE MEAL SEQUENCE ON THE COMPENSATION OF TYPE 2 DIABETES

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Annotation. The article presents the results of the study of the impact of meal sequence on the improvement of the parameters of carbohydrate exchange in Uzbek patients with type 2 diabetes.

Key words: type 2 diabetes, meal sequence, compensation

Diabetes mellitus is a serious disease leading to severe complications. In 2019 the number of patients with diabetes mellitus in the world reached 463 million people (1), mostly with diabetes mellitus type 2. It is known, that treatment of diabetes mellitus type 2 is based on a correct style of life, in other words, rational nutrition and physical activity (2). Unfortunately, not all the patients can follow dietary recommendations due to some reason. Dietary recommendations for patients with diabetes mellitus type 2 suffering overweight, as a rule, are aiming decrease of nutrition calories.

Yabe D et al. Reported that, consumption of dietary fibers prior to proteins, carbohydrates, and lipids by Japanese patients promoted improvement of glycemic profile, even if hypoglycemic therapy was not intensified (3). Studies of Japanese researchers served the basis for the design of dietary recommendations based on the role of sequence of food consumption in the control of diabetes mellitus type 2 in Japanese people (4).

The origin of that study was established by the observations made by Kun-Ho Yoon et al. published in 2006, which showed that in Asia, different from USA, the prevalence of obesity was not correlated with the prevalence of diabetes mellitus type 2, and that confirmed the dominance of beta-cells dysfunction over insulin-resistance in Asian countries (5).

As it is known, Central Asia is a territory located between Europe and Asia, which was conquered both by Alexander Macedonian, and Chingiz khan, and it causes interest in the character of physiopathological alterations in the development of diabetes mellitus type 2 in people living in that area for the application of the obtained data in the design of the regulation of that state.

On the basis of the aforesaid, **the objective** of this work was to reveal the impact of the food consumption sequence on the compensation of carbohydrate exchange in the patients with diabetes mellitus type 2 among Uzbek population.

Research methods and data. The study enrolled 40 patients with diabetes mellitus type 2. The patients of the basic group were recommended to consume dietary fibers such as salads made of fresh vegetables before protein, lipid, and carbohydrate food. The control group patients (n=20) were those, who followed only the principles of nutrition based on the decrease of food calories. The study lasted for 3 months.

Patients were asked and their status was clinically assessed. The measurements included the measurements of height and weight for the calculation of BMI. Besides that, waist circumference was measured. In order to assess the condition of carbohydrate exchange the level of fasting glycemia and glycemia after meal was measured together with the level of glycosylated hemoglobin (HbAIc).

For statistical processing of the data Microsoft Excell 2010 software was used with Student's criterion. The data were expressed in statistical mean M±m.

Results and discussion. Table 1 represents clinical characteristics of patients with diabetes mellitus type 2 enrolled in the study.

The average age of the patients in the basic group was 52 years old, and in the control group it was 54. Duration of diabetes was compatible in both groups, being 5.6 and 5 years respectively. The groups were also matched by other criteria.

Table 1.
Clinical characteristics of the patients with diabetes mellitus enrolled in the study

	Basic group (n=20)	Control group (n=20)
Gender (M\F)	9/11	8/12
Age (years)	52±5.7	54±6.4
Duration of diabetes (years)	5.6±2.3	5.0±3.1
BMI, kg/m²	30.1±1.7	31.2±1.9
Waist circumference (cm)	92.4±4.5	91.0±5.4

As it is seen from the Table the groups were compatible.

In the basic group 66.7 and 42.5% of the patients, and in the control group 61.2 and 47.6% had diabetic neuropathia and retinopathia, respectively. Patients in both group administered oral glucose decreasing therapeutic agents, mostly consisting of a combination of metforminum, sulfonylurea agents, and DPP-4 inhibitors. Glucose decreasing agents were not administered during the study.

Table 2 present the values assessed in the study.

Table 2.
Values of the patients enrolled in the study

	Basic group (n=20)		Control group (n=20)	
	Before	**After**	**Before**	**After**
Fasting glycemia, mmol/l	8.5± 0.4	7.9±0.3	9.1± 0.9	8.9±0.9
Postprandial glycemia, mmol/l	12.4±0.9	8.7±0.5*	12.1±1.3	10.9±0.9
HbAlc, %	11.6±0.8	9.5±0.7*	12.6±1.8	11.5±1.7
BMI	30.1±1.7	29.9±1.3	31.2±1.9	31.5±2.1
Waist circumference, cm	92.4±4.5	92.1±4.4	91.0±5.4	92.0±6.1

According to the obtained data only some parameters of the basic group underwent certain changes. There was a reliable decrease in postprandial glycemia and glycosylated hemoglobin levels ($p<0.05$).

Decrease in postprandial glycemia, which is considered to be an important risk factor of cardiovascular complications of diabetes mellitus, demonstrates the impact of food consumption sequence. As it is known, glycosylated hemoglobin is the criterion of carbohydrate exchange compensation and the control of diabetes mellitus was based on its individual level for each patient. Decrease of that value by 2.1% by means of alteration of just dietary recommendations is considered to be a perfect result, and together with the intensification of glucose decreasing therapy it will allow the achievement of therapeutic target levels.

Thus, the obtained results demonstrate that in case of diabetes mellitus type 2 in Uzbek patients it is necessary to apply the method of consequent food consumption, in other words, to consume dietary fibers before proteins, lipids, and carbohydrates, as traditionally in Central Asia consumption of these food components is simultaneous, but this does not lead to the improvement of diabetes mellitus type 2 compensation.

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ASSESSMENT OF PHYSICAL DEVELOPMENT, BODY COMPOSITION AND LIPID PROFILE IN ADOLESCENTS

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Abstract. We studied the indicators of physical development (PD), component composition of the body and lipid profile in healthy adolescents of 10-17 years old, living in Vladivostok. Children with health groups 1 and 2 were examined, divided by age into groups: I (7-9 years old) - 202 people, II (10-14 years old) - 221 people and III (15-17 years old) - 601 people. Conducted: PD assessment by centile method, quantitative assessment of body components - by bioimpedanceometry (BIM) on the apparatus "Diamond - Stork" (St. Petersburg), biochemical parameters were determined (on an automatic biochemical analyzer MIN-DRAY BS-200): glucose, total cholesterol (TC), triglycerides (TG), high density lipoproteins (HDL) and low density (LDL), etc. Statistical processing of the material was carried out using specialized research application packages (Excel 2010 and Statistica 6.0, 8.0). In 48.9% of children and adolescents of the study group, a harmonious PD was diagnosed. In 1/3 of boys in all age groups and in 26.1% of girls - in group II, disharmonious due to excess body mass (BM) was revealed, in 35% of cases in girls 15-17 years old (group 3) PD was disharmonious due to BM deficiency. An AC/BH index above 0.5 was diagnosed in 2% of girls and 4% of boys in the study sample and reflects a tendency toward gracification. It was proved that in addition to age and gender, they are most susceptible to deviations from the average BM, BH, OT, BFM, LBM, PACM, TW, XC, LDL, TG (LBM, ECL, PACM prevailed in boys ($p \leq 0.001$), in girls - BFM, LBM, TW, ECL ($p \leq 0.001$)). When analyzing the lipid profile, significant ($p \leq 0.05$) age-gender differences were revealed

between girls and boys in group II and III in terms of LDL and TC and in children of group I in terms of TP. A wide range of range of indicators was revealed at various age periods with a tendency to increase TC, TP (in the group of boys) and LDL (mainly in the second age group).

Keywords: physical development, body mass components, lipid profile, children

Scientists all over the world note the widespread occurrence of PD disorders, which depends on genetic, ethnic, geographical, social, economic, social - hygienic and other conditions [1,2]. The variability of PD parameters in children and adolescents of different age groups in the Russian Federation has wide variative indicators [3]. Despite the lack of a unified scientific opinion on the methodology and standards of PD, shifts and patterns of PD have been studied, regional standards have been developed. Systematic large-scale scientific studies note an increase in excess BM and obesity [1,2,4], the problem of weight deficiency and malnutrition in children and adolescents is no less acute [5]. Recent studies of PD indicate a decrease in the number of children with harmonious PD [4,5]. Assessment of anthropometric indicators is important in the practice of a pediatrician and is the main criterion for the dynamics of growth and development of the child. However, the measurement of traditional indicators of BM and body height (BH) is currently insufficient. With the development of modern diagnostic methods, an assessment of the components of BM is available for the doctor-pediatrician, which allows you to adjust the PD imbalance parameter, information resources for calculating and predicting PD. Body size is important in assessing PD. In accordance with the recommendations of the National Adult Cholesterol Education Program in the third revision (National Cholesterol Education Program Adult Treatment Panel III, NCEP/ATP III) in the modification for children, one of the criteria for the metabolic syndrome in children is abdominal - visceral obesity, the criterion of which is the abdominal circumference> the 90th percentile [4,6,7]. Indicators: abdominal circumference (along the waistline) (AC), the ratio of abdominal circumference to hip circumference (AC/HC) and abdominal circumference to height (AC/BH) more accurately characterize the distribution of visceral fat, in contrast to the generally accepted criterion, the mass index body sys (BMI) [4,5]. No less important criteria in assessing PD is the assessment of the circumference of the chest (ACC), which characterizes the body volume and the functional state of the organs of the chest cavity, and the circumference of the head, which gives an idea of the degree of development and normal functioning of the brain.

Regional studies of the PD of adolescents in the Russian Federation make it possible to determine the vector of changes in the somatic development of children and adolescents, which is relevant, and timely deviations of PD that indicate poor health status will allow to adjust preventive and health measures.

Purpose of the study: based on the study of indicators of physical development, component composition of the body, lipidograms, to assess the risk of impaired health of schoolchildren and justify a set of preventive measures.

Materials and methods. A simultaneous (transverse) study of PD of schoolchildren aged 7-17 years of the 1st and 2nd health groups was carried out. Based on voluntary consent, 1024 schoolchildren were comprehensively examined in educational institutions of Vladivostok. Children are divided into age groups: I group (7-9 years old) - 202 people, II group (10-14 years old) - 221 people and III group (15-17 years old) - 601 people. PD assessment was performed by the centile method (regional and Russian centile tables): BM, BH, ACC, AC, HC, wrist circumference (WC), BMI, AC/BH index were evaluated. The integrated assessment took into account the level of development (biological age according to the criteria of sexual development and dental age), the functional state of the body (VC, dynamometry, blood pressure, etc.). A quantitative assessment of body components by bioimpedansometry was carried out on the apparatus "Diamond - Stork" (St. Petersburg), the following were evaluated: body fat mass (BFM), lean body mass (LBM), total fluid (TF), extracellular fluid (ECL), intracellular fluid (ICL), active cell mass (ACM), proportion of active cell mass (PACM), total water (TW), atherogenicity index (AI). The biochemical parameters were studied (using the MINDRAY BS-200 automatic biochemical analyzer): glucose, TC, TG, HDL, LDL, etc. The results were evaluated and a comprehensive systematic analysis of the data was carried out by the method of variation statistics with calculation of arithmetic mean (M), arithmetic mean error (m), Student's confidence coefficient (t) at a given significance level (p). The values of the confidence interval characterizing the degree of evidence of the data were calculated, including average (true or normal), reduced and increased values. Statistical processing of the material was carried out using specialized research application packages (Excel 2010 and Statistica 6.0, 8.0).

Results: Average values of PD indicators are presented in tables 1, 2 and reflect the age-related dynamics of growth and development, as well as age-gender differences.

Table 1.

Average values and intervals of indicators of physical development of girls 7-17 years old (M ± m)

Indicators	7-9 years (I group) (n =100)		10-14 years (II group) (n =120)		15- 17 years (III group) (n = 301)	
	M ± m	Interval (minimum - maximum)	M ± m	Interval (minimum - maximum)	M ± m	Interval (minimum - maximum)
BM, kg	29,69±0,73	20,00-50,00	46,18±0,89▲	24,00-75,00	54,75±1,16■●	39,00-94,00
BH, cm	131,22±0,79	117,00-155,00	155,81±0,81▲	125,00-176,00	164,58±0,69■●	155,00-177,00
CH, cm	63,92±0,59	54,00-79,00	73,76±0,61▲	60,00-93,00	76,58±0,76■●	64,00-99,00
OT, cm	57,53±0,69	45,00-75,00	63,45±0,69▲	47,00-88,00	62,63±1,62	20,00-93,00
HC, cm	43,88±0,59	34,00-60,00	52,12±0,60▲	40,00-70,00	53,32±0,77■●	43,00-75,00
WC, cm	12,41±0,12	11,00-17,00	14,98±0,13	10,00-18,00	14,88±0,12●	13,00-17,00
BMI	17,06±0,29	11,24-25,51	18,93±0,28	13,60-26,26	20,21±0,42*●	15,76-36,72
AC/BH Index	0,44 ±0,004	0,34-0,58	0,41± 0,004	0,31-0,55	0,39 ± 0,005	0,26-0,58

Note: ▲ p ≤ 0.001 between group I and II; ; ■ p ≤ 0.001 between group I and III, ● p ≤ 0.01 between group I and III, * p ≤ 0.05 between group II and III.

Table 2.

Average values and intervals of indicators of physical development of boys 7-17 years old (M±m)

Indicators	7-9 years (I group) (n =102)		10-14 years (II group) (n =101)		15- 17 years (III group) (n = 300)	
	M ± m	Interval (minimum - maximum)	M ± m	Interval (minimum - maximum)	M ± m	Interval (minimum - maximum)
BM, kg	29,76 ±0,64	19,00-49,00	48,93±1,31▲	24,00-98,00	66,64±1,55■●*	52,00-99,00
BH, cm	132,86 ±0,89	113,00-154,00	157,63±1,22▲	130,00-184,00	176,52±0,78■●*	163,00-194,0
CH, cm	64,22 ±0,60	53,00-80,00	76,74±0,80▲	60,00-105,00	83,94±1,00■●*	70,2-107,00
OT, cm	57,62 ±0,65	49,00-82,00	66,95±0,92▲	47,00-102,00	73,25±1,25■●*	62,00-99,00
HC, cm	42,99 ±0,57	31,00-64,00	50,52±0,74	24,00-75,00	54,64±0,80■●	43,00-69,00
WC, cm	13,70 ±0,12	11,00-17,00	15,57±0,15▲	13,00-19,00	16,45±0,13■	14,00-19,00
BMI	16,6 1±0,24	9,49-24,68	19,38±0,33▲	13,79-31,28	21,48±0,46■●	17,17-32,37
AC/BH Index	0,43 ±0,004	0,37-0,57	0,43 ±0,005	0,34-0,61	0,42±0,006	0,35-0,59

Note: ▲ p ≤ 0.001 between group I and II; ■ p ≤ 0.001 between group I and III, ● p ≤ 0.01 between group I and III, * p ≤ 0.05 between group II and III

PD assessment showed that in the study group half (50%) of schoolchildren had BM scores in the range of $P_{25\text{-}P75}$, that is, average values. BM above average ($P_{75 \text{ and above}}$) was detected in 1/3 of adolescents 15-17 years old, mainly in girls, and in the interval $P_{3 \text{ and below}}$ (below average) in 7% of girls 7-9 years old, 11.7% - 10- 14 years old and 4.6% at 15-17 years old (average in the study group 7.7%), boys respectively 7.6%, 12.9% and 2% (average 7.5%). 33.2% of schoolchildren 10-14 years of the study group had an increased BMI ($P_{75 \text{ and above}}$): girls in 41.4% of cases, boys in 25%, which characterizes the rounding period. The BH indicator in the studied age groups had characteristic physiological patterns of growth; individual growth rates were revealed in girls in group III. CH in ½ of the boys corresponded to age (44.1% in the first group, up to 50% in the II and III groups), while in girls a similar tendency persists only in the I and II groups. TF in most children 7-17 years old was in the range of $P_{25\text{-}75}$, while in 20% of girls of group I, 17.5% of the second and 9.6% of the third, the indicators were below average ($P_{3 \text{ and below}}$). In 1/5 of the boys in group I, TF was also reduced. For a pediatrician, a more important assessment is TF in the range of $P_{75 \text{ and above}}$, which characterizes the increased body weight and the degree of obesity, which was diagnosed in girls in 14%, 15% and 2%, respectively. Above average and high was TF in 1/3 of the boys in the I and II of the study group, and only 3.7% of boys 15-17 years old had elevated TF. The WC and HC indicators in the majority of the age and gender groups of the studied sample did not have significant differences and were included in the assessment using the centile method in the range of $P_{25\text{-}75}$, i.e., were average. Only in the II age group (10-14 years) in 38% of girls and 37.4 boys, WC was increased, HC was 39 and 42 percent, respectively. The AC/BH ratio in schoolchildren of 7–17 years of age as a mean did not go beyond the threshold value (an indicator of more than 0.5). Attention should be paid to the maximum values of AC/BH in the study group, which were more than 0.5 for all boys and girls in groups II and III, emphasizing the significance of the individual PD score. AC/BH above 0.5 was diagnosed in 2% of girls and 4% of boys in the study sample and reflect a tendency to gracification. In the group of children examined, only ½ (48.9%) of children and adolescents (I group - 51.1%; II group - 54.6%; III group - 46.4%) had a harmonious development. The disharmony of PD due to BM deficiency in boys averaged 6.9%; in girls, depending on age, significant differences were noted ($p \leq 0.01$). Evaluation of the somatotype in group I in girls revealed in equal parts (45.5% and 41.8%) - the mesosomatotype and macrosomatotype, and the microsomatotype was determined in 12.7% of female children. In boys, more than half, a macroomatotype was

detected - 64.5%, while a mesosomatotype was diagnosed in 29.2%, and a microsomatotype in 6.3%. In the II group, regardless of gender, more than half of the children had a macrosomatic type of development (50.9% in girls and 60.9% in boys), in the III group, about 50% of the children had a mesosomatic type. BIM results are presented in tables 3, 4.

Table 3.
Average values and intervals of indicators of body mass components of girls 7-17 years old

Indicators	7-9 years (I group) (n =100)		10-14 years (II group) (n =118)		15- 17 years (III group) (n = 65)	
	M ± m	Interval (minimum - maximum)	M ± m	Interval (minimum - maximum)	M ± m	Interval (minimum - maximum)
BFM, kg	5,39±0,34	0,21-14,9	10,03±0,44▲	0,39-22,39	14,03±0,78■	4,74-44,92
ICL, l	5,72±0,11	3,32-8,25	9,23±0,17▲	4,85-22,89	10,12±0,14■	7,04-12,71
ECL, l	9,05±0,20	5,04-14,53	15,16±0,28▲	6,29-25,64	17,94±0,32■	10,06-22,95
TF, l	14,78±0,29	9,23-22,23	24,43±0,43▲	11,15-48,53	28,36±0,40■	20,26-34,85
LBM, kg	24,37±0,46	16,36 -35,20	36,09±0,56▲	21,46-69,51	40,73±0,54■	29,67-49,25
ACM, kg	14,69±0,28	10,41-22,64	22,13±0,36▲	11,93-36,15	25,78±0,36■	19,06-32,55
PACM, %	50,16±0,39	42,36 -59,72	48,27±0,26	18,98±40,11	47,54±0,41	34,63-54,84
TW, l	17,9±0,34	11,97-25,77	26,52±0,41▲	15,71-50,88	29,80±0,39■	21,72-36,05
AI	2,72±0,14	1,70-4,60	3,12±0,21	2,00-4,80	3,04±0,19	2,40-3,90

Note: ▲ p ≤ 0.001 between group I and II; ■ p ≤ 0.001 between group II and III.

Table 4.
Average values and intervals of indicators of components of body weight of boys 7-17 years old

Indicators	7-9 years (I group) (n =100)		10-14 years (II group) (n =101)		15-17 years (III group) (n = 56)	
	M ± m	Interval (minimum - maximum)	M±m	Interval (minimum - maximum)	M ± m	Interval (minimum - maximum)
BFM, kg	4,82±0,34	0,78-18,60	8,27±0,61▲	0,48-38,54	10,71±1,03●	1,71-31,24
ICL, l	5,82±0,10	3,63-8,37	9,83±0,25▲	5,00-17,40	12,82±0,19■	9,21-15,86
ECL, l	10,29±0,21	5,88-14,92	16,98±0,37▲	8,95-26,56	22,72±0,29■	18,70-27,60
TF, l	16,15±0,29	9,51-22,48	26,70±0,60▲	14,33-43,96	35,54±0,46■	27,91-43,46
LBM, kg	24,97±0,37	17,17-33,00	40,67±0,99▲	21,73-68,86	55,93±0,74■	44,00-68,79
ACM, kg	15,65±0,26	10,45-21,51	25,19±0,64▲	1,92-40,96	35,51±0,46■	28,91-43,00
PACM, %	53,11±0,34	42,95-66,70	52,50±0,42	39,74-65,28	53,51±0,60	40,34-60,46
TW, l	18,28±0,27	12,57-24,40	29,77±0,72▲	15,91-50,41	40,94±0,54■	32,21-50,35
AI	2,61±0,16	1,40-4,30	3,21±0,24*	2,00-5,40	2,96±0,32	1,8-5,70

Note: *p ≤ 0.05 between group I and II; ▲ p ≤ 0.001 between group I and II; ● p ≤ 0.05 between group II and III; ■ p ≤ 0.001 between group II and III.

A negative trend in the health status of boys was revealed. There is an increase in the number of boys from 57.1 to 67% with insufficient BFM in all age periods, while in girls the deficiency of BFM is diagnosed mainly in group I (63%). It is important to note that in group III in girls, the distribution ratio of BFM: reduced - normal - increased almost equal. In the study group of children, regardless of gender and age, from 45.8% to 76% of cases, normal LBM indicators were revealed, which allows us to consider their general nutritional status corresponding to age. The TW assessment criterion includes the assessment of ECL, ICL, and fluids in the body in a bound state. By BIM, in the first group of children, 73% of the children (62% of girls and 84% of boys) had a normal TF value; a reduced rate was observed in 11 children, and an excess of TF in 21.5%. A similar picture was obtained in children of group II; in group III, 104 boys and girls had normal TF values, which amounted to 85.2%; excess values were observed in 13 adolescents (11.2%) and TF deficiency in 4 adolescents (3.6%). The distribution of ECL was of the following nature: ECL within the average standard values in group I and group II, regardless of gender - 28% of children, in group III this indicator increased to 45.4%. ECL was increased in 63.5% of cases, which characterizes the insufficiency of the processes of conversion, storage and use of energy. ICL values corresponded to normal limits and were reduced in a small number of children. When assessing PACM, it was found that its normal percentage in the body decreases with age (from 7 to 17 years) in children and adolescents of both sexes, especially this trend is expressed in girls (from 60% in the first group to 15.4% in the third). A decrease in ACM is characterized by insufficient cellular nutrition, impaired function of internal organs, intake of too many “empty” calories, and lack of physical activity.

In the Far Eastern region, there is no single reference range and there are no standards for lipid profile in children. When analyzing the lipid profile, significant age - gender differences were revealed in groups II and III in terms of LDL, TC and TG in group I. A wide range of indicators was revealed at different age periods with a tendency to increase of TC, TP (in the group of boys) and LDL (mainly in group II), table 6.

Table 6

Average values and intervals of lipid profile in the blood of children

Indicators		7-9 years (n =100)		10-14 years (n =118)		15-17 years (n =65)	
		M ± m	Interval (minimum - maximum)	M ± m	Interval (minimum - maximum)	M ± m	Interval (minimum - maximum)
Cholesterol, mmol/l	G	4,23±0,09	2,57-7,80	4,36±0,07	2,78-7,51	4,37±0,12**	2,59-6,89
	B	3,99±0,08	2,50-6,12	4,07±0,08	2,50-6,80	3,77±0,08●	2,59-5,06
HDL, mmol/l	G	1,64±0,07	0,66-2,39	1,54±0,09	0,93-2,25	1,42±0,13	0,86-2,09
	B	1,79±0,11	0,83-3,70	1,39±0,11*	0,78-2,44	1,51±0,21	0,63-3,84
LDL, mmol/l	G	2,22±0,18	0,36-5,16	2,57±0,31	1,05-4,32	2,43±0,21**	1,82-3,60
	B	2,23±0,23	1,11-4,16	2,62±0,32	1,04-4,02	1,65±0,28■	0,60-2,85
Triglycerides, mmol/l	G	1,12±0,09**	0,57-2,70	0,83±0,10*	0,57-2,29	0,95±0,06	0,67-1,28
	B	0,75±0,05	0,57-1,82	0,89±0,10	0,57-1,75	1,05±0,18	0,57-2,39

Note: * p ≤ 0.05 between group I and II; ▲ p ≤ 0.001 between group I and II; ■ p ≤ 0.05 between group II and III; ● p ≤ 0.01 between group II and III, ** p ≤ 0.05 between girls and boys.

Conclusion. A comparison of our studies with literature data revealed a number of features of PD of teenagers aged 10-17 in Vladivostok with the data of PD in Moscow and in Russia as a whole. ½ (48.9%) of children and adolescents were diagnosed with harmonious PD; in ⅓ boys in all age groups, PD is disharmonious due to excess BM, in girls this trend persists only in group II (26.1%); at the same time, in girls in group III, more than 35% of PD disharmony is observed due to BM deficiency. AC/BH above 0.5 was diagnosed in 2% of girls and 4% of boys in the study sample and reflect a tendency to gracification. It was proved that in addition to age and gender, they are most susceptible to deviations from the average BM, BH, OT, BFM, LBM, PACM, TW, XC, LDL, TG (LBM, ECL, PACM prevailed in boys (p≤0.001), in girls - BFM, LBM, TW, ECL (p≤0.001)). The increase in numerical values of indicators occurs in from 7 to 17 years and increases the risk of impaired health of students. When analyzing the lipid profile, significant (p≤0.05) age-gender differences were revealed between girls and boys in group II and III in terms of LDL and TC and in children of group I in terms of TP. A wide range of indicators was revealed at various age periods with a tendency to increase of TC, TP (in the group of boys) and LDL (mainly in the second age group). Based on the results, we determined the risk groups for health disorders and a set of preventive measures according to the "traffic light" type.

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MULTIPLE SCLEROSIS. POSSIBLE OPTIONS FOR THE ONSET OF THE DISEASE IN A CLINICAL EXAMPLE

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Abstract. Multiple sclerosis (MS) is a neurological problem of great socioeconomic importance, as it develops mainly in young and middle-aged people and, in the absence of timely and adequate treatment, leads to the formation of severe neurological deficit and early disability of patients in the first year after diagnosis. The clinical manifestations of MS are diverse and the well-known slow onset and development of the disease are not always found. A variety of clinical forms and options for the onset of MS, an increase in the age interval for debut, various rates of disease progression indicate different mechanisms for the development of the demyelinating process and thereby increase interest in studying the clinical features and pathogenetic mechanisms of the development of this pathology.

Keywords: multiple sclerosis, demyelination, atypical debut of the disease.

Multiple sclerosis (MS) is a neurological problem of great socioeconomic importance, as it develops mainly in young and middle-aged people and, in the absence of timely and adequate treatment, leads to the formation of severe neurological deficiency and early disability (up to 80%) of patients already first year after diagnosis [1, 3, 5, 10].

Today, it is generally accepted that MS is a multifactorial disease, in the initiation and development of which an important role is played by a viral infection, a hereditary predisposition, geoecological factors, nutritional features, injuries, and the presence of frequent stressful situations [1, 3]. Numerous experiments and clinical studies have proved that autoimmune disorders are the basis of MS pathogenesis [3, 5, 6]. However, a variety of clinical and morphological manifestations of MS indicate a heterogeneous development of the demyelinating process.

The latter is confirmed by pathomorphological and histochemical studies of foci of demyelination and unchanged white matter, which identified several types of pathological changes in MS, which differ in the severity of demyelination, the nature of damage to oligodendrocytes and progenitor cells, the presence of reparative processes in the foci, which suggests various mechanisms for the development of these disorders [9].

A variety of clinical forms and types of MS can also be due to the heterogeneity of myelin [7, 8], since oligodendrocytes are able to form different types of myelin in different parts of the central nervous system, which differ in immunochemical and physicochemical properties. There is an opinion [2, 4] that in MS there is an initial immaturity of myelin, which makes it especially vulnerable to various inflammatory mediators and active forms of oxygen. It is possible that in some cases a violation of the physicochemical properties of myelin precedes the development of immunopathological reactions [11].

Such complexity and versatility of the pathogenesis of MS determines the significant variability of the clinical picture, the variety of typical clinical syndromes and atypical debuts of the disease.

In this work, as a clinical example, we present the medical history of a patient in whom the debut of the disease was characterized by a stroke-like onset.

Extract from the medical history № 12586. Patient M., born in 1965, in 2019 was admitted to the municipal non-profit enterprise of the Kharkiv Regional Council “Regional Clinical Hospital” with a diagnosis of persistent residual symptoms of a stem stroke (2012) with right-sided hemiparesis and vestibulo-atactic syndrome. On admission, he complained of problems in walking, stiffness of movements in the lower extremities, weakness and awkwardness of movements in the upper and lower extremities, more on the right, swelling in the legs, expressed in the evening, difficulty speaking, hearing loss, more on the left, decreased vision. From the medical history it was found: in 2012, after a nervous overstrain against the background of an increase in blood pressure to

220/120 mm Hg, he suddenly felt weakness in his right limbs and difficulty speaking. The patient was admitted to a hospital with a diagnosis of a stem stroke with right-sided hemiparesis and severe vestibulo-atactic syndrome. Against the background of vascular, nootropic and restorative therapy, positive dynamics were noted. In 2013, the patient's condition worsened again. There was a stiffness of movements in the lower extremities, weakness and awkwardness of movements in the upper and lower extremities, more to the right, difficulty speaking. The patient was hospitalized with a diagnosis of repeated acute cerebrovascular accident. Against the background of the therapy, the patient's condition improved. At these stages of treatment and examination of the patient, a CT scan of the brain was performed, which did not reveal pathological changes and foci in the substance of the brain, including foci of a vascular nature. In the winter of 2019, the condition worsened sharply. There was a pronounced stiffness of movements in the lower extremities, difficulty speaking, pronounced weakness and awkwardness of movements in the right limbs. The patient was hospitalized in the municipal non-profit enterprise of the Kharkiv Regional Council "Regional Clinical Hospital". On admission: the general condition of the patient is satisfactory, cardiac activity is rhythmic, heart sounds are muffled, blood pressure is 140/100 mm Hg, vesicular breathing in the lungs, the abdomen is soft, painless on palpation. In neurological status: palpebral fissures D>S, pupils D=S, eyeball movements are somewhat limited in volume. Light asymmetry of the right lower facial muscles, the tongue along the midline. Speech is chanted. Tendon reflexes from the arms - D>S are revitalized, from the legs - D=S are high, abdominal reflexes are absent. Clonuses of the feet. Muscle strength in the right hand - 3.5 points, in the left hand - 4 points, in the lower extremities - 2.5 points. Muscle tone is increased in spastic type. Pathological reflexes of Babinsky, Strumpel from two sides. Coordination tests are performed with a miss. The Romberg test was not carried out due to the inability to stand. There are no sensitive problems. There are no meningeal signs.

Analysis of general clinical studies (general analysis of blood, urine, blood glucose, protein fractions, acute phase indicators) did not reveal significant deviations from the norm. ECG: single ventricular extrasystoles. Mild changes in the myocardium of the left ventricle. Inspection of the therapist: stage 3 hypertension. Left ventricular myocardial hypertrophy. CHD: atherosclerotic cardiosclerosis. Ventricular extrasystolic arrhythmia. CH stage I. Eye examination: retinal angiopathy in both eyes. Amblyopia of the left eye.

The patient underwent an MRI scan: in the white matter of the brain periventricularly, small foci with a low-intensity increase in MR are detected along the corpus collosum with a low-intensity increase in MR - signal in T2-vi. The ventricular system is moderately expanded. The outer subarachnoid spaces are convex and basally somewhat enlarged. Conclusion: signs of a demyelinating process. Moderately pronounced internal hydrocephalus.

An immunological blood test revealed a slight increase in CEC and an increase in the amount of CD 4, in relation to CD 8.

Given the clinical picture of the disease, additional research methods, the diagnosis of persistent residual effects of a post-stroke (2012) was doubtful. Thus, the final diagnosis was established: multiple sclerosis, secondary progressive type of course, with tetraparesis, gross violations of the walking, cerebellar-atactic and bulbar syndromes. EDSS=7.0 points.

In the commentary on this case, we would like to draw attention to the presence of a relatively late onset disease and stroke-like debut that is not characteristic of MS.

Thus, the clinical manifestations of MS are diverse and the well-known slow onset and development of the disease are not always found.

Therefore, the variety of clinical forms and variants of the onset of MS, an increase in the age interval for debut, various rates of disease progression indicate different mechanisms for the development of the demyelinating process and thereby increase interest in studying the clinical features and pathogenetic mechanisms of the development of this pathology.

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3-D MODELS OF HAIR CELLS OF STAMENS FILAMENTS OF TWO SPECIES OF *TRADESCANTIA* (*TR. PALLIDA AND TR. BLOSSFELDIANA*)

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Resume. Based on the 3DMax Studio (2009) program, an original method was developed for constructing 3-D models of stamen filament hair cells (SHC) of *Tradescantia*. This made it possible not only to create a three-dimensional image of cells, but also to obtain their stereometric characteristics (surface area of cells and their volume).

The morphometric characteristics of live (unfixed) SHC of two species of *Tradescantia* (*T. pallida* and *T. blossfeldiana*) were studied. It was shown that cell elongation plays a significant role in the growth of SHC, especially strongly in the basal cells of SHC *Tr. blossfeldiana*. In this regard, SHC of *Tr. blossfeldiana* may be an interesting model for the analysis of the mitotic cycle and cell espancing mechanisms under normal conditions and after the influence of biotic and abiotic factors.

Key words: 3-D cell models, stamen hair cells of Tradescantia, morphometric analysis, cell expansion

Stamen filament hair cells (SHC) of *Tradescantia* consist of linearly located meristem cells. The growth of SHC is provided by mitotic division of apical cells and their subsequent stretching. Some subapical cells also divide, but only once. Other intermediate hair cells divide very rarely (Ichirawa et al., 1969).

In particular, it was shown that the mitotic cycle time of SHC in “apical” zone is about 50 minutes (Sitte, 1962; Mineyaki, Gunning, 1988; Wolniak, 1987 and others). The large sizes and linear arrangement of cells in stamen hairs allow them to conduct subtle studies of the molecular mechanisms of intracellular regulation using microinjection and biochemistry methods (De Pass et al., 2001; Molchan et al., 2002 and others).

The stamen hairs of hybrid clones 02 and 4430 *Tradescantia* present a test for radiobiological and environmental studies of the cytogenetic effects of mutagenes of different nature (Osipova and Shevchenko, 1984; Cesniene et al., 2017 and many others).

Currently, one of the important areas of experimental cytology and histology is associated with 3-dimensional reconstruction of cells and tissues. This allows a description of the shape and size of cells using stereometric parameters. For the purpose of 3-D reconstruction, special computer graphics programs are used in conjunction with confocal microscopy (a series of "optical" sections) or reconstruction based on serial "physical" sections.

In this work, we used the original 3-D reconstruction method based on the use of the 3-d Max Studio (2009) program – building 3D models of objects by rotating the spline of the lateral projection of the object by 360º (Burlakov, 2009).

This paper presents the morphometric characteristics of live (unfixed) SHC of two *Tradescantia species* (*T. pallida* and *T. blossfeldiana*). The following morphometric parameters of the cells were determined: the width and length of the cells, the length of the perimeter and the area of the cell profile, the surface area and cell volume. A quantitative assessment of the variability of the metric parameters of living cells in the "apical", "middle" and" basal" zones of stamen hairs are given.

Material and methods

Two species of *Tradescantia* (*Tr. pallida* and *Tr. blossfeldiana*) were used in the work. Plants were grown in ordinary flower soil under natural light conditions (August 2018 - February 2019). Morphometric measurements were carried out on fully opened flowers. Immediately after the isolation of stamen hairs, the cells were photographed in water in a special microcamera on an Olympus 71 microscope (Japan) with an Olympus-330 digital camera (Budantsev, 2007). In all the studied cells at the time of photographing, an active jet movement of the cytoplasm was observed. On average, one stamen hairs contained from 15 to 27 cells.

Measured and calculated: the maximum length (L) and width (W) of the cells, the ratio (L/W), the length of the perimeter of the cell profile (LP) and the profile area (AP) of the cells and the ratio LP/AP (using the AnalySIS-Olympus Program). Volume (V), cell surface area (AS) and ratio AS/V were measured on volumetric cell models constructed using 3D-studio MAX (2009). An object micrometer OM-O was used to calibrate the measured cell parameters. Statistical processing of the results was carried out using the program Statistica 6.0.

Measurement results

Figure 1 shows a general view of *Tr. pallida* cells and mesh image of the cell model obtained using 3DMax Studio (2009). Given the apical growth of stamen hairs, we conditionally divided the hairs into three areas: “apical” zone (zone of mitotic activity); the “middle” zone (the beginning of cell stretching) and the “basal” zone (active stretching). In all areas, the cells have an “ellipsoidal shape”.

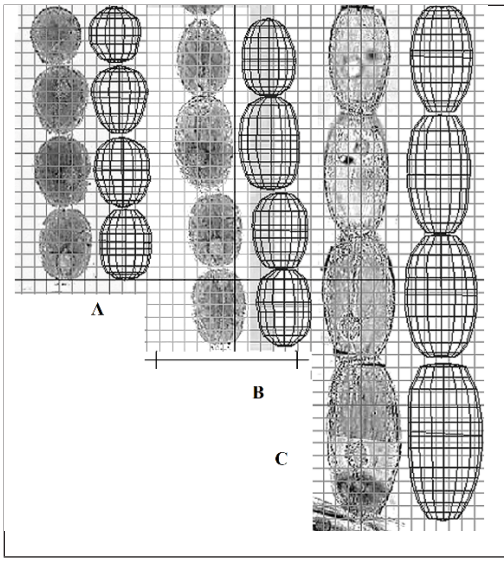

Fig. 1. Fragments of stamen hairs of *Tr. pallida*. A - cells from the “apical” zone; B - from the “middle” zone and C - from the “basal” zone. Left - micrographs of cells (background image), right - 3D models (mesh shell, orthographic projection). Ob. 40x. Scale - 100 microns

The L/D ratio varies from 1.52 to 2.00. The shape of the cells varies slightly along the entire length of the stamen hairs. The P/AP ratio in the three cell zones is: 0.066, 0.060 and 0.055 μm^{-1}, respectively.

Cell volume variability is very significant (> 30%), cell form variability (AS/ V ratio) varies between 0.103 and 0.088 μm^{-1} (tabl.1).

Figs. 2 show cells of stamen hairs of *Tr. blossfeldiana* and their 3-D models. The figures show that the cells are very different in shape and size from the cells of stamen hairs of *Tr. pallida*, especially in the apical and basal zones. In the apical zone, the cells are more compressed along the axis of the cells (the shape of the “barrel”), while in the middle and basal zones, the cells have an elongated shape with a characteristic extension at the base of the cells (“pear-shaped”).

Tabl.1. Morphometric parameters of SHC *Tr. pallida and Tr. Blossfeldiana*

Parameters	Tr. pallida			Tr. blossfeldiana		
	Apical cells (n=64)	Median cells (n=58)	Basal cells (n=72)	Apical cells (n=105)	Median cells (n=82)	Basal cells (n=85)
Cell length (L) (μm)	76±1,70* 50-111 σ =14 υ =18%	95±1,19 76-117 σ =9 υ =9%	110±1,93 85-156 σ =16 υ =14%	71±2,0 (38-123) σ =19 υ = 27%	103,0±2,13 (68-184) σ =19 υ = 18%	191±6,40 (114-396) σ =59 υ = 31%
Cell Width (W) (μm)	51±0,78 40-65 σ =6 υ =12%	52±0,55 42-59 σ =4 υ =8%	55±0,80 42-79 σ =6 υ =11%	57±0,06 (37-69) σ = 6 υ = 10%	50±0,92 (32-66) σ =8 υ = 16%	43±0,53 (32-59) σ =5 υ = 12%
L/W	1,520	1,827	2,000	1,246	2,060	4,442
Cell Perimeter (P) (μm)	224±4,19 135-294 σ =33 υ =15%	264±2,63 214-306 σ =20 υ =7%	299±4,48 237-415 σ =38 υ =13%	224± 4 (152-326) σ =43 υ = 19%	284±4,70 (194-452) σ =43 υ = 15%	462±13,72 (286-900) σ =127 υ = 27%
Perimeter Area (AP) ($μm^2$)	3388±116 1310-5560 σ =902 υ =27%	4366±75 3046-5600 σ =544 υ =12%	5401±145 3500-9880 σ =1259 υ =23%	3542±121,25 (1601-5875) σ =1242 υ = 19%	4853±128 (2463-8799) σ =1163 υ = 24%	8301±392 (1155-22318) σ =3640 υ = 44%
P/AP ($μm^{-1}$)	0,066	0,060	0,055	0,063	0,058	0,055
Cell Surface Area (AS) ($μm^2$)	12114±374 7520-21610 σ =2970 υ =24%	15257±284 10370-21330 σ =2129 υ =14%	19118±506 12210-35840 σ =4495 υ =23%	13501±450 (1156-23049) σ =4611 υ = 34%	17135±468 (8592-32632) σ =4238 υ = 25%	28340 1173 (12360-61724) σ =10755 υ = 38%
Cell volume (V) ($μm^3$)	117907±5613 5760-270130 σ =44549 υ =38%	156882±4150 89890-241080 σ =31054 υ =18%	216262±9084 110750-538930 σ =78669 υ =36%	144911±6664 (11258-305507) σ =68286 υ = 47%	177710±6755 (10060-367508) σ =61171 υ = 34%	303605 16605 (100708-887412) σ =152189 υ = 50%
AS/V ($μm^{-1}$)	0,103	0,097	0,088	0,093	0,096	0,093

* In each cell: M ± m; scatter of data min-max; σ is std.Dev; υ - coefficient of variability: υ = (σ / M)100%

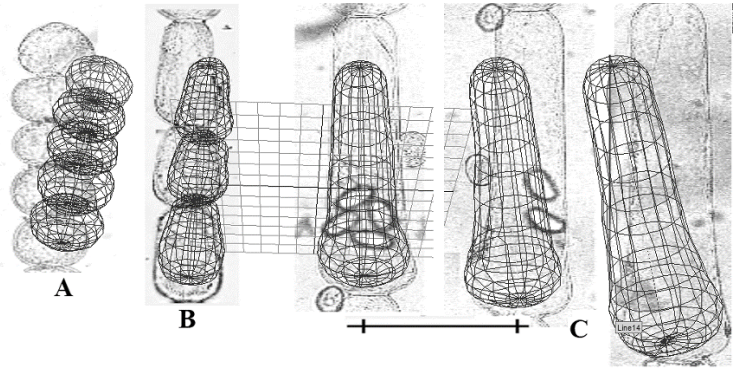

Fig. 2. Fragments stamen hairs of *Tr. blossfeldiana*. Designations see fig. 1. The image of 3D cell models is superimposed on the background image of cells. Pollen grains are visible on group C cells. Central projection.

In the basal zone, the L/H ratio shows significant cell elongation (average value is 4.442, maximum value is more than 7). In both species of *Tradescantia*, a significant variation in cell volumes is noted, but the cell shape variability in different zones of stamen hairs of *Tr. blossfeldiana* is varies between 0.093 - 0.096 μm^{-1}) (Tabl.1).

Discussion

Briefly, regarding the original method for obtaining stereometric parameters of living cells. Normally, the stamen hairs represents a chain of cells connected in series to the bases. The branching of hairs is a consequence of the action of abiotic factors (for example, radiation) that violate the direction of formation of daughter cells during mitosis.

The shape of the SHC of both types of *Tradescantia* is different: “ellipsoid”, “barrel-shaped” and “pear-shaped”, but there is one similarity: they represent 3-dimensional objects with axial symmetry. This gave us the basis to develop a new way to build 3-D cell models using 3DMax Studio (2009). One of the standard modifiers, “Lathe,” was used to construct 3D models of stamen hairs cells by 360 ° rotation of the spline of the lateral projection of cells (Burlakov, 2009). A micrograph of cells was used as a background image (Budantsev, Demyanov, 2017; Budantsev et al., 2018).

In the process of building a 3D model, 3DMax Studio automatically calculates the surface area and volume of cell models. Previously, we analyzed the values of the surface area and volume of stamen hairs cells obtained by 3-D modeling and based on confocal microscopy. The differ-

ences were shown to not exceed 5-6% (Budantsev et al., 2018). The developed method allows you to quickly get the stereometric parameters of living cells without additional treatments.

It is well known that cell mass in plants increases as a result of mitosis (the number of cells) and extension (changes in the volume and shape of cells). Currently, the dynamics of the mitotic cycle in plant cells and the molecular mechanisms of extension are being actively studied. A number of reviews describe the achievements and problems in studying cell stretching and the role of plant hormones and expansion cells in the mechanisms of stretching (Kuluev, Safiullina, 2015; Marowa et al., 2016; Mangano et al., 2016; Ivakov et al., 2017; Majda, Robert, 2018 et al.).

As shown in our work, stretching plays a significant role in the growth of stamen hairs, especially strongly in the basal cells of *Tr. blossfeldiana*. Data on the mechanisms of stretching of these cells could not be found. In this regard, it can be noted that stamen hairs cells of *Tr. blossfeldiana* may be an interesting model for analyzing the mitotic cycle and cell elongation under normal conditions and under the influence of biotic and abiotic factors.

The difference in the morphology of the cells of the compared species of *Tradescantia* is probably related to their location in the flower. The stamen hairs cells of *Tr. pallida* are located in the form of individual cell chains attached to the middle part of the stamen filaments. The stamen hairs of *T. blossfeldiana* represent “brush” of hairs attached to the stamens at the base of the flower. Therefore, with the same number of mitotic cycles, these cells reach the upper part of the corolla of the flowers due to the greater activity of extension of stamen hairs cells in the middle and basal zones of the hairs. The “pear-shaped” form of basal cells is possibly associated with this.

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MANAGEMENT OF HISTORICAL RESIDENTIAL DEVELOPMENT PROJECTS

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Abstract. This article analyzes the foreign and domestic strategies for the preservation and enhancement of the historical urban environment. The article also analyzes programs to preserve the historical urban environment. A program for the conservation and enhancement of historical residential development is proposed. The article discusses the effectiveness of the conservation and enhancement program of historical residential development, as well as the factors and risks that affect the efficiency and effectiveness of the conservation and enhancement of the historical residential development program.

Keywords: historical urban environment, historical residential development, strategy, program, analysis, performance assessment, risk assessment, effectiveness.

An analysis of foreign practice allows us to identify strategies for the preservation and enhancement of historical residential development (HRD) according to the degree of state regulation, as well as the depth of its transformation (figure 1.)

Of interest from the perspective of the subject of research are the results of analyzes of various approaches to understanding the basic principles of working with historical residential real estate conducted by N. N. Ivanov [2], in accordance with table 1.

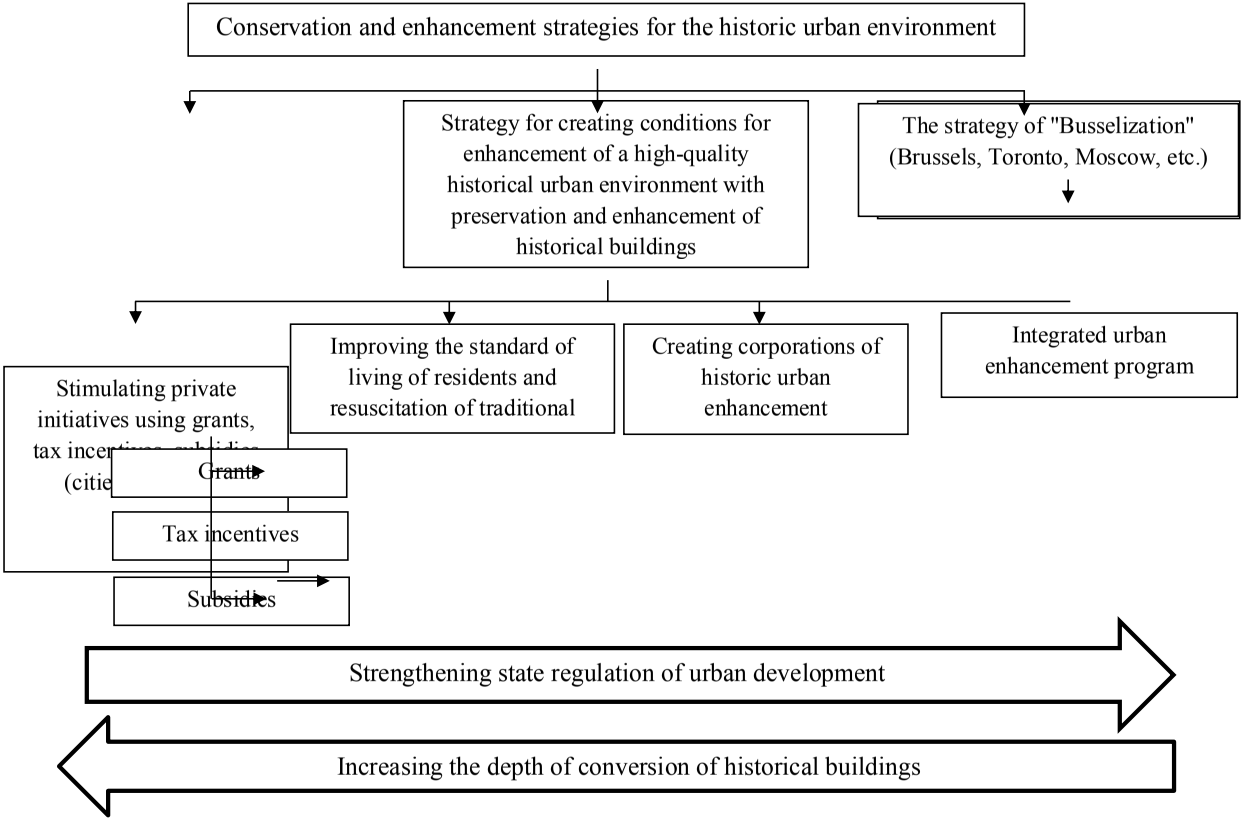

Figure 1 - Strategies for the conservation and enhancement of historic housing development

Table 1 - Analysis of the basic principles of enhancement of historical residential real estate

Principle	Content
1	2
maintaining the integrity of the spatial organization and the authenticity of the historical and cultural heritage	implies that the actions of the Strategy implementers are aimed at the physical preservation of cultural heritage objects and ordinary historical buildings, as well as ensuring the authenticity of the "material" ("substance"), the authenticity of "mastery" of execution, the authenticity of the original "design" during repair, reconstruction and restoration works. e. the absence of substitutions, the use or replacement of materials that do not correspond to the originals, the change of the original or extant project.
priority of social interests over commercial, taking into account the interests of an individual.	implies that when deciding on issues related to the further fate of buildings, implementers of the Strategy should proceed from the fact that the main goal of maintaining residential development is not only to maintain the physical form of buildings, but also to ensure high-quality, comfortable and safe living conditions, as well as the indispensable guarantee of the right to property and non-interference of all third parties in the sphere of economic domination, on which extends the power of the owner and the principle of social justice for the sake of each citizen to achieve a decent standard of living.
creating conditions for the harmonious development of the personality of residents based on the improvement of social infrastructure.	implies that the provision of residents of the reconstructed quarters with social infrastructure must comply with established standards. Without providing the population with high-quality social services, it is impossible to ensure the proper quality of living standards and harmonious development of the personality of residents.
ensuring investment attractiveness, increasing the share of private investment and minimizing budget participation in the program, as well as increasing the efficiency of using budget funds.	implies that the implementation of the whole range of works is impossible without attracting private investment, they should create the basis of the resource provision of the Strategy, while budgetary funds only create conditions for ensuring the investment attractiveness of private initiatives, and also participate in solving problems in which it is impossible to attract private capital. At the same time, budget funds should be allocated efficiently, based on open models and rules. At the same time, there are opportunities for the development and application of public-private partnership models that can increase the effectiveness of the implementation of program activities as a whole.

Principle	Content
1	2
use of modern technologies in the modernization of engineering, utilities and transport infrastructures, the elimination of the infrastructure "depression" in the central regions.	This principle implies that in the design and implementation of the Strategy for the development of engineering, utilities and transport infrastructure, the Strategy Implementers should be guided by best practices in this area, and the implementation of the Strategy should result in the adoption of accepted standards for the provision of residents with engineering, communal and transport infrastructure, as well as the quality of this provision is not lower than in other areas of the city.
application of modern technologies for the modernization of engineering, utilities and transport infrastructures	implies that when designing and implementing actions of the Strategy for the development of engineering, communal and transport infrastructure, its Contractors should be guided by best practices in this field, and the result of the implementation of measures should be to ensure the adopted standards for the provision of residents with engineering, communal and transport infrastructure facilities.
ensuring the equal existence of various forms of ownership and the normal functioning and preservation of the housing stock of various forms of ownership.	reflects the equal rights of various owners of residential buildings: citizens, investors, the state, the city, etc. When forming the Strategy, the interests of any of the parties should not be unjustifiably infringed in favor of the interests of other parties.
resource supply	implies that in the formation of the Strategy activities, each of them should be justified and provided with the necessary amount of resources for implementation.
principle of inclusion and cooperation, an interagency approach in the planning and implementation of strategy measures, the use of all available resources.	implies that in the formation and implementation of the Strategy activities, a dedicated structure is created in each of the interested parties responsible for their implementation, coordination of work, reduction of the terms of coordination and increase of efficiency. In general, all such structures form a single executive person, acting in the interests of achieving the goals of the Strategy.
principle of professionalism and scientific validity	implies that when conducting procurement and other tender procedures for the implementation of certain measures of the Strategy, one of the primary criteria for admission and evaluation of applications should be many years of experience, a scientific base and a positive business reputation of potential performers.

Principle	Content
1	2
project management	within the framework of the implementation of the Strategy measures, tasks should be considered as separate projects, to which the principles and methods of project management are applied. The coordinating and managing organization of the Strategy should in its work rely on the principles and methods of managing the program of projects as a series of related projects, the management of which is coordinated to achieve benefits and a degree of manageability that are not available when individually managed.

Thus, the universal principles for the preservation of cultural heritage are: delimitation of powers between government bodies at all levels; a variety of forms of ownership with a clear burden on use; the principle of ensuring economic benefits when using monuments with the priority of their cultural value; ensuring the return on investment in restoration through profitable investment projects, infrastructure development and improvement; the formation of a favorable investment climate [1].

In domestic practice until the 1960s, they were limited to overhaul of individual objects, then there was a significant transformation of the approach to the conservation and enhancement of the historical centers of cities, given in accordance with figure 2.

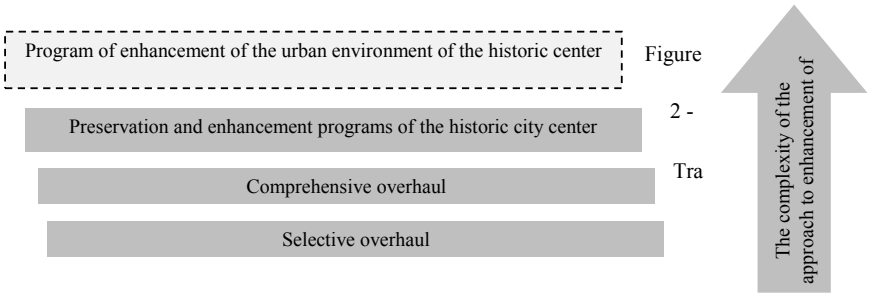

Figure 2 - Tra

Figure 2 - Transformation of the approach to the conservation and enhancement of the historical centers of cities

The programs for enhancing the urban environment of the historical centers of St. Petersburg, Yaroslavl and others, having accumulated various measures to solve the problems of enhancing the city centers as unique objects that combine residential, business, social, cultural and tourist-recreational functions, do not contain a comprehensive approach to enhancing the historical center in general and its housing development in particular.

We agree with N. Ivanov, who states that the implementation of the principles given in table 1 should solve the problems of historical development and increase the efficiency of using budget funds and increase the attractiveness of the historical center as an investment object. Of course, institutional conditions must be created for this.

Based on the Conservation and enhancement of HRD Strategy, it is necessary to develop a Program that includes specific measures for its implementation, as well as to form an adequate organizational and economic mechanism designed to "ensure the implementation of the basic management functions, and which is a system of elements, methods, forms, means, rules, management and decision-making procedure.

The following seems to be important: the inclusion in the program of a mechanism to attract private investment in financing or the direct implementation of program activities; a description of the mechanism for determining the priority and boundaries of the quarters that fall under the program.

In practice, there is no single established methodology for evaluating the effectiveness of conservation and enhancement of HRD programs. When calculating, qualitative and quantitative indicators of the effectiveness of budget programs are taken into account. For example, in St. Petersburg, the hierarchy of goals and objectives of strategic planning, as well as the ways to achieve them, are officially documented and supported by regulations; For each program, a list of quantitative indicators has been compiled. Evaluation of state programs is carried out during the examination of the project concept, and then at the end of each financial year, according to the results of the effectiveness of activities carried out within the program.

The stages of evaluation of the conservation and enhancement program of historical residential development are given in accordance with figure 3.

If the program is long-term, a passport is created for it indicating both the goals and objectives of the target program and the planned performance indicators that should be achieved during its implementation, in quantitative terms, as well as the expected qualitative results of its implementation. The passport also sets the deadlines for the implementation of the target program, the total amount of financing with the distribution by year. To monitor their implementation, performance monitoring is carried out. At the end of each financial year, the effectiveness of the implementation of long-term target programs is assessed by a comparative analysis of actual targets with planned targets. A high level of subjectivity is a drawback of the current system, to avoid which, when assessing the effectiveness of the program, one should rely on qualitative indicators.

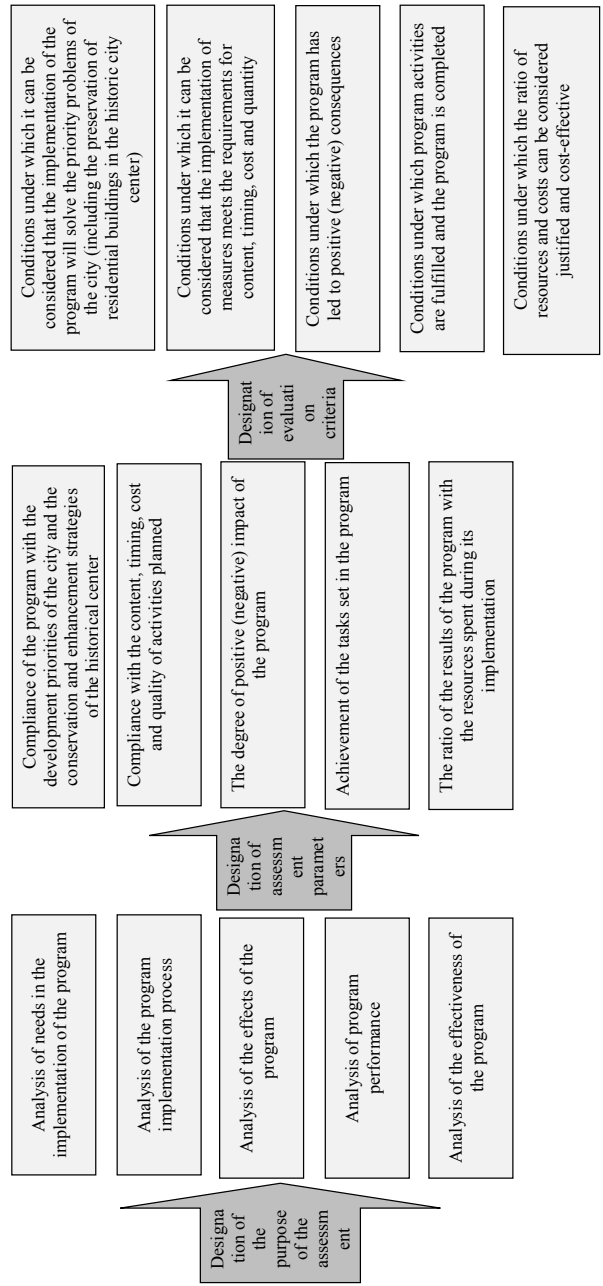

Figure 3 - Stages of evaluation of a conservation and enhancement program for historic housing development

Figure 4 - Factors and risks affecting the efficiency and effectiveness of the program for the preservation and enhancement of residential historical development

Given that the effectiveness and efficiency of the program can be significantly affected by factors of the external and internal environment, it is necessary to assess the risks associated with the implementation of the program at each of the levels at each stage in accordance with figure 4.

In order to ensure the ability to quickly respond to deviations from the course, and adjust it in accordance with emerging threats, it is necessary to re-evaluate the effectiveness of the program at each stage. The results should be compared with those obtained at the previous stage, and practical and methodical recommendations should be developed based on the comparison.

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INFLUENCE OF SHEET MATERIAL THICKNESS ON THE QUALITY OF THE CUTTING SURFACE DURING NARROW-JET AIR-PLASMA CUTTING OF CARBON STEEL

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Abstract. The features of structure formation in the zone of thermal influence (ZTI) formed during plasma cutting of St3ps steel sheets are considered. It is shown that when cutting a steel sheet with a thickness of 40 mm with a narrow-jet plasma torch PMVR-5.3, the ZTI is less than 400 μm, and at a thickness of 36 mm – more than 1 mm. When cutting steel of large thickness, there is also an increased carburization and an increase in the hardness of the surface layer, an increase in the surface roughness parameters. The results of the research allow us to conclude that the developed PMVR-5.3 plasma torch is able to produce a sufficiently high-quality cutting of sheet steel up to 40 mm thick or more. However, butt welding after plasma cutting without pre-machining can be performed with a steel thickness of no more than 20 mm.

Keywords: Plasmatron, design, zone of thermal influence, structural transformations, defects, quality, efficiency.

Cutting of complex sheet steel profiles is one of the most important technologies in the modern procurement industry for the production of critical welded metal structures for various purposes. For these purposes, plasma cutting methods are currently considered very promising, in particular, using the technology of air-plasma processing of metals [1-3].

In the process of thermal cutting, due to the rapid movement of the concentrated heating source relative to the surface of the cut metal, there is a large temperature difference (from the melting point to the initial one) in a relatively narrow area adjacent to the cut surface. As a result, metallurgical processes occur in the metal edges, accompanied by changes in the chemical composition, structure and mechanical properties compared to the initial state. It is noted that structural transformations in the process of thermal cutting of metals differ significantly from transformations in conventional heat treatment. In this case, the decomposition of solid solutions in the cutting zone occurs in a more complex and continuously changing environment, and the presence of chemical heterogeneity in the thermal heating zone in many cases significantly changes the kinetics of solid solutions decomposition [4,5]. As a result, the processes of metal crystallization and structural transformations occurring in the cutting zone most often determine the subsequent technological and operational properties in this zone.

Such qualitative changes in the zone of thermal influence (ZTI) of metal in the most cases negatively affect the indicators of cut quality and properties of steel, and the nature and size of the ZTI depend on the composition and thickness of the cut metal, operating current and cutting speed. However, as it was shown in [6], other things being equal, it is possible to improve the quality of plasma cutting by increasing the efficiency of the gas-vortex stabilization system (GVS) in plasma torches for air-plasma metal processing. As a criterion for the efficiency of GVS, it is proposed to use the degree of uniformity of the distribution of parameters of the plasma-forming gas flow (PFG) in the control sections (primarily in the cylindrical channel of the nozzle node) of the air-gas path (AGP) of the plasma torch.

For this purpose, company "Polygon" developed and manufactured a narrow-jet plasma torch of the 5th generation PMVR-5.3 for precision metal cutting (Fig.1), using the method of improved gas-vortex stabilization of the plasma arc through the use of two swirlers and a symmetrical supply of PFG to the GVS system [7]. The use of such plasma torch allowed to solve many problems of plasma cutting by significantly reducing the cutting width, improving its quality, increasing efficiency, material and energy intensity of the process, as well as to ensure systematic import substitution of consumable equipment for energy cutting of metal materials installations.

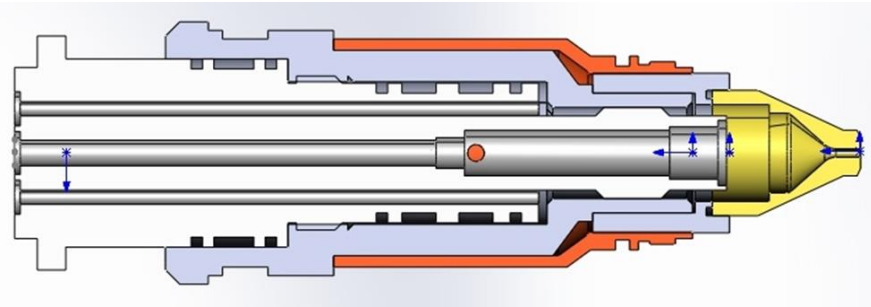


Fig.1 – PMVR-5.3 plasma torch for precision metal cutting (constructive scheme)

Using the specified plasma torch, the study of ZTI structure formation was performed during narrow-jet air-plasma cutting of steel sheet St30ps with the following parameters of the plasma torch operation: cutting current – 120 A; cutting voltage ~ 180 V; PFG pressure ~ 0.45 MPa; nozzle diameter – 1.9 mm; plasma torch-metal gap – 6-7 mm. The cutting speed was selected depending on the thickness of the steel sheet and corresponded to 1.5 m / min at a thickness of 10 mm and 0.3 m/min at a thickness of 40 mm.

Structural studies were performed using a NEOPHOT-21 microscope at magnifications from ×500 to ×1000. The chemical composition of sheet steel was determined by the spectral method on the SPECTROMAX device and averaged by burnings at several points on the cross-section surface of the samples. To identify and determine the possible spread of the chemical composition data in the studied steels, the concentration of all components in each sample was analyzed depending on the thickness of the sheet. In order to determine the distribution of chemical elements on the cut surface, a micro-X-ray spectral analysis was performed at a magnification of ×2000 using a TESCAN VEGA IIXMU scanning electron microscope equipped with INCA ENERGY 450 energy dispersive microanalysis systems with an OXFORD ADD detector and INCA software. The study of the cut surface relief was performed using an optical interferometer Veeco NT-1100. The hardness values are determined on a LEICA instrument with the Materials Workstation software at a load of 25 g on the upper and lower cutting edges.

Table 1. Analysis results of the chemical composition in the studied steel sheets

sheet thickness, mm	C	Si	Mn	P	S	Cr	Ni	Mo	Al
	chemical composition, %								
10	0,160	0,170	0,433	0,027	0,0092	0,078	0,142	0,013	0,0034
40	0,145	0,215	0,441	0,020	0,012	0,136	0,220	0,021	0,0088
sheet thickness, mm	Cu	Co	Ti	Nb	V	W	Pb	Mg	B
	chemical composition, %								
10	0,142	0,021	<0,001	<0,0040	<0,0076	<0,0010	<0,0030	<0,001	<0,0017
40	0,180	0,017	<0,001	<0,0040	<0,0010	<0,0017	<0,0066	<0,001	<0,0015
sheet thickness, mm	Sn	Zn	As	Bi	Ca	Ce	Zr	La	Fe
	chemical composition, %								
10	0,0049	<0,0020	0,019	0,011	0,0012	<0,0030	0,0026	<0,001	98,7
40	0,0083	<0,0020	0,015	0,012	0,0007	<0,0030	0,0025	<0,001	98,5

Table 1 shows the analysis results of the chemical composition in steel sheets of the studied thicknesses for all selected components, which characterizes the brand composition of sheet materials. In accordance with GOST 380-2005 «Ordinary carbon Steel» (S355JR by EN 10025-2:2004), the samples under study can be identified as St3ps steel, the mass fraction of the main components of which is within the tolerance for hot-rolled sheet metal.

Visual analysis of cut surface of samples subjected to plasma cutting allowed us to determine the quality parameters and the geometry of the cut edges. The design features of the PFG feed in this model of the plasma torch did not lead to significant differences in the macroscopic picture of the cut surface depending on the thickness of the sheet. As shown by the external control (Fig. 2), on all the samples studied, the formation of grate and sticking of molten metal droplets were practically not detected on the lower edges. In addition, there was no melting and rounding of the upper edge, which provided almost zero angular deviation of the cut. This result, in our opinion, is obtained due to the maximum possible compression of the arc implemented in the technology of narrow-jet plasma-air cutting of materials. It is very important to consider that the chosen plasma cutting speeds did not lead to significant arc oscillation, which allowed to obtain a minimum waviness of the cutting line.

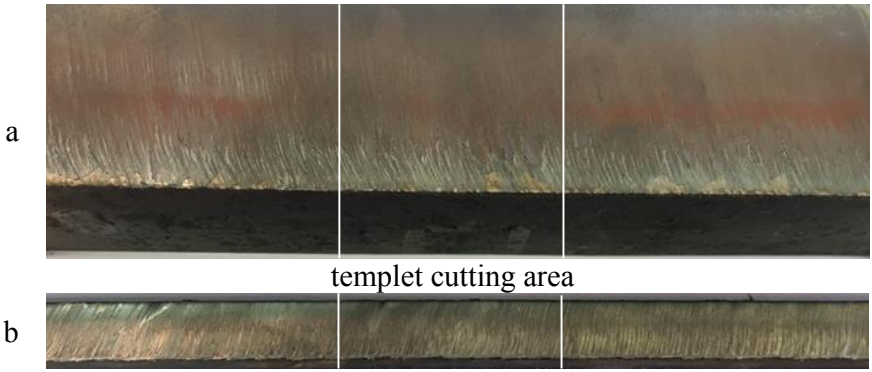


**Fig.2 – Appearance of samples after plasma cutting:
a – sheet thickness 40 mm, b – sheet thickness 10 mm.**

Fig. 3 a and b compare the microstructure of the external plasma cutting zone of the studied samples depending on the thickness of the sheet, and table 2 describes the structure of the samples in each zone.

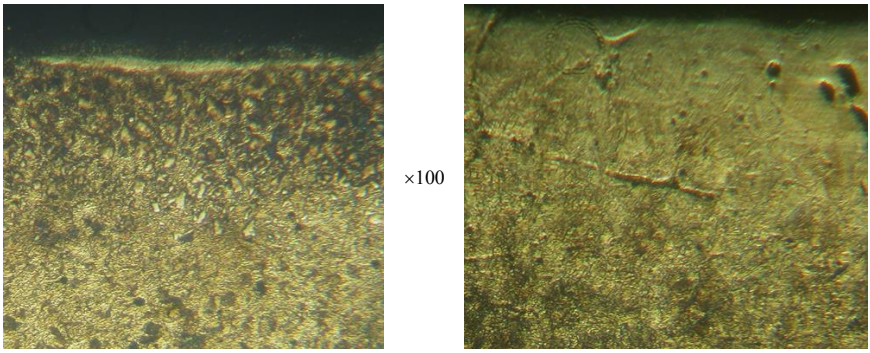


**Fig. 3. Microstructure of the surface layers of the studied steel after plasma cutting:
a – sheet thickness of 10 mm, b – sheet thickness of 40 mm.**

Studies of thermal processes occurring in the cutting (thermal heating/melting) zone are of particular interest, since the properties of the ZTI depend on the structure and chemical composition in it. As a result of thermal cutting, the formation of conditional sections from the melting zone to the base metal is established. First of all, it should be noted that under the influence of a plasma jet, a narrow zone of plates melts. The molten metal is blown out by plasma jet, as a result, the plates are divided into 2 parts.

Near the cutting surface, the steel is heated to high temperatures. Moreover, the closer to the cutting surface, the heating temperature value are higher. In general, the entire cutting seam is ZTI up to the initial state of the steel. Structural condition of the ZTI should be divided into 3 sub-zones: I – zone of critical overheating (ZCO) near the surface cut in the form of light strips of structureless martensite, where the temperatures close to the melting points; II – zone of heating to the austenitic state, i.e., the zone of phase recrystallization (ZPR) with the quenching structures and III – heating zone to temperatures below the temperature of eutectoid transformation of steel, where transitional structures are formed, so it should be called the transitional zone (TZ).

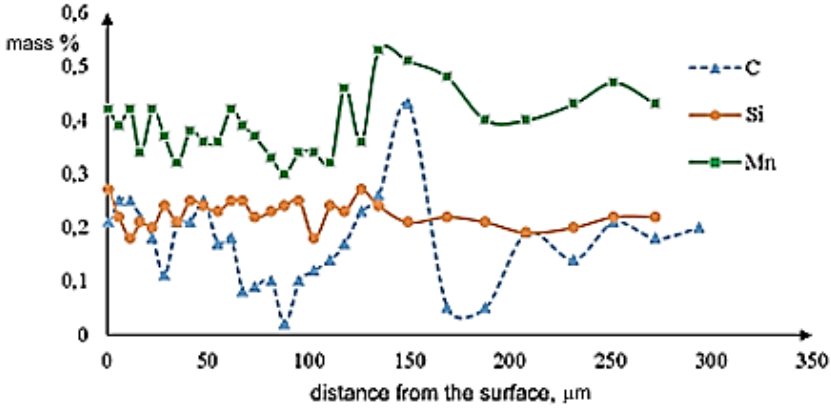
Table 2 - Description of the sample structure in each zone

Sample thickness, mm	Zone	Zone thickness, mm	Structure
10	I (ZCO)	25	Structureless martensite
	II (ZPR)	175	Sorbitol-like perlite, 1 point, interplate distance less than 0.20 microns
	III (TZ)	200	Perlite-ferritic structure with p/f ratio =65/35
	Steel base	>400	Perlite-ferritic structure with p/f ratio =20/80
40	I (ZCO)	10	Structureless martensite
	II (ZPR)	390	Medium-plate perlite, 7 points, interplate distance less than 1.20 microns
	III (TZ)	800	Perlite-ferritic structure with p/f ratio =85/15
	Steel base	>1200	Perlite-ferritic structure with p/f ratio =20/80

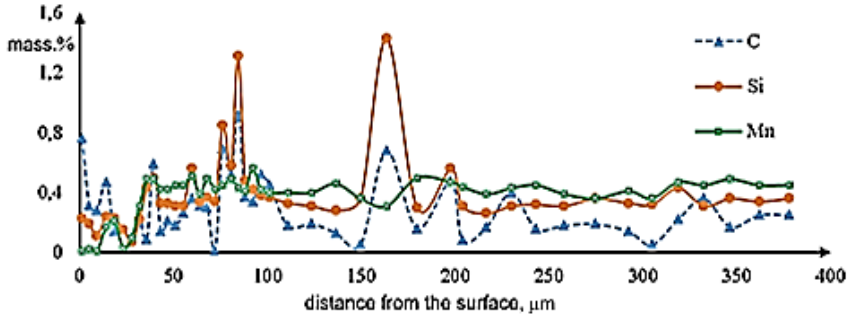
Analysis of microstructures allows us to conclude that when the cutting conditions change depending on the thickness of the cut sheet, significant differences in the structure formation of the II and III ZTI subzones in the studied samples were found. Thus, with an increase in the cutting speed, the total thickness of the ZTI increased almost 3 times, with other unchanged parameters of the plasma torch operation. In both cases, a non-etching white layer of structureless martensite is formed on the cut surface in the ZCO, and a different grain structure is formed in the ZPR and TZ structures. At a cutting speed of 1.5 m/min in the thin plate in ZPR due to recrystallization under conditions of intensive heat removal formed fine-grained structure of sorbitol-like perlite 1 points, while the thick plate at a cutting speed of 0.3 m/min formed the condensed structure of grain medium-plate perlite 7 points. In the transition zones of the studied samples, the amount of perlite in the perlite-ferritic structure increased sharply compared to the initial ratio in the steel base (see Table 1).

Such features of structure formation are determined by the redistribution of alloying elements in steel and, mainly, carbon in the process of energy processing. Micro-X-ray spectral analysis showed (Fig. 4) that as a result of diffusive carbon redistribution, its concentration in the cut zone significantly increased. The distribution graphs show that the increase in carbon concentration in various cutting zones is irregular. The maximum increase is observed in ZTI near the cutting edge, then slightly decreases and by the end of the transition zone, the amount of carbon is equalized in accordance with the chemical composition of the base. All this fully reflects the nature of the structures formed in different cutting zones as they move away from the edge.

It should be noted that the degree of carburization when cutting a thick plate with a low speed was significantly higher and reached values in the cutting edge of 0.76 mass.% C, while in a thin plate with a high cutting speed did not exceed 0.25 mass.% C, with an average concentration of carbon in the base of 0.14 mass.% C. At the same time, in the melting zone, as a result of strong energy processing in the cutting zone of a thick sheet, the mass fraction of manganese and silicon significantly decreased due to burnout, which was practically not observed in a thin sheet over the entire thickness.



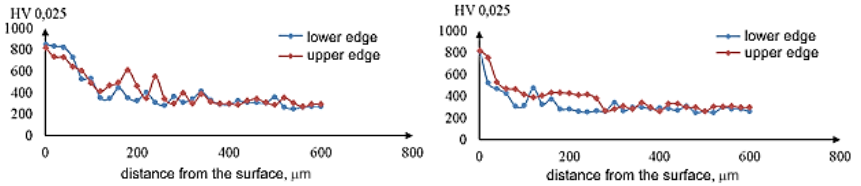
a



b

Fig. 4. Distribution of alloying elements in the zone of thermal influence of St3ps steel after plasma cutting: a – sheet thickness of 10 mm, b – sheet thickness of 40 mm.

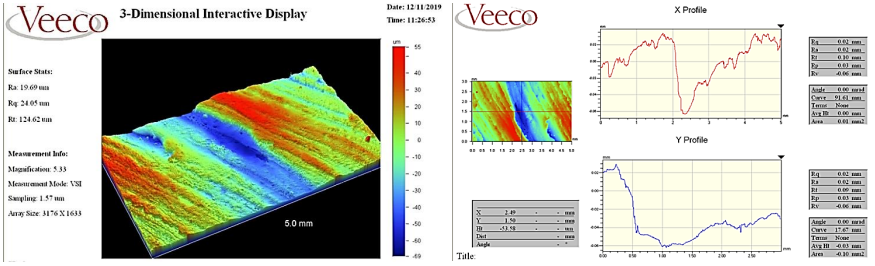
Significant saturation of the surface layers with carbon led to a sharp hardness increase of the surface layers in the plasma cutting zone of steel (Fig. 5). In the most obvious form, this is noticeable for the low cutting speed, at which a high-carbon state of steel was formed in the surface due to diffusion processes. It is very important to note the almost identical nature of the hardness distribution on the upper and lower edges of the studied samples cut, which is due to the design features of the developed narrow-jet plasma torch.



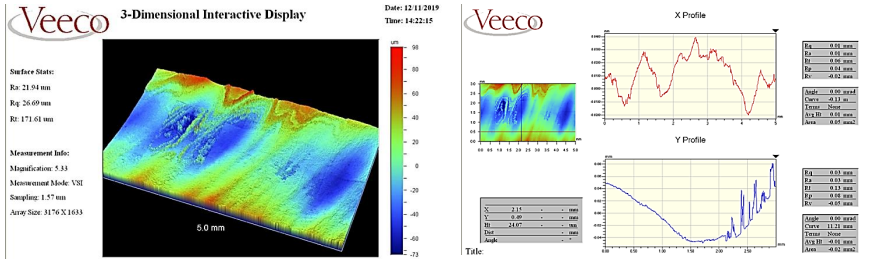
a b

Fig. 5. Graphs of the hardness distribution in samples: a – the thickness of the sheet is 10 mm, b – the thickness of the sheet is 40 mm.

Great importance in assessing the quality of plasma cutting is given to the study of surface roughness according to the criteria of microgeometry of the cutting line relief. The results of the study are shown in Fig.6 and Table 2.



a



b

Fig.6 – Analysis of the surface relief of the samples:
a – the thickness of the sheet is 10 mm,
b – the thickness of the sheet is 40 mm.

Table 3 - Results of the surface relief research

The thickness of sheet, mm	The average roughness R_a, m	Average square roughness R_q, m	The maximum height of the surface R_t, m
10	19,69	24,05	124,62
40	21,94	26,69	171,61

It can be seen that for all the estimated parameters, the quality of the cutting surface of a thick sheet at a slow speed of the plasma torch movement was slightly worse than when cutting a thin sheet. This is especially noticeable in terms of the maximum height of the surface (the vertical distance between the highest and lowest point of the relief), which indicates a greater undulation of the cut line in this case.

Thus, according to the results of the research, it can be concluded that PMVR -5.3 plasmatron by its technical capabilities due to the use of a new GVS system with two (forming and stabilizing) swirlers, two expansion

chambers and a symmetrical feed of PFG, allows to produce a sufficiently high-quality cutting of sheet steel in the conditions of narrow-jet air-plasma cutting in a fairly wide range of thicknesses up to 40 mm or more. However, it should be taken into account that welding of workpieces without pre-machining can be performed with a cut thickness of no more than 20 mm. At large thicknesses, a very long ZTI is formed with significant changes in the structure of the base metal and a number of other indicators, which involves chamfering the cut surface to a depth of at least 1.0 mm.

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ANALYSIS OF THE EFFICIENCY OF PLASMA AFTERBURNING FOR GASEOUS PRODUCTS OF HAZARDOUS WASTE PROCESSING

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Abstract. The technology of neutralization of hazardous waste products with the use of arc-type plasma generators has been developed and studied. It is proposed to introduce plasma torches at the stage of afterburning of gaseous products of hazardous waste processing. The problem of neutralization of supertoxicants (dioxins), as well as nitrogen oxides in the process of thermal processing of household and industrial waste is analyzed. Temperature approximations of the decomposition time of dioxins in the range of plasma heating temperatures are found. Criteria for the efficiency of plasma heating and neutralization are introduced. A modernized design of the plasma torch for utilization of gaseous products of hazardous waste is proposed. Gas-dynamic parameters of the air-plasma flow in the mixing chamber of the plasma torch for environmental technologies are determined. The characteristic temperatures, speeds and times of heating of the disposed gases in the mixing chamber are determined.

Keywords: Plasmatron, design, environmental safety, waste disposal, neutralization, disinfection, incineration, efficiency.

The thermal processing of wastes with different composition are often accompanied by formation of gaseous toxic emissions – dioxins and dibenzofurans, biphenyl, etc. To solve this problem, we can use plasma generators-

plasma torches [1]. In plasma torches, neutralization of such substances occurs due to high-energy plasma action, which leads to their deep decomposition – plasma incineration [2]. From a rational point of view, the introduction of plasma torches is advisable at the stage of afterburning of gaseous products of hazardous waste processing. Similar technologies using DC arc plasma torches were proposed by the authors earlier [3-5]. As an upgrade of the previously considered technologies, several designs of the mixing chamber (MC) for plasma-forming and recycled gases, as well as various schemes for feeding toxic gaseous waste into it, are proposed. The assessment of the neutralization effectiveness is made on the example of one of the most dangerous technogenic superecotoxicants - dioxin.

The plasma neutralization technology was developed by using a patented utility model of an arc plasma torch [6]. In this technology, a plasma jet is formed in the MC by the interaction of a plasma arc, excited and burning between the cathode and the anode of the plasma torch nozzle, with a vortex flow of plasma-forming gas (PFG) and its subsequent blowing into the MC due to the high kinetic energy of the PFG flow. In the process of technology modernization, the design of a mixing and heating chamber for flows of a tangentially fed toxic vapor-gas mixture and a pre-swirled by gas-vortex stabilization system and a plasma-arc-heated PFG flow was proposed. The pipes for supplying the secondary (recycled) flow are located on the replaceable part of the plasma torch, or they can be placed outside it and located under the nozzle section at any angle to the axis of the plasma jet (Fig. 1).

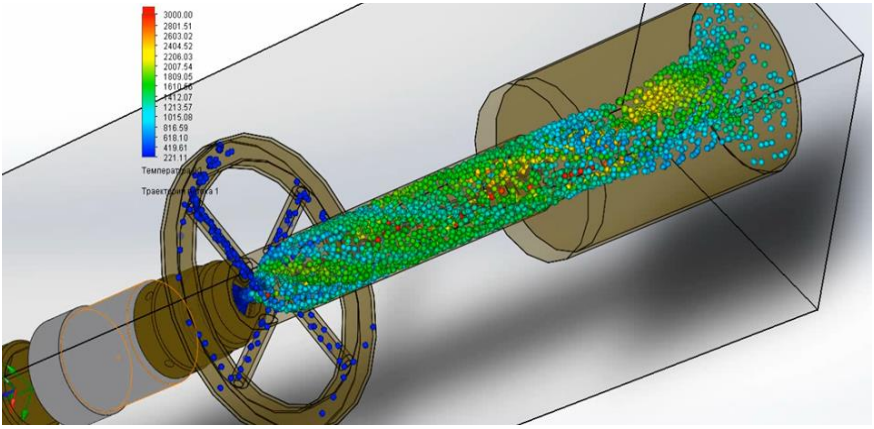

Fig. 1. 3D modeling of gas-dynamic processes in the plasma torch mixing chamber f or disposal of hazardous waste

The efficiency of plasma combustion of gaseous waste depends, obviously, on the ability to ensure the required time of the hazardous waste gas flow at the appropriate temperature in the MC. The efficiency of heating the gas-air mixture in the MC was estimated by calculating gas dynamic parameters in the FlowWorks application of the SolidWorks software with a variable value of the sampling parameter of the calculated grid. Technological parameters of modeling: the mass flow rate of the PFG – 0,011 kg/s, the diameter of the inlet hole in the MC – 4 mm. The temperature and velocity in the MC were calculated using several straight-line trajectories (lines) of various distances from the axis of the chamber (Fig. 2) at temperatures of 7000-10000 K typical for the air-plasma arc (jet).

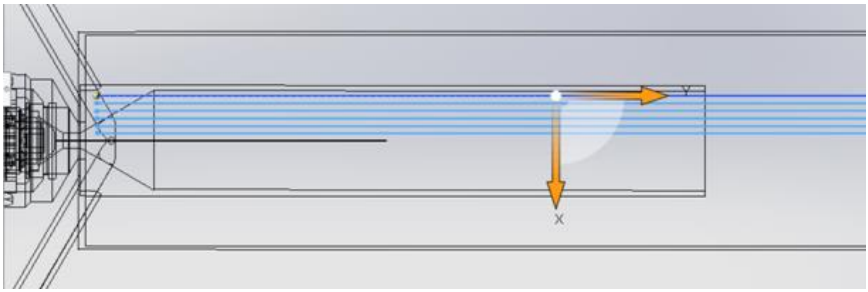

Fig. 2. Trajectories for calculating speeds and temperatures in the plasma torch mixing chamber

Several technological schemes of plasma neutralization were considered. At the first stage of research, the scheme with the flow of recycled gas through 2 axisymmetrically located pipes at angles of 10, 20 and 30 degrees to the axis of the plasma jet with a length of 90 mm, with a mass flow rate of 0.005 kg / s for each tube was analyzed. Geometry of the MC: length of at least 150 mm, opening angle of the initial part – 20°, opening on the rest of the length – for cylindrical MC – 0^0, for the confusor MC –5°. At the next stage, in order to assess the efficiency of the technology at a higher productivity (increasing the volume of recycled gas), a scheme was considered with the supply of recycled gas tangentially to the PFG flow through 4 pipes with a diameter of 4 mm, located perpendicular to the MC axis at a distance from the nozzle section of 11 mm (Fig. 1).

The process parameters were selected for comparative analysis: the main gas flow rate – 0.005 kg/s, the gas consumption per pipe – 0.004 kg/s, the arc temperature during combustion in an air-plasma environment – 7000-10000 K. In order to ensure effective neutralization, the option of

heating with a "long" plasma jet of 170 mm was also considered. It is obvious that the last heating option requires about a 2-fold increase in the power supply of the plasma arc. Geometry of the MC: length of at least 170 mm, opening angle of the initial part – 20°, opening on the remaining length of the MC – 0^0 (cylindrical configuration). Air (with a small content of dioxins) and nitrogen containing a certain amount of toxic oxide formations (primarily NO and NO_2) were analyzed as the recycled gas.

The results of numerical simulation showed that the main flow of the disposed gas moves in the MC along a spiral trajectory, which is why the calculation of kinematic and thermal parameters along a straight trajectory leads to strong fluctuations of values (Fig.3). In this regard, the parameters were calculated along the spiral line, along which the flow of recycled gas mainly moves: the diameter is 5 cm, the step is 8.5 cm, the length of one turn is 20 cm. The calculation of the average in cross-section of the MC temperatures and speeds was also applied. In this calculation, significantly smaller oscillations of gas-dynamic and thermal parameters were observed.

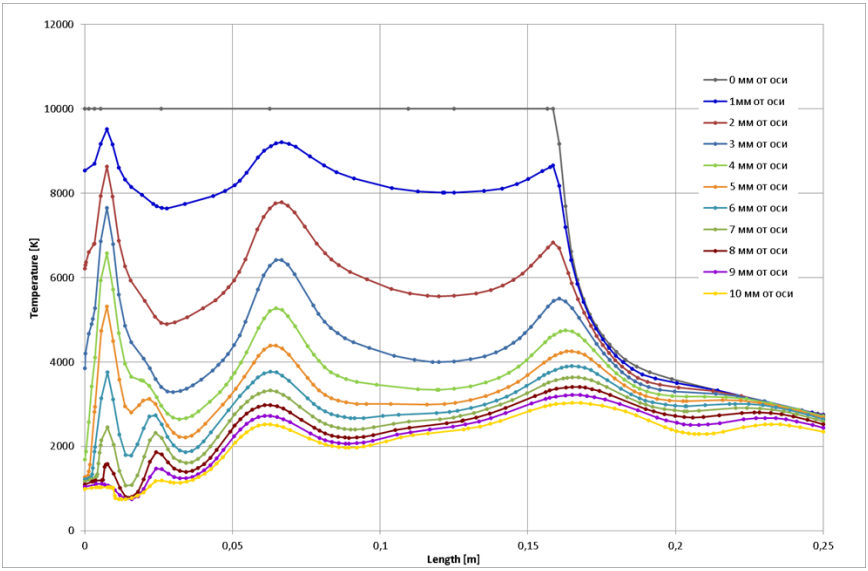

Fig. 3. Temperature distribution when calculating along linear trajectories in the MC of the plasma torch (4 gas supply channels, a length of plasma arc – 170 mm, the axial temperatures – 10000 K)

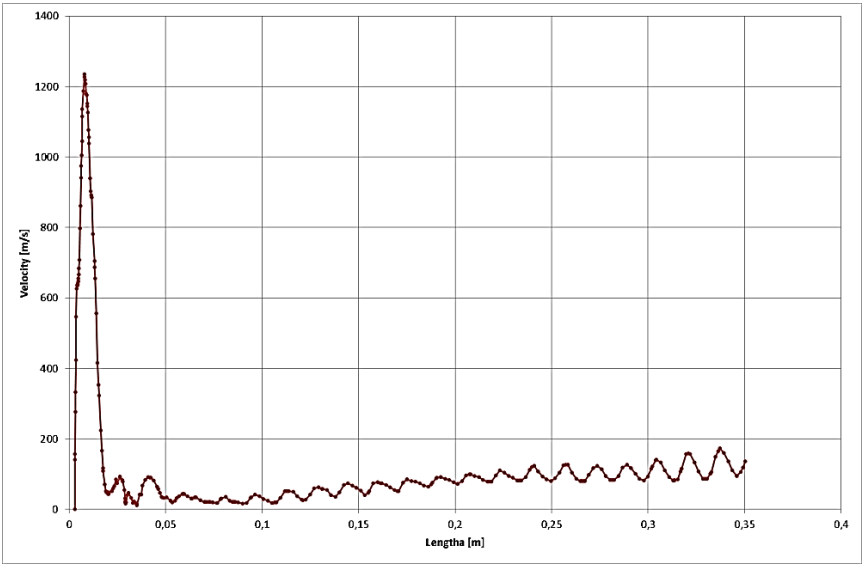

Fig. 4. The velocity distribution when calculating by spiral trajectory in the MC of the plasma torch (4 gas supply channels, a length of plasma arc – 170 mm, the axial temperatures – 10000 K)

The results of gas dynamic parameters (temperature, speed, and heating times) calculations for the disposed gas in the cylindrical and confusor MC showed that heating occurs at temperatures from 2500 to 10000 K (depending on the composition of the PFG and the power of the plasma torch) and speeds of 50-150 m/s with characteristic heating times of 2-5 msec (Fig.5). With the confusor type of MC, the heating time increases by 1.5-2 times depending on the trajectory, with the greatest increase occurring near the walls of the MC. However, from a technological point of view, the use of a cylindrical MC is preferable, since it allows for more efficient cooling of the MC. In the approximation of the spiral trajectories the evaluation of the heating time give it about a two-fold increase for the most remote trajectories from the axis, and about half the rise in average temperature along the path, which for the bulk of recyclable gas flow is in the range of 3-4 thousand K (Fig. 5).

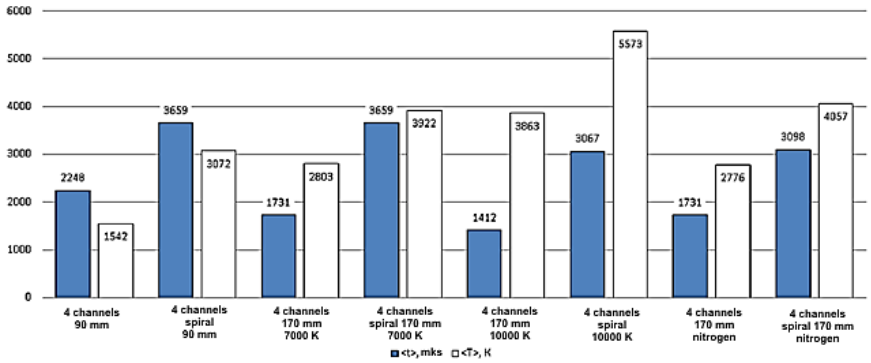

Fig. 5. Average values of heating time and temperature for various MC structures

To assess the effectiveness of dioxins detoxification by the results of recent studies [7], a search for approximating temperature dependencies of the required decomposition time was made. Based on a small amount of known information on high-temperature neutralization of dioxins [8] (at temperatures of 1500^0 and 5000^0), the authors made approximations of the decomposition time τ based on the Arrhenius equation for the reaction rate constant. The search was performed using 2 types of equations (with a constant and temperature-dependent preexponential factor τ_0):

$$\tau = \tau_0 \cdot e^{\frac{E}{RT}} \quad (1)$$

$$\tau = \tau_0(T) \cdot e^{\frac{E}{RT}}, \quad (2)$$

where E is the activation energy, R is the universal gas constant, and T is the reaction temperature.

As a result, two equations were obtained, on the basis of which the following estimates of the required time for their decomposition were made (table 1):

$$\tau = 1{,}28 \cdot 10^{-5} \cdot e^{\frac{18}{T}}, \quad (3)$$

$$\tau = \frac{7{,}2 \cdot 10^{-5}}{T^{3/2}} \cdot e^{\frac{21{,}7}{T}}, \quad (4)$$

where [τ] = sec, [T] = thousand K, with activation energy E=150÷180 кДж.

Table 1. Temperature dependence of the decomposition time for dioxins

T, thousand K		1,5	2	2,5	3	3,5	4	4,5	5	5,5
t	by equation (4)	2000	100	20	5	2	1,2	0,7	0,5	0,3
	by equation (5)	2000	1300	110	20	5	2	0,9	0,5	0,3

Based on the obtained approximating dependencies, the following criteria for neutralization efficiency were obtained:

$$RT \cdot \ln(\tau/\tau_{10}) > E, \tag{5}$$

$$RT \cdot \ln(T^{3/2} \cdot \tau/\tau_{20}) > E. \tag{6}$$

These criteria take into account the fact that an increase in both temperature and heating time leads to an increase in efficiency, as well as the activation mechanism of decomposition reactions. The following expressions can be used as numerical performance criteria for dioxins:

$$C1 = T \cdot \ln(\tau/\tau_{10}),\ C1 > 18, \tag{7}$$

$$C2 = T \cdot \ln(T^{3/2} \cdot \tau/\tau_{20}), \qquad C2 > 21{,}7. \tag{8}$$

Due to the lack of reliable information about the decomposition time of dioxins in the entire temperature range, it is advisable to use both the proposed criteria C1 and C2 when evaluating the heating efficiency, rather than the data in table 1.

Analysis of the results presented in Fig.5 and Fig.6 allows us to conclude that an increase in the length and temperature of the plasma jet in the MC leads to a slight decrease in the heating time. However, this increases the average gas temperature in the MC, resulting in the efficiency of dioxins decomposition is 30-40% higher (according to criteria C1 and C2 – see Fig. 6). The characteristic values of the heating times and temperatures correlate with the orders of time of dioxins decomposition at such temperatures (Table.1), which indicates the possibility of using a plasma afterburning method for gaseous products of hazardous waste processing.

This conclusion is also confirmed when evaluating the effectiveness of neutralization according to criteria C1 and C2 (Fig. 6). The strict requirement of synchronous fulfillment of criteria C1 and C2 clearly determines the need to use a long (170 mm) plasma jet for neutralization of dioxins. In this case, the maximum values of the process efficiency are achieved when calculations are made along the spiral trajectory (the preferred direction of movement of the disposed gas).

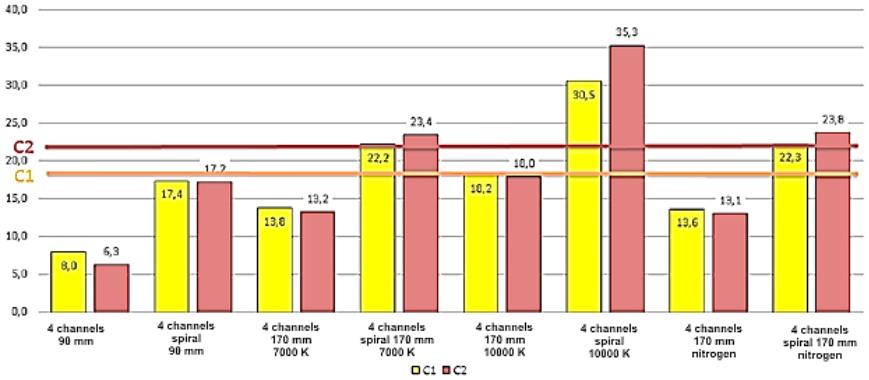

Fig. 6. Criteria of the heating efficiency for different designs of the MC

The obtained data allow us to evaluate the effectiveness of neutralization for dangerous types of nitrogen oxides formed in various technological processes, as well as during thermal waste processing. For example, calculations based on data [9] and presented in table 2 of the characteristic decomposition time and concentration of nitrogen monoxide NO depending on the heating temperature and oxygen concentration in the initial mixture with nitrogen indicate a significantly lower NO content than the MCL (0.06 mg/m^3).

Table 2. Typical decomposition time and NO concentration depending on heating temperature and oxygen concentration

Oxygen concentration	Heating temperature	Time of complete decomposition	NO concentration	
$C_{O2,}$ mol/dm^3	T, K	τ, sec	$C_{NO,}$ mol/dm^3	$C_{NO,}$ mg/m^3
0,0625	3000	0,001	9,6Ч	0,029
0,0937	3000	0,001	1,2Ч	0,035
0,125	3000	0,001	1,4Ч	0,041
0,0625	4000	0,000001	2,6Ч	7,8Ч
0,0937	4000	0,000001	3,2Ч	9,5Ч
0,125	4000	0,000001	3,7Ч	1,1Ч

Based on the results of this study, we can conclude that this method of plasma neutralization of toxic gaseous waste is justified by the example of one of the most dangerous supertoxicants – dioxin, as well as nitrogen monoxide. The advantages of this method in comparison with the known

technologies of high-temperature incineration and waste disposal are the speed and efficiency of the process. However, we should continue to develop and analyze this eco-technology in order to find optimal parameters for its application.

* The work is executed at support of RFBR grant 19-08-00190

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CALIBRATION OF VIDEO SURVEILLANCE SYSTEMS USING MULTIDIMENSIONAL INFORMATION REPRESENTATIONS

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Abstract. A technique for calibrating images from various cameras is proposed. As calibration, reference images (stencils) for each color channel (layer) are used. A statistical approach to image processing is proposed, with a multidimensional vector representation of information. To obtain the calibration vector, moments of multidimensional distribution of the representation of the samples are used. The proposed technique can be used for various color coding of images containing not only three layers, but also a larger number of layers. The rationale for the required sample sizes to obtain a calibration vector is given.

Keywords: calibration, estimates, expectation, covariance matrix, vector, information, color, encoding, pixel, probability distribution, image.

Introduction

Modern CCTV systems are constantly being improved. Based on the obtained video information, the detection and recognition of various objects can be carried out. In this case, it is necessary to use all the information contained in the resulting video images. Several cameras can be used to recognize objects. For training, an object image obtained from one camera can be used, and recognition can be carried out using images obtained from another camera. In such cases, differences in the resulting images, caused by the non-identical characteristics of the cameras, can lead to significant errors in the recognition of objects. Therefore, it becomes necessary to calibrate all video tools used in the system to solve the problems of detection and recognition of objects [1].

As a rule, calibration is understood as the task of obtaining the internal and external parameters of the camera from the available photographs or videos captured by it. With hardware calibration, the video system is profiled using software and hardware, where a colorimeter, spectrophotometer or several other devices are used to measure data [2]. After that, the video channels are adjusted. Such a path is not always possible and requires additional equipment. Therefore, there is a need for new approaches to calibrating video systems using new video processing algorithms.

Calibration methodology for video systems using reference images for multidimensional presentation of information

The tasks of detecting and recognizing objects in video images are usually solved using digital processing of the video images themselves. Therefore, it is possible to calibrate not the cameras themselves, but the final images obtained. Information can be obtained using various types of encoding (or a digital model). For example, the most common is CMYK or RGB encoding. Images are presented in discrete form. The color resolution is that the intensities of the base colors can take a finite number of discrete values. For example, for RGB encoding, each pixel is assigned three levels of brightness. For red, blue and green colors. Thus, one pixel can be represented as a vector, dimension 3.

$$\vec{\mathbf{P}} = \begin{pmatrix} P_r \\ P_g \\ P_b \end{pmatrix} = \begin{pmatrix} P_r & P_g & P_b \end{pmatrix}^{\mathrm{T}}, \quad (1)$$

where: P – the level value in the color channel (palette size) in the bit representation (for example $P = 2^c$, c– bits); r – red; g – green; b – blue; T – transposition sign.

In general, a pixel can also be represented CMYK encoding. The dimension of such a vector will be 4. Further research will be carried out for RGB encoding.

The image is represented by a set of pixels arranged line by line. For example, the resolution is 1200 x 800 (the number of pixels per line per number of lines). Each of the pixels is represented as a vector (1). Therefore, the entire aggregate of image pixels can be represented as a three-dimensional sample of volume n (total number of pixels).

$$\mathbf{P}_{(n)} = \begin{pmatrix} P_{r(1)}\, P_{r(2)} \ldots P_{r(i)} \ldots P_{r(n)} \\ P_{g(1)}\, P_{g(2)} \ldots P_{g(i)} \ldots P_{g(n)} \\ P_{b(1)}\, P_{b(2)} \ldots P_{b(i)} \ldots P_{b(n)} \end{pmatrix}, \quad i = 1,\ldots, n \quad . \quad (2)$$

In the general case, sample (2) is random measurements (it is a multidimensional random variable). This is determined by the fact that the image formation process is subject to random disturbances, the probabilistic nature of which affects all stages. These are errors of the meter itself, inaccuracies in registration and noise in the channels when transmitting measurement data, rounding errors in the calculations, and a number of other parameters [3]. This assumption allows us to use a statistical approach to obtaining estimates. The probabilistic distribution of the sample can be characterized by two points - the first initial (mathematical expectation) and the second central (covariance matrix) [3]. In statistical processing, it is not the moments of distribution that are found, but their estimates. In the future, we will operate not with the distribution moments, but with their estimates. The estimate of the mathematical expectation (ME) of the sample (2) is determined by the expression [3]

$$\vec{\mathbf{m}} = \begin{pmatrix} m_r & m_g & m_b \end{pmatrix}^{\mathrm{T}}, \tag{3}$$

where the elements of the vector are determined by the expressions

$$m_r = \frac{1}{n}\sum_{i=1}^{n} P_{r(i)}, \quad m_g = \frac{1}{n}\sum_{i=1}^{n} P_{g(i)}, \quad m_b = \frac{1}{n}\sum_{i=1}^{n} P_{b(i)}. \tag{4}$$

The estimate of the covariance matrix is calculated in accordance with the expression [3]

$$\mathbf{M} = \frac{1}{n-1}\sum_{i=1}^{n}\left(\vec{\mathbf{P}}_i - \vec{\mathbf{m}}\right)\left(\vec{\mathbf{P}}_i - \vec{\mathbf{m}}\right)^{\mathrm{T}}. \tag{5}$$

Since the obtained estimates of ME and the covariance matrix (CM) are statistical, the sample size should be determined to justify the reliability of the obtained estimates. The sample size will be determined by image size and resolution. Under the assumption that the distribution (Gaussian distribution) of the sample is normal (2), the required sample size will be determined by the dimension of the vectors and the permissible error probability. In [4], the volumes of the necessary samples were determined for various confidence probabilities of the estimates. If the confidence probability of the estimate is 0.99, then the sample size for three dimensional vectors should be at least 4656. Thus, an image measuring about 70 by 70 pixels is sufficient to obtain ME and CM estimates.

For calibration, it is necessary to use certain reference images that will be observed by the camcorder. With RGB encoding, images are required that have only red, only green and only blue colour.

In order to evaluate the distortion of the equipment during image acquisition, each color channel is calibrated separately.

A reference image is set on which there is only red color. Then we get

the image using the camera. Using the resulting image, we form a sample of the form (2) in digital form. Next, ME and CM are evaluated in accordance with expressions (3-5). In this case, if the camera is fully configured, in the channels (layers) *g* (green) and *b* (blue) there should be no signal levels. If there are levels in these layers, then the images obtained by this camera require calibration [5]. The calibration factor for the red channel (layer) can be determined as follows

$$\Delta P_r = (m_r + m_g + m_b) / m_r . \quad (6)$$

The calibration factor for the green layer is calculated similarly. Only in this case a reference image is used, where only green color is present. Similarly, the calibration factor for the blue layer is calculated using a reference image where only blue is present.

$$\Delta P_g = (m_r + m_g + m_b) / m_g, \quad (7)$$

$$\Delta P_b = (m_r + m_g + m_b) / m_b . \quad (8)$$

From expressions (6-8), a calibration vector is formed [6]

$$\Delta \vec{\mathbf{P}} = \begin{pmatrix} \Delta P_r \\ \Delta P_g \\ \Delta P_b \end{pmatrix}. \quad (9)$$

The calibration vector is used only for the camera for which it was obtained.

All images received by the camera are further calibrated as follows. The resulting image (all pixels) are presented in the form of a matrix of size 3 x *n*, formed from a sample of the form (2)

$$\mathbf{V}_{(3\times n)} = \begin{pmatrix} P_{r(1)}\ P_{r(2)} \dots P_{r(n)} \\ P_{g(1)}\ P_{g(2)} \dots P_{g(n)} \\ P_{b(1)}\ P_{b(2)} \dots P_{b(n)} \end{pmatrix}. \quad (10)$$

Subsequently, expression (10) is transformed using the gauge vector (9)

$$\mathbf{W} = \Delta \vec{\mathbf{P}}\ \mathbf{V} , \quad (11)$$

where: **W** – matrix with 3 x *n* dimensions, which is a calibrated image..

In accordance with the proposed methodology, it is necessary to calibrate all the cameras included in the system to eliminate differences in the color channels (layers) of the resulting images.

Conclusion

The article proposes an approach to the calibration of images obtained on various video cameras. In this case, a multidimensional representation of information was used. The dimension of vector representations is determined by the number of color channels (layers) of the image. During calibration, reference images (stencils) for each color are used. A statistical approach to determining image parameters is used. The technique of calculating the calibration vector using the first initial and second central moments of the distribution is given. In general, the proposed technique can be used for various color coding of images containing not only three layers, but also more layers. In this case, reference images corresponding to these encodings must be used. Calibration of cameras should be carried out in order to reduce decision errors, with further processing of information in order to automatically detect and recognize various objects in the images.

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ANALYSIS OF GEOMETRIZATION IN THE MICROMINE SOFTWARE ENVIRONMENT AT THE NATALKA GOLD DEPOSIT

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Abstract. This article is devoted to assessing the correctness of geometrization in the Micromine software environment, through an analysis of the allocation of ore intervals, an assessment of the reliability of the geological contouring model, and an analysis of the results of reserves estimation.

Keywords: Micromine, design, ore intervals, contouring, model geometrization

Administratively, the Natalka gold deposit is located in the Russian Federation, Magadan Oblast, located in the Tenkinsky District on the Yano-Kolyma Folded System.

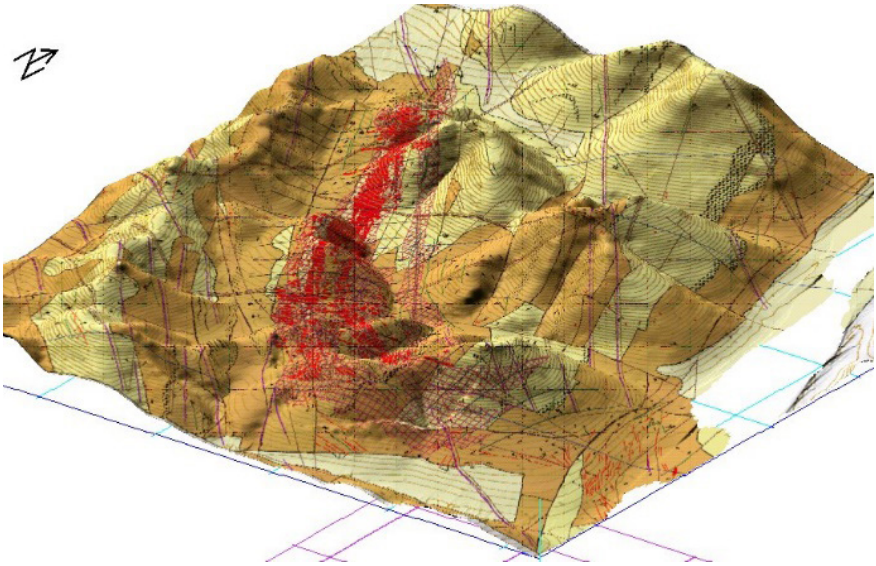

Figure 1

The geological structure of the Natalka ore field is determined by a combination of folded structures disturbed by a complex system of bursting faults. Residential bodies of igneous rocks also act as important structural elements, marking ore-controlling faults and blocks. The general picture of the Natalka ore body in the local geological structure with an overlay on the relief is shown in Figure 1. In the figure, the ore body itself is highlighted in red.

At this site, the entire complex of geometrization is performed in the *Micromine* software environment.

Analysis of the results of the allocation of ore intervals of the Natalka deposit

Comparison and allocation of ore intervals was carried out separately for the sites, taking into account the conditions of the work performed in stages

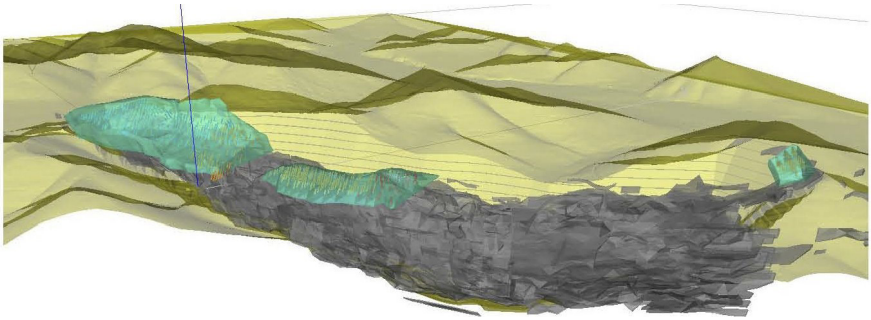

Figure 2 Plots of the first phase of the OEI (turquoise color North-West - on the left, Central-in the center, Southeast on the right) Against the background of the general contours of ore bodies (gray color) and the final contours of the projected quarry Ore interval parameters

The allocation of ore intervals was carried out on the basis of established conditioning indicators. Due to the need for separate contouring and evaluation of relatively rich ores (2 g/t), geological exploration parameters were additionally calculated for other options for cutoff grade of 0.6, 0, 8, and 1 g/t. The calculation results are shown in table 1

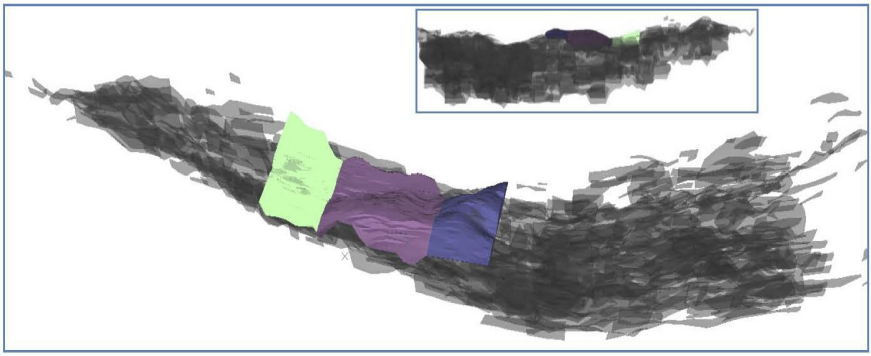

Figure 3 Plots of the second phase of the OEI (The North-West section is shown in turquoise, the Central section to the profile +20 purple, from the profile +20 blue) - gray)

Table 1

C_6	Sum of lengths, m	Cav, g/t	Amount Mgr	Number of intervals	Interval Length Avg. m	% length	% Mrp
North-West Section, profiles 27,5--10							
0.4	2000	1.89	3787	97	20.6	100%	100%
0.6	1234	2.68	3306	80	15.4	62%	87%
0.8	868	3.38	2934	66	13.1	43%	77%
1	656	3.98	2614	50	13.1	33%	69%
Trad. PZ $_6$=0.4		1.46					
Central Section, profiles 10-20							
0.4	5125	1.91	9776	240	21.4	100%	100%
0.6	3399	2.56	8699	202	16.8	66%	89%
0.8	2436	3.18	7758	163	14.9	48%	79%
1	1907	3.69	7039	132	14.5	37%	72%
Trad. PZ C6=0.4		1.71					
Central Section, profiles 20-32,5							
0.4	574	2.08	1194	38	15.1	100%	100%
0.6	406	2.65	1078	28	14.5	71%	90%
0.8	278	3.43	954	23	12.1	48%	80%
1	182	4.54	824	17	10.7	32%	69%
Trad. PZ C_b=0.4		1.62					
Amount and C_{av} at C_b =0,4	7699	1,9 1	14757	375			

From the calculations it can be seen that the dynamics at intervals fully corresponds to the nature of the changes. When the cut-off grade goes from 0.4 g/t to 0.6 g/t, ore reserves decrease 38%-29%. Metal reserves are reduced 13%-10%. Transition of onboard contents from 0.4 g/t
to 0.8 g/t lead to a decrease in ore reserves by 57%-52%; loss of "metal" reserves in this case is 23%-20% of the original amount.

It is noteworthy that the average gold grades with an on-board grade of 0.4 g/t in the "new" intervals are significantly higher (15%-20%) than according to traditional estimates. This discrepancy is due to the correct consideration of the zones of influence of exploratory intersections in the final calculation.

A preliminary analysis of the OEI exploration data allows us to draw the following conclusions:

- the average gold grade with an on-board grade of 0.4 g/t in the wells of the first and second stage of OEI is slightly higher than previously determined;

- the results of the second stage of OEI confirm the possibility of separating “rich” ores with a content of 2 g/t.

Reliability analysis of the geological contouring model

The contouring of ore bodies in calculating reserves in 2006 was based on the geological model of the deposit. Its main element was the structural-tectonic structure diagram, created taking into account previously identified ore zones (1981) and newly identified structures on the flanks of deep horizons. Such a model of the deposit allows us not only to link ore intervals between exploration crossings, but also to track the position in the space of ores of various quality, determining the possibility of their selective excavation. On the whole, the reliability of the geological model underlying the previous calculation is no less important factor in assessing the quality of the calculation than the reproducibility of the calculation numbers.

Reliability analysis of the geological model was carried out from the standpoint of confirmability of ore-controlling structures, as well as the convergence of the spatial position of the boundaries of ore deposits, identified according to the results of exploration of previous periods and according to OEI. Previously, studies on the geometrization of ore bodies were carried out on the example of the North-Western section. For the Central site, this analysis was not previously performed, since a significant part of the volume of ore bodies remained unstudied in the field of technogenic disturbances and failures. Currently, this has been offset by the results of the second phase of OEI. The ore intervals allocated according to the testing of production exploration wells for the reporting period were taken to

exploration sections. (fig.). An analysis of the spatial position shows that their main part (80%) falls within the limits of previously established ore bodies. According to the dip and strike of ore bodies identified in 20016, the absence of conditioned ore intervals in the previously constructed contour is noted in 15% of the total number of ore intervals. At the same time, at the intersection with the well-known ore-bearing structure, boreholes are allocated new ore intervals that allow you to select individual counting blocks or expand the boundaries of the “old” blocks. The number of such intervals is 10% of the total. Thus, the "loss" of ore is largely offset by their "increase". It should be noted that such cases of “non-confirmation” and “growth” are typical for areas of the deposit with low-power ore bodies that were previously explored from a relatively rare network. Reserves in them were qualified in category C2, and partially in category C1. At the same time, in places of expected undercutting of structures, as a rule, an increase in the gold content is recorded. Within the blocks rated by category B, only local changes in the contours of ore bodies are recorded.

In addition to the ore-bearing structures noted in the calculation of reserves in 2006, additional ore bodies are distinguished. They are controlled by newly established ore-bearing structures, which are characterized by a relatively small extent (first hundreds of meters) along strike. Ore bodies have a subparallel or diagonal orientation relative to larger structures. On the comparison site, 28 ore intervals were identified within such structures, which is 8% relative to their total amount. Ore bodies associated with them, as a rule, are based on 1-2 exploratory intersections and are mainly traceable to no more than 2 sections. The power of the intervals is 6-12 meters and rarely exceeds 20 meters. These ore bodies are located mainly on the flanks of the deposit, characterized by relatively low exploration in previous periods. The share of reserves associated with “new” bodies and structures, in our estimation, does not exceed 1%.

In general, the analysis shows the correctness of the previously created geological model of the field.

The bulk of ore intervals identified by OEI data fall within the boundaries of previously contoured bodies. Moreover, the position of the boundary of the ore body may shift relative to its expected position in one direction or another. A change in the spatial position of mineralization during network thickening is considered characteristic in intelligence practice. Quantitatively, it is estimated by ***geometrization errors***, the permissible value of which depends on the qualification of the reserves. For category B reserves, the marginal error is 30%, and for category C1, 50%. Within the area under consideration, the reserves of the field have been explored,

mainly B and partially C1. The estimation of geometrization errors (GE) was performed earlier in the report for the first stage of OEI. For calculation, formula 1 was used.

$$GE = \frac{(\sum S_{EX} + \sum S_{EM})}{2 * S_T}; \quad (1)$$

where:

$\sum S_{EX}; \sum S_{EM}$- ore area outside the exploration circuit, empty (barren) areas in the exploration circuit, respectively;

S_T- true sectional area of ore bodies.

For the newly obtained data (the second stage of OEI), as in the previous case, the contouring reliability was estimated by intermediate horizons with marks 775, 815, 855 and 895. The contours of ore bodies of calculation 2006 and the boundaries established using OEI were compared (Fig. 4). Green color shows the contours and areas of ore bodies according to 2006 estimates; red - contours of ore bodies according to OEI results. The blue line indicates the boundaries of the matching plots. As the "true" were taken the contours of the frameworks of deposits, determined according to OEI. The results of the estimation of geometrization errors are given in table 2.

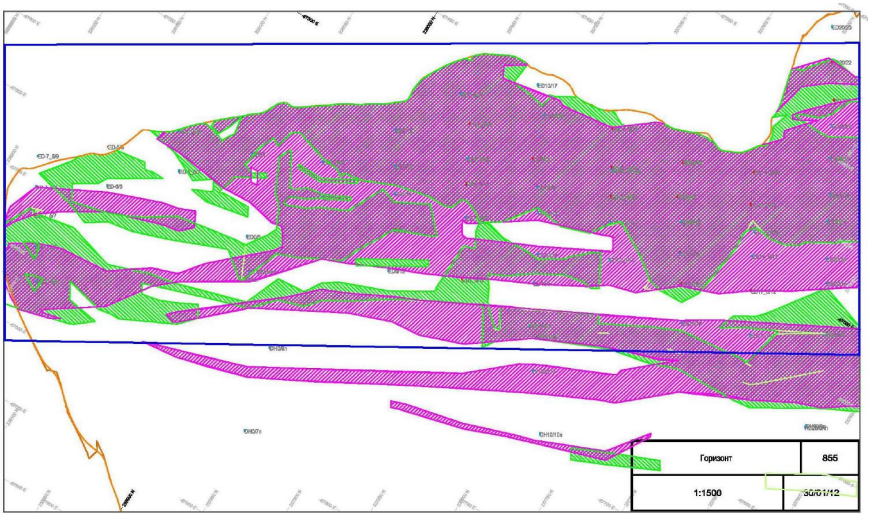

Figure 4 Contours of ore bodies at horizon 855

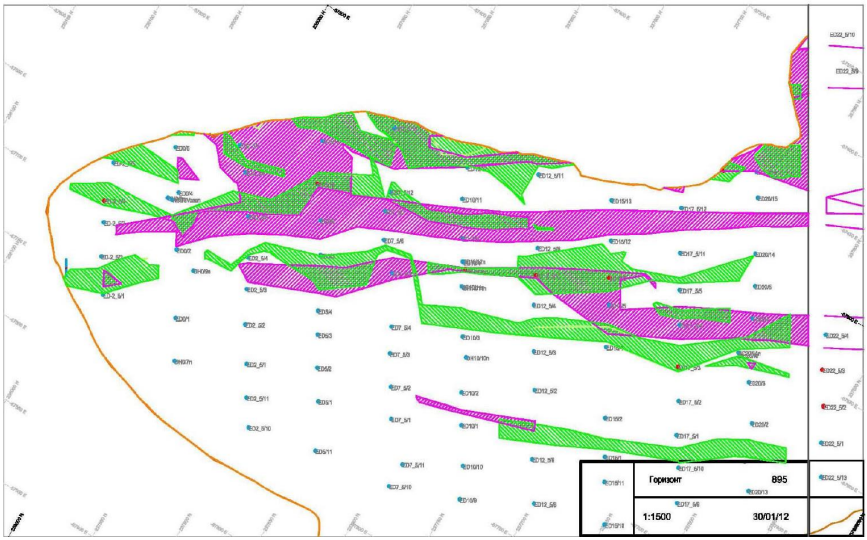

Figure 5 Contours of ore bodies at horizon 895

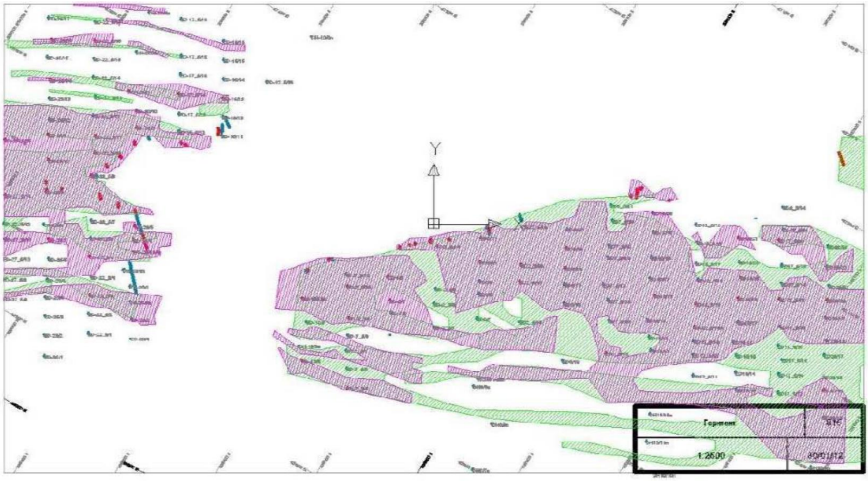

Figure 6 Contours of ore bodies at horizon 815

Table.2

Horizon	True area in m^2	Ore area beyond the contour, m^2	Area of waste rock in the contour, m^2	Geometrization error %
895	18103	10077	14421	67.7
855	61540	13519	14718	22.9
815	139375	20625	50625	25.6
775	150000	18125	11250	9.8
Total	369018	62346	91014	20.8

The maximum geometrization errors are characteristic for the horizon of 895 m, where ore bodies have a small thickness; these sites also have small ore reserves. The minimum values of this indicator are observed at a horizon of 775 m, where the thickness of ore deposits increases. The average value of the geometrization error for all intermediate horizons was 20.8%, which fully corresponds to the requirements for contouring category B reserves. Thus, the reliability of the previous results is confirmed from the contouring position.

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IMPROVING THE DESIGN OF MILK SEPARATORS

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Abstract. This article discusses the physical characteristics of milk, in particular milk fat balls; equipment for cleaning and separating milk, their types and design features; scientific views on the problem of universalization of centrifugal separators-purifiers and separators; methods for solving research and design of multi-purpose universal separators that ensure the efficiency of separation and stability of the interstitial flow of milk in a centrifugal spiral separator. The possibilities of improving the design of separators are suggested.

Keywords: Milk, milk fat content, mechanical processing, separation into fractions, filter, separator, separator construction, universal separator.

Introduction

The milk medium is a liquid in which all the constituent substances are distributed or dissolved. These substances are in different physical states. Milk fat has the form of globules of size from 0.1 to 10 microns, which can be seen under a microscope at a magnification of 300-500 times.

The amount of fat in milk ranges from 3 to 4.5% or more, with an average of 3.8%. When determining the fat content, it is important to consider tenths and hundredths of a percent. If the fat content in the milk obtained after separation is reduced by only 0.1%, this will additionally give hundreds of tons of butter. For its production, it is necessary to keep more than 16 thousand cows.

Since fat does not dissolve in water, its particles, trying to occupy the smallest volume, take the form of globules. About 80% of fat globules have a diameter of 0.5 to 5 microns. Fat balls tend to merge, however, is prevented by the protein shells covering the globules [1].

Mechanical processing is an integral part of the complex technological cycle of milk processing. It consists in mechanical impact on milk in order to divide it into fractions (cream and skimmed milk), increase the homogeneity of the fat phase in milk before and after separation, as well as in preparation for obtaining the same ratio of the mass fraction of fat and dry substances in the raw material and in the finished product. The main technological operations of mechanical processing are separation, normalization and homogenization of milk.

During mechanical processing, milk is cleaned from contaminations, divided into fractions (separation), its fat balls are dispersed (homogenization), and it subjected to separation using membrane methods.

Mechanical processing of milk and dairy products is carried out using filters, centrifuges, separators of various designs, homogenizers and membrane filtration devices [2].

1. Equipment for cleaning and separating milk

For milk purification, filters and separators are used.

Filters. Cleaning of milk and dairy products is carried out under the influence of the pressure difference on both sides of the filter septum. The filter septum represents the main part of the filter and mainly determines its design and technical characteristics (performance, degree of cleaning, etc.). A large number of different properties of filtering septum made of inorganic and organic materials are known.

In filters for milk and dairy products, fabric (canvas, gauze, flannel), metal (titanium alloy granules, stainless braided and perforated stamped mesh with holes of 0.5...2 mm) and other materials are used. The cross-section area of the filter septum is up to 50 %.

By design, milk filters can be cylindrical, plate, disc, open and closed [4].

Separation of milk. The separation process is a mechanical separation of milk into fractions under the action of centrifugal force. Separation is used to separate milk into cream and skimmed milk, as well as to clean it from mechanical and natural (blood, mucus, etc.) impurities. In addition, during separation, proteins are isolated from whey, high-fat cream is obtained, microorganisms are separated from milk (bacterial separation), etc.

Under the action of centrifugal force, milk is separated due to the difference in the densities of the fractions: the density of the dispersed phase (fat) is less than the dispersion medium (milk plasma), or the density of the dispersion medium (milk plasma) is less than the dispersed phase (particles of mechanical and natural impurities).

Milk separation is carried out in special machines – separators. Separa-

tors that designed to separate milk into cream and skimmed milk are called cream separators, and for milk purification – milk purifiers. Cream separators with milk normalization devices are called normalizer separators.

The separation mechanism is very complex. Its main essence is that under the influence of centrifugal force, the fat phase is released from the milk stream [2].

2. Methods for solving research and design issues of multi-purpose universal separators

Scientific works devoted to the problem of universalization of the largest class of processing machines - centrifugal separators-purifiers and separators, are most relevant in various industries.

Separation engineering is one of the earliest industries, but it also lags behind in solving the problem of universalization. Creating centrifugal separators that can process as many different liquids as possible is a difficult but achievable task. The main directions of scientific research are the introduction of additional types of separation, separation processes, changing parameters through the use of various physical and biochemical methods of influencing the liquid in the working area, in order to create the most favorable kinematic and dynamic conditions for separation [5].

The development of the most common technology used in all areas of production for the centrifugal separation of a solution into fractions is based on a complex system of the following preparatory operations:

- determination of the main properties of the material to be separated and the possibility of applying the Stokes law for this solution;
- selecting the characteristics that define the processing process,
- preparation of the product for processing in order to give it properties that ensure the highest productivity of machines and high quality of separation;
- setting up the equipment used, designing new mechanisms and selecting suitable parameters for separators.

The selection of criteria parameters that characterize interstitial flows is carried out at the further stage of these studies. They consist in solving a complex mathematical problem by the usual selection method, which includes determining the width of interstitial gaps and the main hydrodynamic values that characterize the separation process, according to known technological, kinematic and geometric parameters that are set by design tasks.

The solution of the problem is to check the rationality of the pre-selected conditions that ensure the efficiency of separation and stability of the interstitial flow. If these conditions do not ensure effective separation, the original data is corrected and the calculation is repeated [3].

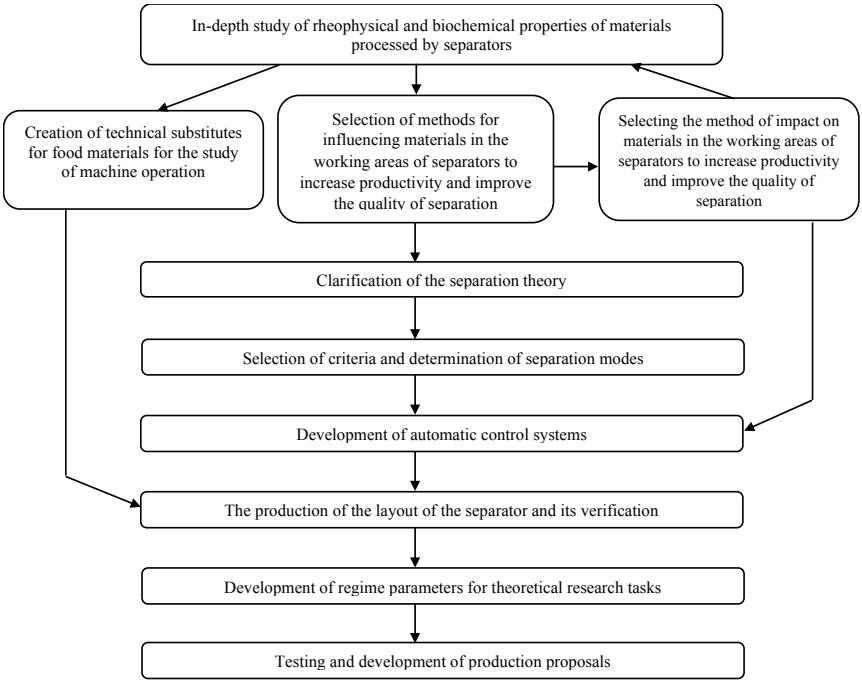

Figure 1 – Research program

Improving the design of modern universal centrifugal separators should go the way of developing new differentiated theoretical and experimental methods for studying the rheophysical and biochemical properties of solutions. At the same time, in each technological operation of material processing, the most realistic mathematical models of the liquid are selected for this mode, the main analytical dependencies of the separation theory are clarified, new parameters regulating the separation process are introduced, changes are made to the design of separators and new machines are created. The introduction of additional automatically controlled separation parameters will simplify the second stage of the study, that is, limit the preliminary calculations. The adjustment of technological and hydrodynamic separation modes can be entrusted to the automatic control systems of the machine itself - the autoseparator. The research and design program for multi-purpose universal separators and the relationship between them are discussed below (figure 1).

Many modern separators are adapted for processing two different quality liquids, but under a mandatory condition: they must belong to the same class of materials and be similar in properties. For example, the proposed spiral-centrifugal separator for cleaning and separating milk is also offered for use for cleaning dispersed liquids in other industries. The application of such recommendations to the technical data of machines is a great help to enterprises that operate separators. However, most separators do not have these recommendations. As you can see, there is quite a lot of work to be done not only to create new separators, but also to research constructions for their use for processing other materials [3].

The process of pipeline transportation of milk shows the need for parametric synthesis of a low-speed centrifugal cyclone separator. Classification of types of hydraulic separators will reveal their advantages and disadvantages. Reducing the impact of structural and operational group factors will increase the efficiency of separation.

At the same time, one cannot do without the use of reliable working fluids that mimic the properties of real solutions processed by these machines. Creating stable, steady, reusable technical substitutes (model materials) for food products that do not change their properties over time is one of the stages of research of the operation of centrifugal machines and other technological equipment.

3. Conclusions

The search and selection of processing modes that have the most favorable impact on the quality and productivity of the process of separating various materials into fractions using complex methods of physical and chemical influence on them in the working areas of machines will allow us to apply the proposed research methodology, as well as the principle of designing centrifugal separators in many areas of the national economy.

The least mechanical impact on the milk has a centrifugal spiral channel, so we choose this separation design for further research.

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NOTES

Scientific publication

International Conference
"Process Management and Scientific Developments"

Birmingham, United Kingdom
(Novotel Birmingham Centre, May 2, 2020)

Signed in print 06.05.2020 г. 60x84/16.
Ed. No. 83. Circulation of 500 copies.
Scientific publishing house Infinity, 2020.