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Development**

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The materials of the conference have presented the results of the latest research in various fields of science. The collection is of interest to researchers, graduate students, doctoral candidates, teachers, students - for anyone interested in the latest trends of the world of science.

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## **SECTION I. Chemical sciences**

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### **SYNTHESIS AND PHYSICOCHEMICAL PROPERTIES OF Ta<sub>2</sub>O<sub>5</sub> NANOPARTICLES FOR THERANOSTICS<sup>1</sup>**

Inorganic nanoparticles are an alternative to existing organic cancer therapies. Due to their small size, they can simultaneously visualize tumors and metastases using computed tomography, target drug delivery, and kill cancer cells by generating of reactive oxygen species that damage the DNA of actively dividing cells [1]. It has been proven that Ta<sub>2</sub>O<sub>5</sub> nanoparticles are biocompatible [2] and have excellent contrast properties in computed tomography [3]. Theoretically, for spherical NPs, the value of the dose enhancement factor (DEF = 1.7) was calculated. It reflects the potentially high radiosensitizing ability of tantalum (V) oxide [4].

We hypothesize that the morphology of nanoparticles will affect the radiosensitizing ability. The aim of this work is to synthesize, study the morphology of tantalum(V) oxide nanoparticles and analyze their radiosensitizing properties for use in radiation therapy of cancer. The following tasks have been set: the synthesis of nanoparticles of various morphologies (spheres, "flowers", "rods"), the study of the physicochemical properties and the assessment of radiosensitizing characteristics.

We are developing new methods for the synthesis of Ta<sub>2</sub>O<sub>5</sub> nanoparticles of various morphologies, in the form of spheres, "flowers" and "rods". It is expected that these forms of nanoparticles will contribute to an increase in the number of electrons knocked out by X-rays during irradiation of the tumor. It will increase the effectiveness of radiation therapy several times.

The syntheses of nanoflowers, nanopillars and nanowires were carried out by the solvothermal method. The stability of the obtained sols (Z-potential) and particle sizes were studied by the method of dynamic

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<sup>1</sup> This work was supported by the Russian Foundation for Basic Research (grant №18-29-11078)

light scattering (DLS) (Figure 1). The morphology of Ta<sub>2</sub>O<sub>5</sub> particles was characterized using electron microscopy (Figure 2). An X-ray phase analysis of the samples was carried out to determine the crystallinity, crystallite sizes and to confirm the formation of tantalum (V) oxide (Figure 3).

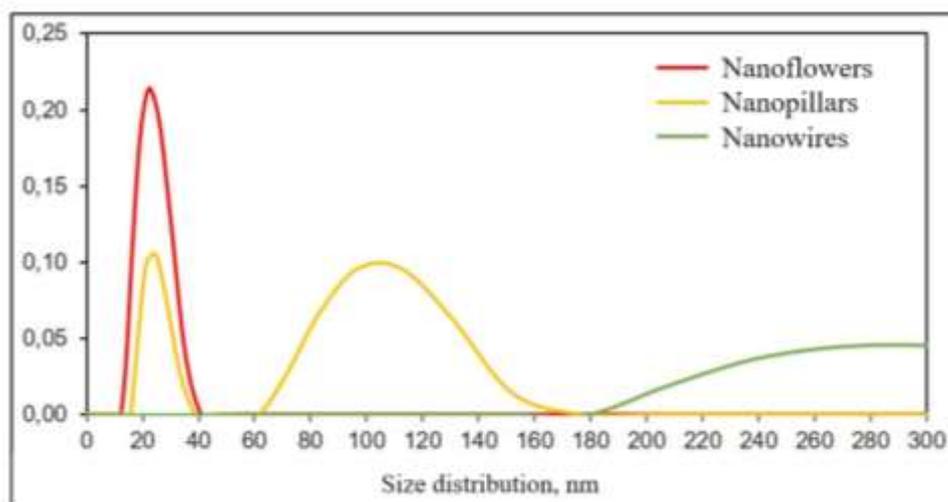


Figure 1. Size distribution of Ta<sub>2</sub>O<sub>5</sub> nanoparticles of various shapes

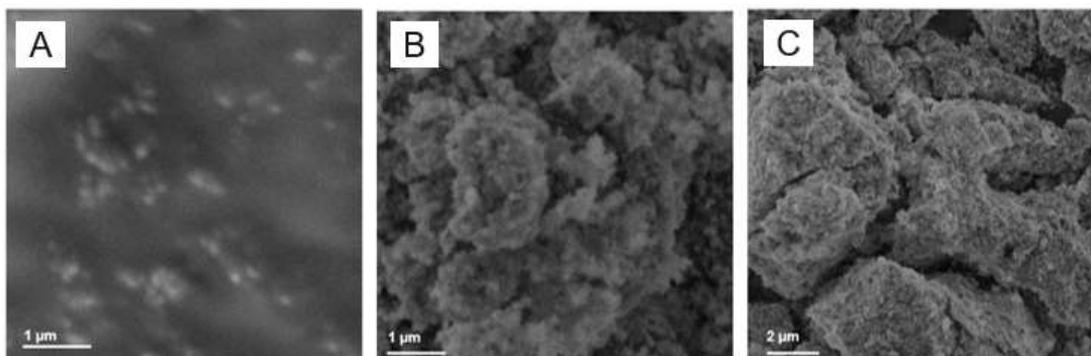


Figure 2. SEM images of nanoparticles:  
A) nanoflowers, B) nanopillars, C) nanowires

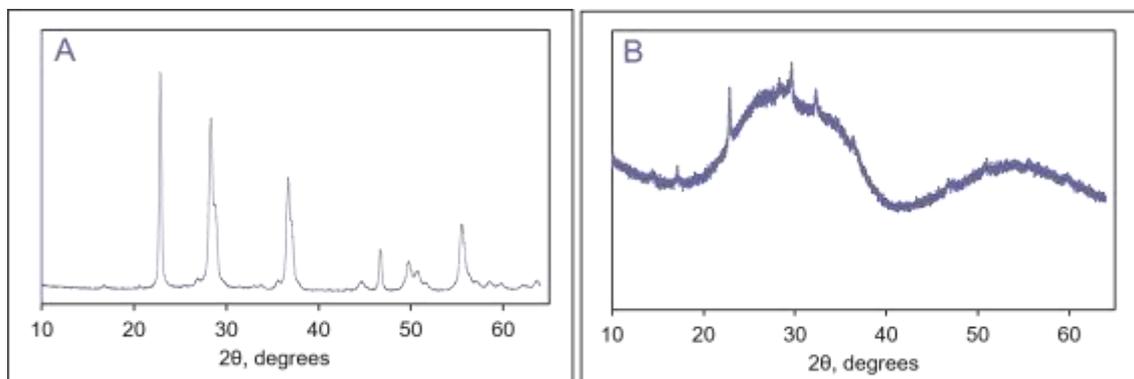


Figure 3. Diffraction patterns of:  
A) nanoflowers (crystal structure), B) nanopillars (amorphous structure)

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## SECTION II. Biological sciences

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### ***CANDIDA ETHANOLICA* YEAST STRAIN AS THE PRODUCER OF PROTEOLYTIC ENZYMES**

The role that enzymes play in the activities of the living objects can scarcely be overestimated. Due to the catalytic function enzymes accelerate a vast amount of biochemical reactions occurring inside or outside the cells [1]. Proteolytic enzymes (proteases) are the enzymes that act as the catalysts of the hydrolysis of proteins, peptides and other compounds with peptide bonds. Proteases are widely used in the food industry. They are used for the wine and beer stabilization (due to removing the albuminous cloudiness), for acceleration of filtration processes, and in the starch industry for the purpose of production of high purity protein-free starch [2]. Microorganisms, such as *Bacillus*, *Micrococcus*, *Pseudomonas* bacteria, *Aspergillus*, *Penicillium*, *Rhizopus*, *Keratinomyces* microfungi, etc., are the most promising source of proteases [1]. Yeasts are also used as the sources of certain enzymes [1-9]. Storage and cultivation of yeasts usually do not require much effort and money. A lot of yeasts are simultaneously used for the production of feed additives that are easy digestible by animals. In this respect the ones of interest are *Candida ethanolica* yeasts that grow in a medium containing ethanol, since synthetic ethanol is an available raw material which is highly water soluble and non-toxic [3-5].

In that regard, the goal of our work was to study the perspectives of the yeast strain *Candida ethanolica* BKM Y-2300 T in the synthesis of extracellular proteases.

For the qualitative assessment of the presence of enzymes in yeasts we performed inoculation of the strain in differentially diagnostic media, various in content (Table 1) [6].

Table 1 – Conditions of the qualitative determination of the proteolytic activity of *Candida ethanolica* yeasts

Name of the medium	Content of the medium (g/l)	Sterilization conditions	Incubation conditions
Peptone water (tubes)	meat peptone – 10 g; NaCl – 5 g; Na <sub>2</sub> HPO <sub>4</sub> – 3.5 g; KH <sub>2</sub> PO <sub>4</sub> – 1.5 g; pH 7.2 ± 0.2 gelatin – 12% of the medium volume	Steam sterilization (121°C) during 15 min.	T = 20-22 °C during 7 days
Meat-peptone broth (tubes)	prepared meat-peptone broth; gelatin – 12% of the medium volume		
Milk agar (Petri dishes)	equal amounts of nonfat milk and the 3% water agar	Milk: steam sterilization (112°C) during 15 min. Agar: steam sterilization (121°C) during 15 min. After sterilization the solutions were combined together and dispensed to sterile Petri dishes	T = 37 °C during 4 days

The analysis of the results of the research showed that in the media containing gelatin its deliquation by the enzymes of *Candida ethanolica* yeasts occurred on the third day and intensified during the whole period of cultivation. During the incubation of yeasts on milk agar clarification zones of the medium occurred in two days and increased during the whole cultivation process. Thus, the qualitative determination of the extracellular proteases has showed their presence in *Candida ethanolica* yeasts.

Then, we carried out the quantitative assessment of the activity of proteolytic enzymes in such yeasts using the modified Method of Willstätter and Waldschmidt-Leitz [7]. This method is based on determination of free carboxyl groups in the alcoholic solutions of amino acids and polypeptides. Per a unit of proteolytic activity we took 1 ml of

culture liquid, which produces 1 mg of amino nitrogen per hour during the hydrolysis of the 5% gelatin solution or the 5% casein solution with pH 7.3–7.5 at the temperature of 40 °C. Cultivation of yeasts was performed during 26 hours. The result is given in Figure 1.

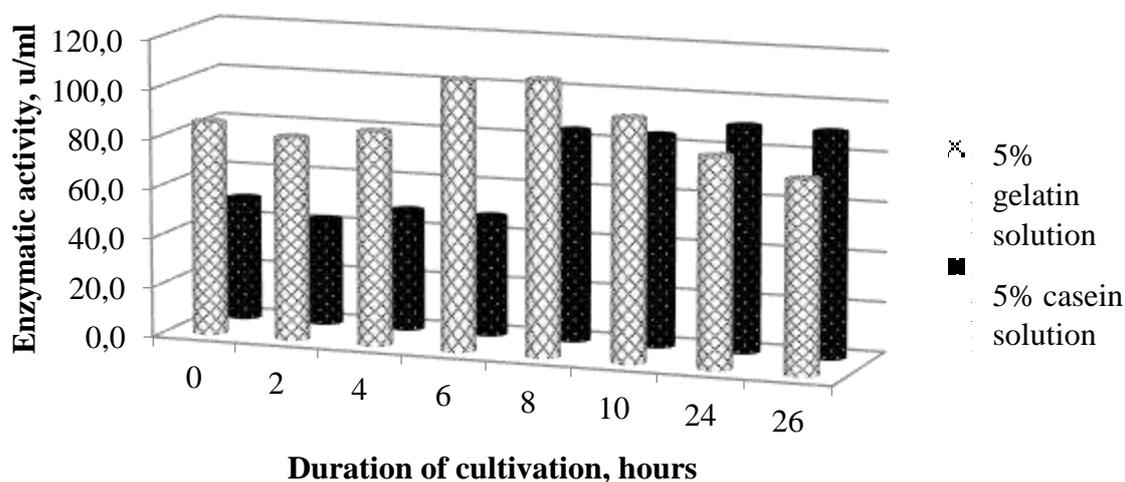


Figure 1 – Activity of proteolytic enzymes in *Candida ethanolica* yeasts when growing in different substrates

The analysis of the obtained results showed that when growing in gelatin medium, the maximum activity of the extracellular proteases in *Candida ethanolica* could be observed 8 hours after cultivation and amounted to 110 u/ml. When growing in casein medium, the maximum proteolytic activity was recorded 24 hours after and amounted to 90 u/ml.

Comparing to the values of proteolytic activity of other microorganisms (*Aspergillus oryzae* 107 = 20.5 u/ml [8], *Bacillus subtilis* = 4–6 u/ml [9]), it was found that the activity of proteases in *Candida ethanolica* yeasts is significantly higher, i.e. 4.4–27.5 higher.

Thus, the conducted research has shown the opportunity of application of *Candida ethanolica* BKM Y-2300 T yeast strain as the promising producer of proteolytic enzymes.

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## **SECTION III. Engineering**

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### **WAYS TO IMPROVE THE COOLING CAPACITY OF REFRIGERATION EQUIPMENT**

Refrigeration systems are widely used in many industries. They are actively used in the food and chemical industries, in metallurgy and in medicine. Refrigeration industry is an energy-intensive production. Currently, refrigeration industry is one of the largest power consumers, so the issue of energy efficiency of refrigeration equipment takes one of the most important places in the energy balance.

Energy efficiency of refrigeration machines can be improved in different ways. One of these ways is to use compressors with high efficiency. This allows the power of the electric motor to be reduced. Also, energy efficiency can be increased by using modern heat exchangers with high cooling capacity due to heat exchange intensification [1].

It is possible to reduce energy consumption of refrigeration equipment by increasing the cooling capacity of this equipment. One of the ways to increase the refrigeration capacity is to supercool the liquid refrigerant.

Supercooling can be obtained in different ways. Special regenerative heat exchangers are used for supercooling. In these units, supercooling is achieved by vaporization of the refrigerant leaving the evaporator.

The supercooling process is most effective in low-temperature units. In such units, supercooling of a refrigerant after a condenser by 1 degree allows increasing the cooling capacity by 1% [2].

Another way to obtain supercooling is to replace single-stage compression with multistage compression, where supercooling occurs by boiling the refrigerant in an intermediate vessel at intermediate pressure. The use of an intermediate vessel largely determines the efficiency and economy of the refrigeration unit as a whole. It is most

effective at very low boiling temperatures, when the pressure ratio  $p_k / p_0$  increases.

Increase of  $p_k / p_0$  causes the reduction of the refrigeration machine efficiency, i.e. energy and volume characteristics of a refrigeration machine decrease, the discharge temperature increases, and it can provoke temperature deformations and oil combustion. If the ratio  $p_k / p_0$  is high, the quantity of vapor entering the evaporator increases and it considerably worsens the heat exchange intensity. Therefore, it is more reasonable to compress the refrigerant in several stages. It provides additional possibilities to use supercooling systems in such units. Thus, maximum efficiency of the refrigeration machine is achieved in units with two-stage compression with a supercooling system.

Multistage refrigeration units are widely used by major European companies with significant experience in creation and introduction of low-temperature equipment.

Taking into account growing prices for electric power in Russia, application of multistage refrigeration units with a supercooling system looks very promising. This will allow leading enterprises in the field of industrial refrigeration to create more efficient and environmentally friendly refrigeration units in the future.

It can be concluded that the use of a supercooling system allows significant increase of the cooling capacity of the refrigeration unit. Increasing the cooling capacity is a promising trend for improving the efficiency of refrigeration machines in general.

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## **DECREASE OF CARBON DIOXIDE EMISSIONS AND ALUMINA PRODUCTION FLOW CONTROL USING DEEP DECOMPOSITION OF NEPHELINE SLUDGE**

### ***Introduction***

Modern metallurgical production may be characterized by the application of technologies, helping to recover a significant quantity of valuable constituents during the natural and man-made ore raw material processing. Meanwhile, poor-value impurity constituents and mineral impurities are accumulated in sludge products in their original or chemically changed form with further storage in sludge depositories. Currently, these processes are becoming a global severe challenge for the industrial and ecological safety of the active plants and the adjacent grounds. The problem is particularly acute for the aluminum-bearing raw material processing. For example, during the bauxite processing not less than 2 tons of waste sludge are produced per a ton of the final product (aluminum). During nepheline processing the amount of sludge is as much as 12 and more tons depending on the quality of the original raw material. The existing comprehensive approach to the processing of nephelines to alumina and secondary products allows for the recovery of nepheline sludge in the production of Portland cement and binding materials. However, this approach goes along with a vast amount of carbon dioxide, produced during the technological process. And the current situation in the construction market together with the economic inexpediency of the long-distance Portland cement transportation leads to the accumulation of solid wastes in the sludge depositories. Thus, the one of particular interest is the development of an economically efficient technology, aimed at the accumulation of lime constituent as a standalone product with its further application in the alumina production cycle, which will help to regulate the flows of the complex technology and decrease the amount of the produced limestone and the carbon dioxide emissions.

### ***Materials and methods of research***

Nepheline sludge represents a multicomponent system, the composition of which depends on the chemical interactions, proceeding during the sintering and leaching of the nepheline concentrate and the further washing. The chemical composition of the nepheline sludge is presented in Table 1.

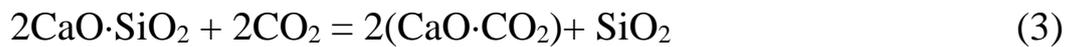
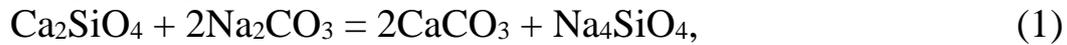
**Table 1** - Chemical composition of the nepheline sludge, % (weight):

Plant	LOI	SiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	CaO	R <sub>2</sub> O
Pikalyovsky Alumina Plant	2.6	29.6	2.6	3.0	56.8	1.8
Achinsk Alumina Refinery	3.4	28.8	4.2	3.6	54.6	2.6

The solid wastes, prepared during the production, have the density of 3150-3200 kg/m<sup>3</sup>, the bulk density within 1000-1500 kg/m<sup>3</sup>. Its mineralogical composition is 80% of dicalcium silicate (belit). The great role in the formation of the active forms of dicalcium silicate (Ca<sub>2</sub>S) lies on the alkali modulus of the limestone-nepheline charge (LNC). Such relation is determined in the works of P.I. Bozhenov [2]. Considering the operating requirements for the alkali modulus of LNC, it may be concluded that the activity of the nepheline sludge, produced by Russian plants at work, is within the optimum range for its processing.

At the same time, it should be kept in mind that during the alumina production one of the key tasks of the sintering process is the silicon fixation in dicalcium silicate in the low-activity  $\beta$ -modification ( $\beta - C_2S$ ). The  $\alpha$ -modification, in its turn, is more preferable, and it would significantly simplify the sludge processing due to its activity. However, such decision is unreasonable, since it will cause substantial contamination of aluminate solutions during leaching, while the additional heat treatment of the sludge for the transition of dicalcium silicate from  $\beta$ -modification to  $\alpha$ -modification is economically inexpedient, since it requires the heating of the material to the temperatures not less than 700 °C. Therefore, it is necessary to develop comprehensive approaches to hydrochemical treatment, which would help to recover the nepheline sludge with no additional heat treatment. The research, carried out previously, has shown the possibility in principle of soda-carbon dioxide conversion of the nepheline sludge into calcium carbonate and separation of silicon in the form of the silicate

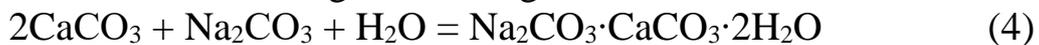
solution. This approach is connected with the thermodynamic instability of calcium silicates, produced in the high-temperature sintering conditions, with respect to the processes of hydration, hydrolysis, and ion exchange [1], [3]. The soda and carbon dioxide conversion is characterized by the following stoichiometric relationships correspondingly:



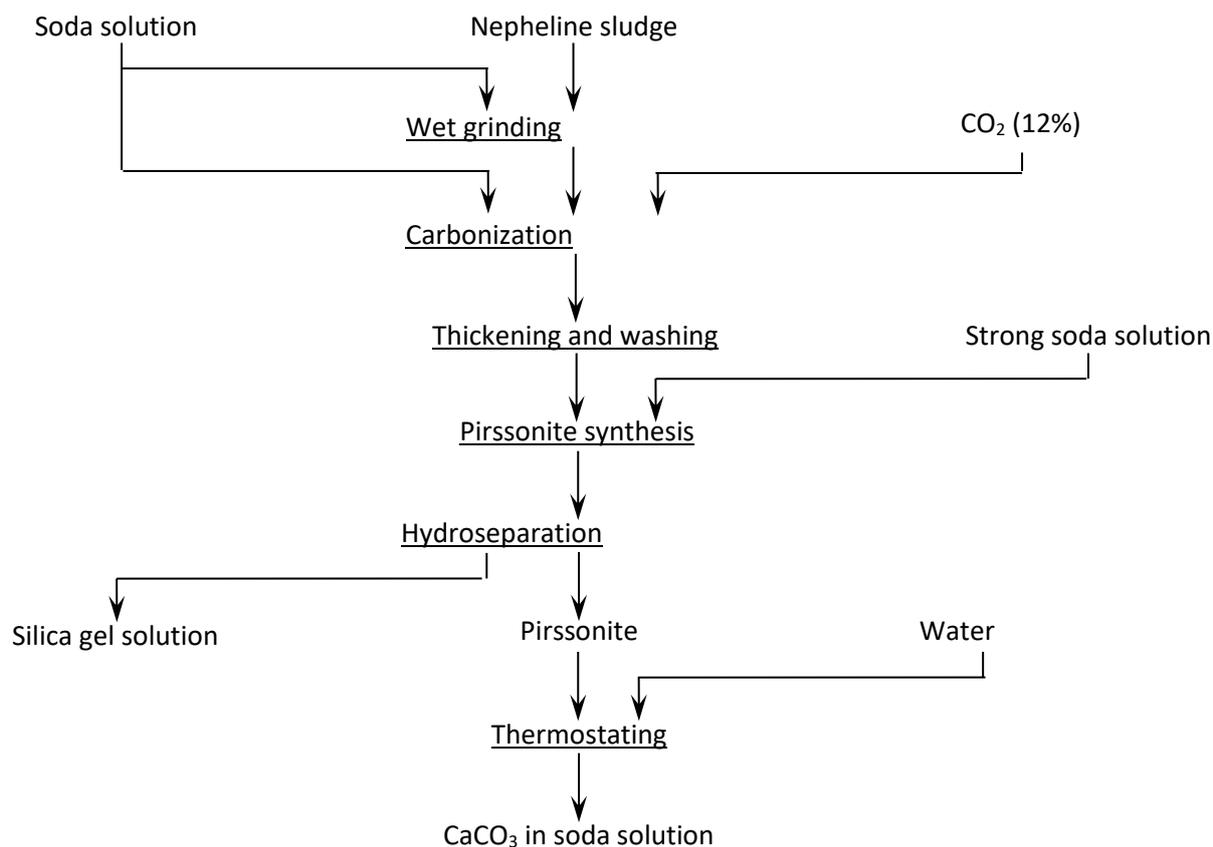
However, the suggested methods and technical solutions do not provide for the high degree of conversion (at the level of 30-45%), and they are aimed mostly at the preparation of one-component Portland cement mix. The above-mentioned justifies the necessity of carrying out the research, intended to reach the conversion degree of belit in the nepheline sludge composition of up to 95-100%, that will increase the efficiency and complexity of its processing and help to reduce the amount of carbon dioxide emissions.

### ***Experimental research***

To intensify the conversion process and reach the higher rates the experiment of the three-stage thermochemical nepheline sludge treatment has been performed, based on the transition to the region of pirssonite formation when using soda solutions with the concentration of Na<sub>2</sub>O more than 220 g/l according to the reaction:



The method choice is contingent on the fact that the key stage of the process of nepheline sludge decomposition and further use of the produced lime constituent in the alumina production technology depend on the separation of the silicon constituent. Therefore ‘the pirssonite transformation’ may be considered as the essential technological method in the sludge decomposition scheme. Such a transition of the silicon constituent into the form of double carbonate is carried out using Reaction 4. The experiment scheme is given in Picture 1.



Picture 1. The experiment scheme

The selection of technological parameters and methods of treatment is performed based on the analysis of the scientific-technical literature in the field of nepheline and sludge processing. To intensify the process of decomposition the scheme firstly suggests mechanical activation of the nepheline sludge particles in the ball mill. The balls and soda solution treatment causes disintegration of the sludge particles (and consequently, the increase of the reaction surface) and starts the process of its decomposition according to Reaction 1. The wet grinding was carried out using the L/S ratio = 1/3. After grinding the sludge size was equal to the sieve residue of 80  $\mu\text{m}$  – not more than 10%. The concentration of soda solution during grinding was 100-150 g/l  $\text{Na}_2\text{O}$ . After grinding the suspension was treated by the soda solution up to the in-pulp L/S ratio of 6-10 and sent for further carbonization at the temperature of 80-90  $^{\circ}\text{C}$  for 3-5 hours. The gas phase composition corresponded to 10-15 % of  $\text{CO}_2$  volume. The flow rate of the gas mixture was kept at the level of 2.0 l/min. At this stage the first pirssonite crystals are formed which subsequently act as the seeding in the pirssonite synthesis. For the separation of the silicon constituent at the second stage of the experiments the produced sludge, after the washing,

underwent additional treatment with strong soda solution with the concentration of 220-240 g/l  $\text{Na}_2\text{O}_y$  during 4-6 hours at L/S=4-6 and at the temperature of 70-90 °C. Due to this operation we may observe pirssonite synthesis in its stability range. After that, the obtained pulp was split using the laboratory vacuum filter, and the solid phase underwent washing.

The third stage of the experiment involved thermostatic control of the fixed residue in the water for the transition to the metastable range of pirssonite and its decomposition with the production of calcium and soda solution.

The material, obtained as a result of the experiment, was analyzed for inorganic carbon using the analyzer TOC-L. The calculated conversion degree amounted to 60-70 %. The results of the experimental research have shown the possibility in principle of their processing using the approach under consideration. An additional fact, proving that nepheline sludge conversion goes along with decomposition of pirssonite with the formation of calcium carbonate and alkali, is the result of titrimetric analysis of the filtered solution for total alkali that has shown the alkali concentration at 130-150 g/l.

### ***Conclusions***

The obtained results have shown the possibility in principle of nepheline sludge modification with the production of lime constituent. Further research should be aimed at analyzing the effect of the parameters of nepheline sludge mechanical-chemical activation, carbonization processes and pirssonite synthesis for reaching the conversion degree of nepheline sludge at the level of 95-100 %.

Meanwhile, this method will help not only to increase the efficiency of the comprehensive approach to processing the alumina-bearing raw material, but also to lower the environmental impact by decreasing limestone production by 1.5 million tons per year and decreasing carbon dioxide emissions approximately by 660 thousand tons per year having the annual production of alumina equal to 240 thousand tons.

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## **SECTION IV. Medical sciences**

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## **THE ROLE OF HEPATIC RENAL FAILURE IN THE SYNDROME OF PROLONGED COMPRESSION**

*Abstract.* The review is devoted to the study of the pathogenesis of hepatic renal failure in the syndrome of prolonged compression. The main attention is paid to the violation of the biochemical mechanisms of energy, protein and lipid metabolism in this type of pathology.

In peaceful conditions, the incidence of long-term crush syndrome with injuries ranges from 5.5% to 20%. Often, a type of crush syndrome is distinguished - a syndrome of positional compression, in which trauma to the muscle mass occurs when they are compressed by the weight of their own body against the background of a coma. The crush syndrome is characterized by a high mortality rate of up to 75%. In the clinical course of the syndrome, two phases are observed: shock with massive plasmorrhage and acute renal failure. There are three periods during its course: early, covering the first three days, intermediate, lasting up to 12 days, late, lasting up to two months or more. The early period is the period of hemodynamic disorders, characterized by blood thickening, hypotension, tachycardia, oliguria. In the early period of the syndrome of prolonged compression, 25–40% of victims show the first signs of the development of wound infection and a decrease in the body's immunological reactivity. The clinical picture of a purulent infection in

this case is characterized by a severe course due to the injury itself, often accompanied by tissue wounds, bone fractures and damage to the articular apparatus with pronounced edema of soft tissues and their necrotic changes. The intermediate period is a period of acute renal failure, characterized by an increase in hemodynamic disorders and oliguria up to anuria. The late period is the period of manifestations of local changes, characterized by limited skin necrosis at the site of compression, traumatic neuritis and muscle necrosis. At the same time, the experiment has shown that the components of loose connective tissue and the macrophage system actively respond already to 1-hour compression of the hind limb. On the 1st and especially on the 7th day after decompression, in the subcutaneous loose connective tissue and in the stroma of various organs (lung, heart, kidney), gross structural and functional changes in cells and intercellular substance are revealed, which partially regress by the 30th day. These changes include structural disorders of fibroblasts, changes in the number and degree of degranulation of mast cells, suppression of RNA synthesis in plasma cells and lymphoblasts, destruction of collagen, elastic and reticular fibers. The number of macrophages in the liver, lungs, spleen and lymph nodes decreases 1–7 days after decompression. In some organs, this effect lasts up to 20 days. With short-term compression of the limbs, a picture develops with less severe manifestations. The pathogenesis of crush syndrome is complex. Some authors believe that in the early period of crush syndrom, a complex of disorders characteristic of traumatic shock develops, and the shock develops even before decompression. Other authors (Kuzin M.I., 1959; Kruk I.N., 1974; Bywaters EGL, 1990;) believe that the picture of the early period of crush syndrome differs from shock by the peculiarity of the mechanism of injury due to the slower development of hemodynamic disorders and a change in excitation by inhibition, and also deep and long-term suppression of renal function (Peck SA, 1990). At the same time, experimental data have been accumulated indicating the leading role in the early period of crush syndrome of afferent pain impulses in the occurrence of pronounced disorders in the functional activity of the brain, characteristic of traumatic shock. It has been shown that in the compression period of crushing, a significant violation of the capacitive function of blood circulation develops, similar to the deep torpid phase of shock (Kovalev O.A. et al., 1980; Chernysheva G.A., Plotnikov M.B., Smolyakova V.I., et al. ., 2000). However, most researchers attribute the early period of crush syndrome to traumatic shock. In the pathogenesis of the early period of crush syndrome, the main links are the neuroreflex

influences prevailing in the initial period, leading to hemodynamic disorders, blood and plasma loss, as well as intoxication of the body with products of autolysis of ischemic tissues.

An important role in the pathogenesis of circulatory disorders characteristic of the early period of crush syndrome is played by disorders of central hemodynamics, which develop already in the compression period and rapidly progress after decompression. Mortality in this form of acute renal failure remains quite high and varies from 50% to 70%, and with the addition of multiple organ failure - up to 85–95%. Renal dysfunction is observed even in the compression period and is caused by prolonged spasm of the glomerular vessels of the kidneys. Uremic syndrome can develop as early as the first day after injury. So, in patients with crush syndrome, renal dysfunction is found in 47.8%, acute renal failure of moderate and severe severity in 27% (Grankin V.I., Khoroshilov S.I., 2005). Acute renal failure develops mainly 5-7 days after compression and its main causes are fatty embolism, thromboembolism of the glomerular vessels of the kidneys and destruction of the vessels of the glomerular system, the basement membrane of the kidney tubules by incoming endotoxins (Rudaev V.I., Krichevsky A.L., Galeev I.K., 1999; Sever MS, 2007).

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**THE STRUCTURE OF DISEASES OF THE MAXILLOFACIAL  
AREA LEADING TO THE OCCURRENCE OF A CASE  
OF TEMPORARY DISABILITY IN THE REPUBLIC  
OF DAGESTAN**

The analysis of diseases of the maxillofacial region, leading to the onset of a case of temporary disability in the Republic of Tatarstan over a 10-year period was carried out. The groups of diseases of the maxillofacial region, leading to limitation and / or disability of the adult population, have been established: inflammatory (odontogenic and non-odontogenic genesis), traumatic, benign and malignant lesions, secondary adentia of the jaw bones (complete or partial), as well as teething diseases.

The largest share in the structure of causes of temporary disability in patients of dental medical organizations was odontogenic inflammatory processes (66.1% of cases), in second place - injuries (13.9%), in third - secondary adentia of the jaws, observed in 7.4% of cases ... The analysis showed statistically significant differences in the structure of cases of temporary disability by nosological groups, depending on gender, age, and the year of observation.

**Introduction.** Examination of temporary disability is a type of medical activity aimed at assessing the patient's health, the quality and effectiveness of treatment, the ability to carry out professional activities, and determining the timing of temporary disability [1,2]. The examination of temporary incapacity for work is regulated by the orders: "On approval of the Procedure for issuing certificates of incapacity for work" No. 624n dated June 29, 2011; "On amendments to the procedure for issuing certificates of incapacity for work" No. 31n dated 24.01.2012; "On approval of the Procedure for the examination of temporary disability" No. 625n dated 08.23.2016; "On the introduction of a form for the registration of clinical and expert work in medical institutions" No. 154 dated 05.21.2002. Among nosologies with

temporary disability, diseases of the digestive system rank VI after the respiratory and circulatory organs, injuries and poisoning, the musculoskeletal system [2,3]. A dental medical organization is a type of medical institution in which primary, including pre-medical, medical, specialized, medical and sanitary care is provided and medical services are performed in accordance with the list of order of the Ministry of Health of Russia No. 121n of 2013. (as amended on 13.06.2017) [4]. When analyzing the special literature available to us, we did not reveal information about the comparative characteristics of diseases of the maxillofacial region, leading to the onset of a case of temporary disability in dental medical organizations.

**Purpose of the study.** To conduct a comparative analysis of cases of temporary disability in diseases of the maxillofacial region in the Republic of Dagestan.

**Material and research methods:** The source of information was the cases of temporary disability established by dental medical organizations of the Republic of Dagestan (analysis of accounting and reporting forms 16-VN, 036 / y, 035 / y, 043 / y for the period 2007-2016). The analysis of the obtained data was carried out using the Microsoft Excel application package, version 2010 for Windows 8.0 (statistical data were used: M-sample mean, m-error of the arithmetic mean).

**The results obtained:** Statistical analysis was carried out by the method of a sample population, in which, based on mathematical calculations, the number was 5204 cases. Moreover, the largest number of cases of temporary disability due to dental diseases was noted in 2013 (904 cases), the smallest - in 2009 (253 cases). Age ranged from 15 to 87 years, with a median of 36 years (Q1-Q3: 26-48 years). The analysis showed statistically significant differences in the structure of cases of temporary disability by nosological groups, depending on gender, age, and the year of observation.

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## **SECTION V. Pharmacology, pharmacy**

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### **PRACTICE-ORIENTED APPROACH TO THE DEVELOPMENT OF EXPERTISE IN THE HIGHER PHARMACEUTICAL EDUCATION**

**Abstract.** Despite the significance of the practice-oriented training in the higher pharmaceutical education, its technologies, content, and forms continue to stay at the stage of theoretical and methodical development. *The purpose of the work* – development and implementation of an electronic teaching and learning package based on the practice-oriented educational technologies in the Pharmaceutical Marketing course for students specializing in Pharmacy (specialist's degree program) in Russia. *Materials and methods.* Teaching and learning package, additional electronic teaching materials, interactive educational computer technologies for the Pharmaceutical Marketing fourth-year students. Sechenov University Unified Educational

Portal (UEP) was used. *Results and discussion.* We have developed and implemented in the educational process a new teaching and learning package, including the work program, video lectures, explanatory videos, the electronic student training manual, electronic manuals for teachers, and additional educational materials for the computer-class work. *Conclusion.* Implementation of the new electronic teaching and learning package in the educational process helps to speed up and enhance the development of the students' expertise, to improve their results in the course and in the final scientific research works, and to train competitive specialists, adjusted to the modern working environment.

**Key words:** higher pharmaceutical education, practice-oriented approach, expertise, teaching and learning package

The current stage of modernization of the higher pharmaceutical education, allowing to train the highest-class specialists, includes the enforcement of the applicative and practical character of professional education, and its compliance with the requirements of the medicine, science and social life. Despite the significance of the practice-oriented training for the modern professional education, its content and forms continue to stay at the stage of theoretical and methodical development [1-4]. According to the activity and expertise paradigm the practice-oriented education is aimed at acquiring not only knowledge, abilities, and skills but also practical experience for the purpose of obtaining professional and socially significant expertise. The traditional teaching triad 'knowledge – abilities – skills' is complemented by a new teaching unit: knowledge – abilities – skills – expertise.

Training of students specializing in Pharmacy (specialist's degree program) in Russia is based on expertise [5]. It includes such forms of professional activity as pharmacy, expert analytics, organization and management, control and authorization, and production and scientific research.

Pharmaceutical marketing is currently one of the most important courses for developing expertise in the higher pharmaceutical education [6, 7]. The implementation of the new educational standard [5] caused a necessity to place emphasis on the principles of dialogism and practice orientation when organizing the education of students-pharmacists and preparing the content of the course. It will allow the future graduates to master the following skills: working in a group; skill of dialogic communication; being tolerant of social, ethnical, confessional, and cultural differences; defining the problem in a situation; choosing the optimal solution; forecasting and analyzing the results; making management decisions on improving the performance of a

pharmaceutical organization or its business unit. Development of the above-mentioned skills complies with the criteria for the expertise of the graduates who have finished the specialist's degree program.

***The purpose of the work*** – development and implementation of an electronic teaching and learning package based on the practice-oriented educational technologies in the Pharmaceutical Marketing course for students specializing in Pharmacy (specialist's degree program) in Russia.

***Materials and methods.*** Teaching and learning package, additional electronic teaching materials, interactive educational computer technologies, i.e. business games, creative tasks, case-technologies, a pharmaceutical marketing focus group for the fourth-year students specializing in Pharmacy. Sechenov University Unified Educational Portal (UEP) was used.

***Results and discussion.*** Introduction of an electronic teaching and learning package within the framework of the practice-oriented approach to the development of the Pharmacy students' expertise implied close attention to detail, and, if necessary, the development of particular electronic teaching and learning materials. The work program on the Pharmaceutical marketing course for the students has had a clear structure, involved precise terms, and strictly complied with the tasks of developing expertise. It has been structured in such a way so that students could acquire all the necessary knowledge, abilities, and skills, as well as the maximum possible expertise. The new teaching and learning package has also included video lectures; an electronic student training manual with methodological and teaching recommendations on the educational process organization for each practice class, and on the students' individual work; electronic guidance materials for teachers on each section of the course; requirements for carrying out different types of testing control on the UEP and for testing the practical skills; and the list of the UEP education tools with the operating procedures.

In addition to the teaching and learning package we have created explanatory videos (20-30 minutes for each topic). Their role was to introduce the problems of the topic to a student with the minimum time expenses, to go through the approximate steps of doing the homework, and to minimize the time of explaining by the teacher the methods of performing the student's individual work in the practice class.

The work program, which is the basis of the teaching and learning package, has been complemented by new practical studies: 'The analysis of the marketing macroenvironment of a pharmaceutical organization: STEP-analysis', 'The analysis of the immediate community of a

pharmaceutical organization's microenvironment, i.e. the customers', 'Interaction between the external and internal environment of a pharmaceutical organization: SWOT-analysis', and 'Evaluation of pharmaceutical organization's competitive ability (quantitative method)'. Electronic teacher manuals have been developed to hold these classes. The new work program emphasizes special aspects of marketing analysis of pharmaceutical organizations:

- it explores more closely the questions regarding the pharmaceutical products' sales scheme;
- it considers in more detail the assortment policy (ABC-analysis, XYZ-analysis, VEN-analysis, assortment width, completeness and depth analysis, etc);
- it shows the necessity of performing the comparative analysis of medical products presented by the pharmaceutical organization and the analogue products for the purpose of determination of the competitive advantages and disadvantages of the new products;
- it emphasizes the exposure of needs and demand to the effect of macroeconomic business environment and seasonality.

The application of the interactive educational computer technologies in pharmaceutical marketing involved the introduction of relevant changes in the development of the educational materials using scientific, information and reference literature and regulatory documentation. We have developed the teaching and learning materials for students for the computer class activities, including a workbook, a reference case solution, the individual work options, and an electronic database on all the educational topics. We have also organized the students' work with the information computer databases online.

Using computer technologies we have developed and implemented in the educational process *business games* on the topics of 'Positioning of a pharmaceutical organization' and 'Evaluation of pharmaceutical organization's competitive ability (quantitative method)'. *Creative activities* have included the individual students' work on the topics of 'Office application software. The rules of the effective presentation of a pharmaceutical product. Internet technologies in pharmaceutical marketing and medicine provision'. *Case technologies* have provided the basis for the following classes: 'Marketing management of product sales', 'Pharmaceutical product segmentation', 'Pricing principles in the pharmaceutical market. The key factors affecting decision-making in pricing'. With the use of an interactive technology '*focus group*' we have developed practical activities on the topics of 'Methods used in marketing analysis of pharmaceutical organizations', 'The analysis of

the marketing macroenvironment of a pharmaceutical organization: STEP-analysis', and 'Interaction between the external and internal environment of a pharmaceutical organization: SWOT-analysis'.

We have also revised and updated the tests (for the admission, formative, current, and final control), cases, and complex activities testing practical skills in certain courses.

All tests were required to be carried out in the testing system on the UEP that provided the computer-aided process of individual testing of the students, computer-aided processing of the results, and storage of the testing results in the network log on the UEP.

**Conclusion.** The results of the development and implementation in the educational process of an electronic teaching and learning package based on the practice-oriented educational technologies (business games, creative activities, case technologies, and a focus group) in the Pharmaceutical Marketing course for students specializing in Pharmacy (specialist's degree program) have shown that application of the new technologies and materials enables the students to make decisions quickly, develops the skills of constructive and critical appraisal of other people's opinions, develops the skill of individual decision-making based on the group analysis of the situation, and develops the ability and readiness for the self-improvement and professional growth based on the analysis of their own and other people's mistakes drawing on the given feedback. All of this, finally, helps to develop the students' expertise better and faster; to improve their results (the average point is 4.7 on a one to five scale), it particularly applies to the final scientific research works (the average point is 5.0 on a one to five scale); and to train competitive specialists adjusted to the modern working environment.

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## **SECTION VI. Economics**

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### **HUMAN CAPITAL AS THE KEY FACTOR OF REGIONAL DEVELOPMENT**

Nowadays one of the worldwide trends is regionalization of social and economic processes. Regulation of these processes has increasingly been a prerogative of territorial authorities. The economic realities of the Russian Federation are not an exception. Meanwhile, the expenses of the regional budgets on the national economy, social policy, sociocultural sphere, and general maintenance of the economic stability have constantly been increasing. The regional funding goes to the public utilities, general schools, secondary specialized education and higher education institutions, partially, public health facilities, environmental protection, roads, and etc. The important fact is also that the bulk of modern Russia's GDP accounts for the regional enterprises and small and medium-sized businesses. Thus, in Russia's modern economics a region must be the main unit of the economic activities. Some researchers consider a region as the integral system with its own structure, functions, relations with the environment, history, cultural achievements, and the people's living conditions. For convenience, the structure of the regional social and economic potential may be expressed in the following way:

- territorial and geographic potential;
- nature-resource potential;
- material and technical, and production potential;
- sociocultural potential;
- financial and tax potential;
- scientific innovative, and investment potential;
- human development.

Regional human capital is the total of the territorial human resources, possessing a certain set of creative and consumer (psychophysiological, spiritual, intellectual, educational, qualification, professional, production, and creative) qualities and abilities, and

attitudes towards the use, consumption, and disposition of these qualities, which provide the social and economic as well as innovative development of the reproduction processes in the region.

The development of the human capital of a region may be characterized, firstly, by the acceptable living conditions, secondly, by the quality of life, and, thirdly, by the sufficient demographic development indexes. Regional human capital directly affects the reproduction processes and territorial social and economic potential by supporting the production processes as well as the effectiveness of the sociocultural sphere and innovative activities. Therefore, the key factor of the social and economic attractiveness is the development of the human capital of the region, meeting the needs of the modern community. For measuring the human capital of a region it would be reasonable to use the Human Development Index, introduced by the UN experts for the purpose of assessment of the achievements in the field of basic human development. It should be mentioned that Russia originally used the term '*Human potential development index*'. In 2013 in the scientific field '*the human potential development*' was substituted by '*the human development*'. Whereas the replacement took place in 2013 in Russia, the previous method was still applicable. The Human Potential Development Index used before was substituted by the Human Development along with keeping the previous calculation method in action under the UN Development Program. The point of this Index calculation method is in using three indicators: 1. Proposed life duration. 2. Educational level. 3. Gross Domestic Product (GDP) per capita.

The approach to the human capital assessment is better developed and tested at the level of a firm. One of the most known and effective variants of the application of the human capital at the corporation level is a system called '*Human resources analysis (HRA)*' (E. Flamholtz, 1960s). It is considered that this concept helps to use and assess the application of an organization's human resources more efficiently. E. Flamholtz relates the main tasks of HRA, firstly, to the information required for decision-making in the human resource management; secondly, to the quantitative methods of the human resources value assessment, and thirdly, to the views on employees as the assets that need to be optimized. In a general form the '*Human resources analysis*' may be represented as a process: determination – evaluation – submitting the information about the labor (human) resources to the organization's managers. However, the concept enables applying the '*Human resources analysis*' at the level of regions as well. At the regional level these tasks

(the ‘*Human resources analysis*’) can be used in the social and economic policies by the administration of a subject of the Russian Federation.

The goals and tasks of region management may be all reduced to sustainable use and reproduction of resources, providing for the high level of the economic development, creating favorable conditions, and allowing for the high quality of people’s life. Regional human capital management resolves itself to the directive actions of the management subjects towards the development of the human capital elements. The actions provide for the social and economic development of a territory at the meso and micro levels. Thus, being an essential component of the social and economic potential of a region, human capital has a direct effect on the regional reproduction processes, the formation of budgets of different levels, the structural changes in regional economy, the growth of the quantitative indicators of production efficiency and social field, the innovation programs, and the level and quality of life.

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**SHARING ECONOMY AS A NEW SOCIO-ECONOMIC  
PHENOMENON**

**Abstract.** The relevance of the article is due primarily to the change of the economic paradigm in general and the formation of a new business model, which is rapidly spreading on the international market. This publication considers the trajectory of the sharing economy, separately considered the advantages and disadvantages of the sharing economy.

**Key words:** co-consumption economy, sharing, sharing economy

Today, one of the large-scale trends in the modern world is the so-called "sharing economy" (sharing economy), which is an economic model based on the exchange, trade and lease of products, works and services, and allows you to gain access to certain property, while not possessing it. The phenomenon of the economy of shared consumption

has been developing for more than a decade and today affects most areas of everyday life, changing the methods of transportation (Uber, BlaBlaCar, Delimobil), living conditions in travel (Airbnb) [1], ways of entertainment (Netflix, Youtube), performing tasks( TaskRabbit), financing (Kickstarter) , etc.

It is important to understand that the sharing economy is based on human interaction and interpersonal trust, which, in turn, are of enormous importance, and its high degree of differentiation requires the same differentiated approach to management and regulation [2]. Today, the economy of shared consumption is a socially useful business model, since it carries the implementation of three socially significant effects: economic, environmental and social.

The economy of shared consumption and its principles suggest the possibility of rapid entry into the international market and integration in new regions. So, having started their way of sharing with small local initiatives, many companies have already become known all over the world. Promoting more sustainable and promising forms of shared consumption and exploiting its benefits while bypassing the pitfalls of a shared economy is becoming increasingly important in an era of COVID-19 and the climate crisis, economic uncertainty, and loss of social cohesion, especially in an anonymous urban environment.

Table 1 describes the advantages and disadvantages of a shared consumption economy.

It is important to note that the prospects for the growth of the international economy of shared consumption are extremely broad, partly because in many regions it is currently an innovative method of saving resources, rather than the usual business model. Speaking of ubiquity, it is worth mentioning that the statistics provide a projected distribution of the revenue of sharing service providers in 2022 by region [3], which is shown in Figure 1.

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Table 1 -Advantages and disadvantages of the sharing economy

<i>Advantages of the sharing economy</i>	<i>Disadvantages of the sharing economy</i>
Unused resources can be reallocated more efficiently	May reduce sales at existing traditional businesses
Sharing economy promotes Social engagement in Online Communities	Participants in the sharing economy do not take into account certain benefits, such as paid leave, sick leave, and bonuses, which are usually part of full-time employment.
Environmentally friendly, there is no need for overproduction (pollution), unused capacity can be used in a more beneficial way	
Reduced unemployment, people can work online from home on their own terms and with a more flexible work schedule	Governments lose revenue because many sharing areas are tax-free
Creates a new business that is funded by crowdfunding, commercial and non-profit organizations	Exchange services are still susceptible to fraud or aphorism

*Source:* Compiled by the author based on Codagnone C., Karatzogianni A., Matthews J., (2019.) Platform Economics: Rhetoric and Reality in the "Sharing Economy". Bingley, UK: Emerald Publishing.

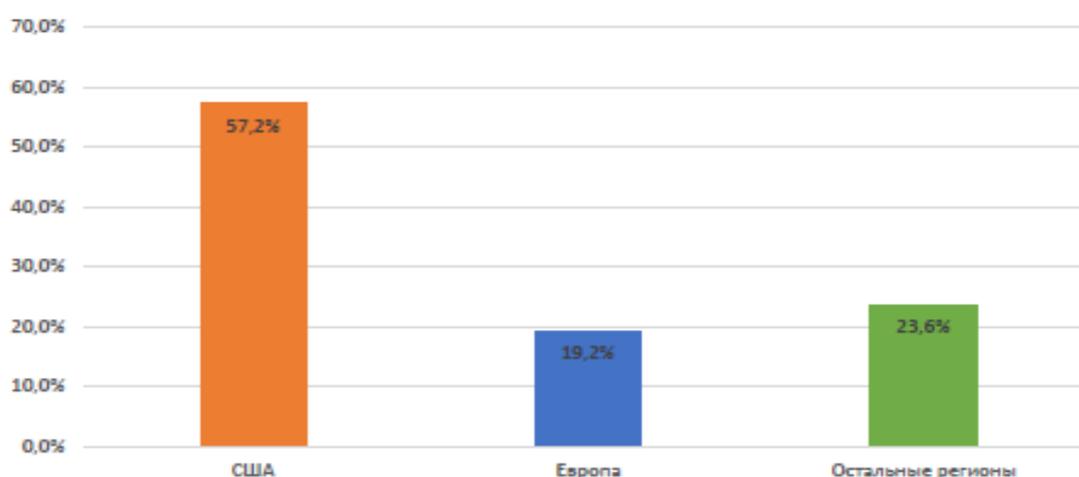


Figure 1. Distribution of income of the sharing economy in 2022 by region

*Source:* compiled by the author based on Statista (2020). Revenue distribution in the sharing economy worldwide in 2022, by region, [Electronic resource] – Electron. dan. - Access mode: <https://www.statista.com/statistics/878907/sharing-economy-revenue-shareregion/> (accessed 15.03.2021).

The United States, as the home of the sharing economy, still expects consistently high growth due to its democratic structure of society and loyal attitude to innovation in various fields, as well as due to the localization of most of the giants of sharing in this country. Europe predicts the smallest growth in this comparison, since most of the companies operating in this region originate from the United States, and the market is already quite saturated and no mass emergence of new enterprises is expected. The remaining regions are projected to successfully start or continue to spread the ideas of the shared consumption economy.

In 2020, the rapid growth of the economy of shared consumption was threatened by the wave of lockdowns caused by the global COVID-19 pandemic, because many consumers were forced to abandon this model of economic relations, often involving direct contact with the service provider. Popular companies such as Uber, Airbnb, bike rental and various coworking spaces that are so used to being an integral part of urban life, urgently made adjustments and created new strategies to make their customers feel safe. People wanted to maintain self-isolation, avoid public places and urban transport, so sharing offered his solutions [4].

It turns out that the experts who initially rushed to bury the sharing against the background of the development of the coronavirus, hurried: not all directions sank, and the fear of infection even spurred interest in some segments of the economy of shared consumption.

The research and consulting company Gartner conducted a study in June 2020 [5] and identified some trends in economics and management caused by the COVID-19 pandemic, among the most relevant for the economy of shared consumption are the following:

1. Increase remote work.
2. The growth of the temporary labor force.
3. Expanding the role of the employer as a social protection system.
4. Inhumane attitude towards employees.
5. Transition from efficiency to sustainability.

From the above, we can conclude that, despite the losses that many sharing services continue to incur due to the pandemic, business models based on shared consumption are still relevant and have broad prospects for growth in international business.

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the national economy after the consequences of the pandemic, taking into account real imperatives and digital technologies».

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## **SECTION VII. Philosophy of Science**

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### **ON THE QUESTION OF THE ANCIENT INDIAN FIVE-TERM SYLLOGISM AND THE PYTHAGOREAN SYSTEM OF PROOFS**

The development of information technologies determines the enhancement of the methods of creation of multilayer computer systems. In this case system designers are required to create more explicit reasoning architecture since logic bugs may lead to the system failures and collapse of business activity for the users and the countries in general. It appears that in order to prevent such a scenario (apart from the development of the ethical level of computer system designers) the logical apparatus of the system designers should be improved, and greater attention should be paid to improvement of rational thinking. Therefore, in our opinion, in the modern environment we should appeal to the origins of building logical arguments and include the basic principles in the system designer training course.

During the research of the status of the topic of the establishment of the system of proofs and the basic rationality algorithms in Ancient India in comparison with the ancient world system of proofs (mostly, Ancient Greece) we ascertained that those questions have been examined in considerable detail. Among the researchers we may name E. P. Elsukova, E. L. Zabolotnyh, N. A. Kanaeva, O. V. Malyukova, O. O. Rozenberg, M. T. Stepanyants, V. K. Shokhin, F. I. Shcherbatsky, G. Brendan, A. Chakrabarti, J. A. Ganery, B. L. Waerden, R. Weber and others). In the examined works the researchers introduce similar positions of the proof development logic in the two ancient cultures. The idea of Eastern origins (Babylon, Egypt) of Pythagoras's proof is supported, not the ones of Ancient India. Although, B. L. Waerden noticed the similarity between a number of religious and worldview positions of Pythagoras and ancient Indian philosophers [1, p. 51] and favored the idea of hypothetical Pythagoras's trip to India. The last one gives an opportunity of searching for the origins of the Pythagorean system of proofs within the ancient Indian tradition of reasoning also. And the research carried out by T. I. Voloshin helped to make a

conclusion stating certain equivalence between the ancient Indian basics of the five-term syllogism and Pythagoras's system of a mathematical proof.

In the comparative historical context the conventional scientific opinion states that the five-term syllogism, established in Ancient India, i.e. the Nyaya syllogism, is compared to Aristotle's syllogism, however, the works analyzed by us did not include any comparison of the origins of the ancient Indian five-term syllogism and the system of proofs that had worked before Aristotle (i.e. the system of Pythagoras). Nevertheless, we suppose that such comparison is reasonable. This gives grounds for the earlier age determination of the existence of the five-term proof structure in the ancient Greek system of proofs.

In consideration of the above-mentioned it may be revealed that there is a contradiction between the existence of a significant file of research regarding the history of establishment of the traditional ancient Indian five-term system of proofs, the syllogism of the ancient Greek scientists, the comparison of the last-mentioned and the unaddressed connection between the earlier origins of the ancient Indian system of proofs and the system of proofs having existed before Aristotle (in particular, the Pythagoras's logic of a mathematical proof). Therefore, the problem for our research is finding the equivalence between the logic of developing the basics of the ancient Indian five-term syllogism and Pythagorean system of a mathematical proof.

As the hypothesis we have made an assumption that the logic of building a five-term syllogism, the ancient Indian origins of which (according to Shokhin) go back to the first half of the first millennium B.C. [2, p. 46] (according to Kanaeva – the origins are dated VIII-VII centuries B.C. [3, p. 17] and the Pythagorean system of a mathematical proof are equivalent to some extent.

The framework of the ancient Indian syllogism has been analyzed on the basis of the *Shatapatha Brahmana* translated by V.K. Shokhin [2]. The Pythagorean system of proofs has been analyzed based on the book VII of Euclid's *Beginnings* (which B. L. Waerden relates to Pythagoreans [4, p. 161], but the basis may be referred to Pythagoras himself) as translated by D.D. Morduhay-Boltovskoy [5]. The novelty of the research is that for the first time a conclusion has been proposed that states the equivalence between the reasoning of the basics of the ancient Indian five-term syllogism and Pythagoras's system of a mathematical proof (T. I. Voloshin). In the aspect of the significance of the research we could not agree more with E. L. Zabolotnyh maintaining that '*the analysis of the logical ideas included in the works of ancient*

*authors may provide incentives for the development of the modern logic'* [3, p. 309].

It is worthy of note that, generally, researchers cannot agree with an idea stating the existence of theoretical thought and the system of proofs in Ancient India, emphasizing the mystical and religious context of the ancient Indian reasoning. In fact, Ancient India of the first millennium B.C. (as well as before and after the period, actually) was an admixture of religions. Nonetheless, it was also the time of substantiating rituals (the proposed idea should have been proved to a person before he/she agreed with it) and the time of development of different types of argumentation (identification, magical, and associative argumentation, myth as argument, negative precedent as argument, and common sense as argument [6, p. 43]).

The scientists, who study the ancient Indian knowledge system specifically, state that it is exactly where reasoning originates from. Thus, A. Kanaeva notes that the concept of knowledge was introduced in the ancient philosophy much later than in India [3, p. 16]. Moreover, in Ancient India it was as early as VIII-VII centuries B.C. when knowledge started to differentiate, and one of its types was based on conclusions. According to V.K. Shokhin, the first half of the first millennium B.C. celebrated introduction of the basics of the five-term (syllogistic) system of proofs. Shokhin suggests the following structure of the system: a thesis, an argument, an implied example, an implied application, a conclusion [2, p. 46]. That structure of proofs was found by the researcher based on the controversy between two schools of ritual studies regarding the identification of the sacrifice object of the shehnai (from the *Shatapatha Brahmana*). *'In this essentially semantic rather than ritual-science discussion the argumentation of Indra followers already implicitly includes all parts of the five-term traditional Indian syllogism: 1) a thesis – 'May them sacrifice... to him as to 'Indra'; an argument – 'Indra had [he] been before he killed Vritra, and Indra is he now, having killed Vritra'; 3) an implied example – 'As a king remains a king both before and after a victory'; 4) an implied application – 'And the same is here'; 5) a conclusion – 'Thus, may them sacrifice as to 'Indra''* [2, p. 46].

It is obvious now that in Ancient India, before the introduction of the ancient system of thesis proof, the system of proof had already been developing into a logical sequence, particularly, with the five-term syllogism basis.

It is an interesting fact that the conditions in Ancient India and in Ancient Greece of the first half of the first millennium were alike with

regard to the system of proof. For instance, in Pythagoras's religious doctrine, called mathematics, it was required that statements claiming to be true had been proved. The task was to insure the truth of a thought so that a person thinking about numbers and figures could learn all their essence, and so that after he had learned the truth and focused on it, he could comprehend the realms different from our ordinary world. Previously, focusing on certain objects or ideas had been typical for ancient Indian religions and practices. The final goal was to turn the attention of a soul (person's self, or his personality) from the earthly realm to the realms of Brahman. While Pythagoras used numbers and figures, and by the means of mathematical exercises he reached '*the preliminary preparation of the soul eyes for the transition from all corporeal to all that truly exists*' [7].

But how can we know the essence of a geometrical figure? We need to learn all of its characteristics. Besides, the characteristics being learned should be true, i.e. actually existing.

Unfortunately, Pythagoras's written works did not survive from that time (although, Diogenes Laertius names a couple of works, written by Pythagoras [8]). However, we shall refer to the stance of B. L. Waerden, who numbers book VII of Euclid's *Beginnings* among the works of Pythagoreans (as well as books VIII-IX) [4, pp. 150, 154, 161]. Since initially the basis of Pythagoreans' theory was represented by Pythagoras's own thought, it is quite probable that certain ideas expressed in book VII of *Beginnings* may be related to Pythagoras, and the algorithm of proof, in particular. Moreover, B. L. Waerden points directly at the existence of a mathematical proof by using a syllogism [4, p. 160]. As the example of the five-term structure of a proof we shall mention Suggestion 23 of book VII of *Beginnings*.

1. Thesis: '*If two numbers are the first between themselves, then a number measuring one of them will be the first with the one remaining. Let there be two numbers, the first between themselves, A and B, and let some number C measure A; I maintain that C and B will also be the first between themselves*' [5]. 2. Argument (a negative one because the impossibility of a thesis will be shown): '*In fact, if C and B are not the first between themselves, then [some] number will measure C and B*' [5]. 3. Implied example: '*Let it measure and be D*' [5]. 4. Implied application: '*Since D measures C, and C measures A, then D measures A as well. It also measures B; it means that D measures A and B which are the first between themselves; but it is impossible. Thus, no number will measure numbers C and B*' [5]. 5. Conclusion:

*‘Consequently, C and B will be the first between themselves, which was to be proved’ [5].*

Obviously, the thesis was proved using the five-term structure. Such algorithm of proving the truth of a mathematical thesis focuses the attention on the mathematical problem itself and takes it (the attention) out of the ordinary world.

In general, Pythagoras found numbers and figures attractive (in terms of attention focusing) for two reasons. Firstly, they allowed to turn a thought from the material to the immaterial realm (since a number can, on the one hand, describe real objects, and on the other hand, a number is an abstract concept that helps to cast aside its connection with an object and consider the number itself as a certain substance. Secondly, thoughts about numbers, particularly, when assured by a proof, finally helped to understand the laws that rule the world. Both of the above-mentioned reasons corresponded to the purpose of learning the truth which was promoted in Ancient India also as a way to leave the infinite cycle of Samsara, since it was the true knowledge that was the guarantee of the future liberation [3, p. 211].

If we extrapolate this conclusion on the goals and results of the current scientific research, then it appears that only true knowledge and conclusions, based on actual regularities, solve the problems in view and provide science with an opportunity to go forward.

Thus, modern scientific knowledge should be based on the strict algorithm of proofs. The origins of this approach may be traced back to the most ancient times. There are a lot of works devoted to the development of the system of proofs, particularly, in Ancient India and in Ancient Greece. The majority of scientific research works regarding the development of the logic of proofs and reasoning suggest the following conclusion: the ancient school of thought adopted the Eastern thesis (theorem) but not the algorithm of proofs. Indologists, in their turn, hold to another view and substantiate that reasoning had existed in Ancient India long before the development of such knowledge and algorithms of proof in Ancient Greece. Based on that and considering the possible Pythagoras’s trip to India, we suggested a hypothesis that the logic of building a five-term syllogism, the ancient Indian origins of which go back to the first half of the first millennium B.C. and the Pythagorean system of a mathematical proof are similar to some extent. The article shows the validity of the hypothesis. This gives grounds for the earlier age determination of the existence of the five-term proof structure in Ancient Greece (before Aristotle). At the same time, we

understand that there may be other correlations as well that require an independent research.

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## **SECTION VIII. Philology**

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### **LANGUAGE AS AN IDENTIFYING FEATURE OF AN ETHNIC COMMUNITY**

Modern mankind is a huge variety of different communities, a special place among which, both in terms of their importance in culture and stability in history, is occupied by communities that are called ethnic groups in scientific literature. The term "ethnos" itself has been used in ethnological literature for quite a long time, but its scientific understanding as a concept to denote a special community of people has occurred, in essence, only in recent decades as a result of an increase in interest in the problems of ethnogenesis and ethnic theory, in all ethnic processes in general.

A significant contribution to the development of the theory of ethnos in the 1920s was made by the Russian ethnographer S.M. Shirokogorov. In his opinion, being a form of development and existence of mankind, an ethnos is a group of people speaking the same language, recognizing their common origin, possessing a complex of customs, way of life, preserved and sanctified by tradition and distinguishing it from those of other groups [1, p.13].

An interesting point of view regarding the definition of "ethnos" is given by the German ethnologist Karl R. Wernhart [2: 177], who believed that "ethnos" is the central concept of anthropological disciplines. As he claims, ethnos is a delimiter, the variations of which range from the smallest local group to the tribe and nationality. Ethnicity is inseparable from people, as it has cultural characteristics. Ethnos represents a community that does not separate culture and man, since they are in a single functional structure.

Science has long recognized the concept of "ethnos" developed by Yu.V. Bromley, who paid special attention to the study of the peculiarities of psychology of various nations' representatives. Ethnos, in his opinion, is a stable set of people historically formed in a certain territory, possessing common, relatively stable features of language, culture and psyche, as well as the consciousness of their unity and

difference from other similar formations (self-consciousness), fixed in a self-name [3: 26].

The language, at least of everyday consciousness, at the level of the autostereotype of an ethnos and ideas about a given ethnos among its neighbors, is in the vast majority of cases the most important, previously named attribute and determinant of an ethnos. There is no doubt that a certain linguistic community, along with a common territory and culture, is a necessary condition for the formation of an ethnic group [4, p.30]. However, in the modern world, an unambiguous correspondence between ethnos and language is not so common. There are large groups of ethnic communities that speak one widely spoken language - English, German, French, etc. For some individual ethnic groups, two- and sometimes trilingualism is characteristic (for example, for the Luxembourgers). There are ethnic groups, one part of which speaks one language, and the other - in another, but at the same time there is always a third part speaking both languages (Irish, Bretons, and Eskimos). Nevertheless, each living language almost always corresponds to one ethnic group. In rare cases, it is not an independent ethnos, but an ethnic group within a larger ethnos, but a group that in the past was a special nationality or tribe (Svans among Georgians, Moksha among Mordovians, etc.) [4, p.31]. In this regard, there are fewer languages in the world than ethnic groups.

In modern science, various types of classifications of ethnic groups are distinguished, but of all the diversity, in our opinion, the most important is the linguistic classification, since it gives the most concrete idea of the ethnic kinship of the respective peoples, of the common sources of origin of a particular culture. In all any more or less complete ethnic surveys of the globe, peoples, as a rule, are grouped according to the principle of linguistic belonging.

The linguistic panorama of the modern world is rich and complex. Scientists know about 6,000 languages spoken by various ethnic communities and groups.

Studies of linguists in the field of kinship of certain languages are important as indicators of the proximity of cultures and, accordingly, peoples speaking these languages. Usually, when classifying the languages of the peoples of the world in order to restore their genetic relationship, the following main categories are used: dialect, dialect, language, group of related languages, language family. At the same time, the kinship of languages can also mean kinship by origin.

The main units of linguistic classification are language families that arose in the development process from the base language. But, as

you know, language is a historically developing and time-changing phenomenon, as a result of which languages related in origin may not only differ from each other, but also lack a number of features that characterize their language system as a whole. In this regard, languages are classified not according to their current state, but according to the principle of historical genetic relationship.

The language classification is based on the principle of mutual understanding between people belonging to the same ethnic group. But one should also take into account people's awareness of their cultural and linguistic closeness with other peoples and ethnic groups. In the linguistic classification, this is described by the concept of "a group of related languages". For example, all peoples who speak the languages of the Slavic group of the Indo-European language family are aware of the similar kinship of their languages, even if they do not understand each other in communication. In addition, in the linguistic classification, ethnology takes into account the relationship between languages and cultures of a more distant type, denoted by linguists by the concept of "linguistic family". In total, 12 such language families are distinguished in modern science, covering about 96% of the world's languages.

One of the most common language families is Indo-European, which includes all Slavic languages, Baltic, Germanic, Celtic, Roman, Iranian, Indo-Aryan languages, which speaks of the kinship and unity of the origin of these peoples.

So, when forming the ethnic picture of the world, the linguistic classification takes into account the strict linguistic kinship between peoples and the ethnic originality of each of them, the ethnological meaning of which is that peoples belonging to the same linguistic family usually have common elements in their material and spiritual culture.

A. Potebnya defines language as an ethnodifferentiating and ethnoforming feature of any ethnic community. As he believes, the only sign by which we recognize the people and, at the same time, the only irreplaceable and indispensable condition for the existence of the people is the unity of the language. Proceeding from the fact that every nation formulates thought through its national language, in a different way from others, A. Potebnya comes to the most important conclusion that the loss of its language by a people is tantamount to its nationalization. It is in the language that he sees the main factor contributing to the unification of people in the "nationality". At the same time, he emphasized that for him "nationality" is not the ethnos itself, but ethnic identity, a sense of community based on everything that distinguishes one people from

another, constituting its originality, first of all, on the basis of the unity of the language [5].

Thus, language is one of the most specific features of any ethnic community. It can be viewed in two ways: in the direction "inward" - then it acts as the main factor of ethnic integration; and in the direction "outside" - in this case, language is the main ethnodifferentiating feature of an ethnos. The performance of the language of a differentiating function for a given ethnic group inevitably presupposes its certain linguistic community: the differentiating function of the language contributes to the performance of the function of an intra-ethnic association by the language. The integrating and differentiating ethnic properties of language represent a dialectical unity: dialectically combining two opposite functions, language is a tool for the self-preservation of an ethnos and at the same time separating it from other ethnic cultures.

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## SECTION IX. Educational Sciences

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### **CREATIVITY OF STUDENTS: ORIGIN, PECULIARITIES, METHODS OF ELABORATION**

Innovative changes in the economy, increasing volume of information, the growing tempo of life, the limited periods for taking decisions both in private and public life, make a modern man be more mobile, independent, critically thinking, ready for creative search, able to see the problem at different angles and find the non-standard solution to it. To realize all these qualities a person should have divergent way of thinking, he or she must accumulate and use the creative potential to the full extend. It is obvious, the number one task of current secondary and higher education is the formation of a person - generator of new ideas, a person - creator. To put this intention into practice is not easy at all, as issues of the development of creativity are still under discussion in psychological and pedagogical sciences.

Analyses of special literature shows that till today modern science hasn't worked out the universal definition of creativity and hasn't defined prerequisites for its origin. Some experts consider that it is closely connected with cognitive sphere of a man, while others search its foundations in the personal characteristics. There is the third group of scientists who are of the opinion that elaboration of creativity demands combination of both cognitive abilities and definite natural dispositions and inclinations. Such variety of approaches to the definition of creativity testifies to its complicated and multi-sided character.

John Gilford was among the first scientists who investigated creativity through the development of cognitive processes. He operated with the term *divergent thinking* that allows a person to come up with original ideas, set up and solve new tasks. Gilford pointed out 16 hypothetical intellectual capabilities which accompany creativity. Among them we can mention fluency of thoughts (the number of ideas per definite period of time); flexibility of thoughts (the ability to switch from one idea to another); the originality of thoughts (the ability to produce ideas that differ from the common ones); curiosity (sensitivity to problems in the surrounding world), etc. [1, p. 12]. E.P. Torrance

defined creativity as a process of solving a problem that begins with the intuitive shortage of available information. Torrance call creative those people who in the situation of incompleteness can put forward the adequate, not banal solution or can choose the most optimal one from the variety of presented ideas [2]. In Soviet and Russian psychology creativity is treated as *tvorcheskost*, that is creative capabilities of a person. D.B. Bogoyavlenskaya introduced the notion of creativity as "intellectual activity, ability to go beyond the boundaries of a predetermined situation" [3, p. 212].

It goes without saying, that absence of universal interpretation of this notion makes the process of its diagnostics and development rather complicated. However, it should be highlighted that in spite of the fact that there are different approaches to the phenomenon of creativity and a great number of various tests, oriented on measurement of imagination, associative and critical thinking, they don't provide valid assessment of a man's level of creativity. In today pedagogic it is generally accepted that a researcher should use several different methods of testing to get more or less trustworthy data about creative abilities of the respondents. Only such synthesis can guarantee the reliable information [4].

The academic discipline "Foreign Language" promotes the development of creativity, verbal creativity first of all, and the development of divergent mentality. To make this process more successful, we began our work with the creativity determination. Into our research were involved students of technical specialties of 1-2 courses of "Volgatch" (Povolzhsky State Technical University). At the first stage students were offered to answer questions that helped us to find out their self evaluation of their creative potential. Then they fulfilled special tasks in order to demonstrate the existing level of creativity.

Self assessment of creative potential presupposed answers to 18 questions. The analyses of the given answers manifested that 85% of the respondents defined their level of creativity as high (they got 38 points and more); 15% of the students referred themselves to people with intermediate level of creativity. None of the students (0%) estimated their creative level as low. However, the results of practical tasks turned out to be quite different.

To study the level of verbal creativity we used two tests. The first one was called "Sentences". Students were to make up sensible sentences composed of three words which began with certain letters for a limited period of time (8 minutes). The number of such sentences correlated to

the index of productivity. The average index of creativity in that extract was 6.4 sentences. It is considered to be a relatively low one for people, aged 19-23. Taking into account the received answers, we distinguished three levels of verbal creativity for that group of students: high (10-13 sentences), intermediate (5-9 sentences) and low (1-4 sentences). A little bit more than a half - 66.7% of students were on the middle level; 13% occupied the high level whereas 20.3% (i.e. one fifth) of respondents demonstrated the low level of verbal creativity.

The second test checked the development of divergence of mentality and level of verbal creativity at a time. Students were to do the tasks of the following types: "Ask a stranger interesting questions", "Guess the reasons", "Guess the consequences", "Fruits of improvement", "Unusual usage", "Let's imagine". Respondents got one point for each nonstandard suggestion. The average index of mental originality and its linguistic representation was 5.3 sentences. We distributed the received data into three levels as well: high level (9-12 original ideas) - 13.1%; middle level (5-8 ideas) - 48.1%; low level (0-4 ideas) - 38.8% of the respondents (i.e. about one third of the total number of students are at low level).

Figurative or image-bearing component of creativity was investigated with the help of the test called "Circles" (created by E. Vartegue). Students were given sheets of paper with 20 printed circles. The respondents were to draw pictures (things, people, phenomena, etc.) which had to be based on the printed circles. The results (the drawings) were analyzed in accordance with the following criteria:

- Fluency of thinking - the total number of images was taken into account. The number of pictures varied from 2 to 20. The average index was 12.4 pictures. The results were divided into three levels: high level (16-20 pictures) - 27.5% of the respondents; middle level (9-15 drawings) - 62.7%; low level (1-8 pictures) - 9.8%.
- Flexibility of thinking - the total number of types of drawings (or classes the drawings belonged). Students got one point for each class (there were 10 groups or classes all in all). The average index in this category constituted 5.8 points. The distribution into the levels was the following: high level (8-10 classes) - 12.7% of students; middle level (5-7 groups) - 33%; low level (1-4 classes) - 54.9% (more than a half of the students showed low plasticity of mental processes). The most common were drawings from the sphere of everyday life, sport, technologies; drawings of animals and plants occurred more seldom; then came objects of the

Universe and drawings of people; no pictures corresponded to the class "Economics" were found.

- Originality of thinking - students got two points for each unusual picture (i.e. rarely encountered picture). The average index in this category composited 4.5 points. The division into levels was as follows: high level (10 points) - 5.9 % of students; middle level (6-8 points) - 39.2%; low level (2-4 points) - 54.9% (again the number of students with low level is rather large - more than a half).
- The index of creative imagination - the total number of points in originality was divided into the number of drawings. The average index in this category ran 0.4. In accordance with the levels the respondents were grouped into three classes: high level (the index was 0.8 and higher) - 7.3%; middle level (0.5 - 0.7) - 31.4%; low level (0.4 and less) - 60.7% of the respondents (about two thirds of the students showed low index of creative imagination).

As the analysis showed the data of the self assessment of the level of creativity and the results of practical tests on creativity differ significantly. Probably it is so because in the heart of hearts students understand that modern way of living and working demands creativity in all spheres and they position themselves as originally thinking and acting people, although the results of doing practical tasks make researchers come to different conclusions.

To improve this state of matters and to help students rise their level of creativity, teachers of all academic subjects should work out the system of special tasks and exercises. Needless to say, the lion's share of these tasks are done during after classes activities, when students participate in various optional contests, quizzes, Olympiads, scientific conferences and practical workshops. However, compulsory classes should also contribute to the process of elaboration of students' creativity. Thus, educational process in English presupposes a great number of exercises. Many of them are the so-called training or pre-speaking exercises which are usually considered to be boring as drilling doesn't require any creative moments. To cope with this disadvantage of the mentioned type of exercises (as they are rather necessary in mastering the foreign language and help to enlarge students' vocabulary and automatize grammar skills), we use new Internet technologies and web services.

To make students' work with new words more interesting, we advise to use flashing or trading cards. It is available at the web site *Study Stack* (<http://www.studystack.com>). It allows to generate your own didactic games. In the template of the game there are several

"pockets" - for all cards, which can be shuffled; for those cards which you can't remember ("I don't know") and the "pocket" for the right answers "I know". The cards from the pocket "I don't know" can be taken more than once till the right answer is given, but the game has the time holder. Service *BrainFlips* (<https://sites.google.com/site/badanovweb2/home/brainflips>) is used for creating didactic cards. Each card can contain video or audio files. The service was done especially for teachers. One more service of this kind is *Flashcard Exchange* (<https://prezi.com/p/qvp4p3gvpvo0/flashcardexchange/>). Students also enjoy working at the service *JeopardyLabs* (<https://jeopardylabs.com/>). Here they are given a chance to produce their own crossword puzzles ([www.jigsawplanet.com](http://www.jigsawplanet.com)) and bingo games (<https://bingobaker.com/view/>). A large amount of creativity and originality of thinking are a must when students generate tests for self checking and mutual checking. It is possible to do at the services *Let'sTest* (<https://letstest.ru/>), *master-test* (<http://master-test.net>).

There are a lot of services that also help the teacher to develop creative skills of students while doing communicative exercises. One of them is *Padlet* (<https://ru.padlet.com/>). To the virtual wall students can attach their own files, photos, links. To make up your own table is not difficult as the service gives a lot of ready-made templates. The table can be in the form of a wall when posters are like bricks; in the form of canvas, timeline or a map.

For producing creative works we often use the service *Venngage* (<https://ru.venngage.com/>). We believe that the big advantage of this web program is the fact that it let students make up info graphics in three simple steps, as the site offers instructions, ready-made templates and examples to see.

In conclusion, it should be stressed that creative orientation of educational process is obligatory nowadays as it leads to creative implementation of the received theoretical knowledge, to the production of one's own new and unique intellectual product; it promotes the process of generating original ideas in nonstandard environment. Due to creativity a person is constantly in the condition of search and activity, is always receptive to any changes and innovations. The development of creative and divergent thinking are the main constituent parts of the creative process and are the pledge of successful self realization of a person.

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## **SECTION X. Cultural Studies**

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### **TOWARDS THE PROBLEM OF INTERCULTURAL DIALOGUE IN MASS MEDIA SPACE**

*Abstract.* The article discusses the problem of the adequacy of intercultural dialogue in the context of mediated mass communication. The article considers technical, institutional and cultural factors that prevent an equivalent dialogue of cultures in the communicative space of the mass media.

*Key words:* intercultural communication, mass media, mediocracy, postmodern

The modern theory of intercultural communication has distinctly an interdisciplinary character and includes many aspects: semiotic, psycholinguistic, cognitive, socio-psychological etc. The definitions of intercultural communication are also different, but their general concept is always conveyed by the well-known metaphor of "**dialogue of cultures**".

It should be recognized that this metaphor, which has the status of a scientific concept, is an abstraction that fixes a certain angle of view of the studied object. This abstraction inevitably contains an element of

idealization, so that it takes into account only those properties of the object that correspond to the system of concepts, in which the abstraction is carried out. In the case of the "dialogue of cultures" we also have a certain "ideal" to which the concept itself aspires, but how much reality corresponds to this ideal - this problem deserves the special consideration.

In our report we will try to find out whether modern *intercultural communication* "in fact" is an equal *dialogue of cultures* and whether the media, as the dominant space of mass communication today, is a favorable environment for such a dialogue.

In our opinion it is the *environment*, which is the key concept for identifying trends and mechanisms of interaction between cultures, since the content of communication is largely determined by its external factors: tools, communication channel, social roles etc. While in the interpersonal communication the influence of the communicative environment channel is minimal, is such influence in the intercultural communication very important. And it is hardly possible here to talk about the "direct interaction of cultures", especially in the modern information society, where mass communicative interaction is highly mediated by technical means. Herbert M. McLuhan [2] spoke about the determinism of the types of culture by the nature of the historically dominant communication technology, and his famous phrase «The medium is the message» has acquired special relevance in our age of communication technologies. For specialists in the field of communication and mediology it is obvious that modern mass communication is not a spontaneous "free communication" of "free individuals", but the professionally controlled processes with their own laws and instruments. The "management" of public opinion and social stereotypes is moving more and more actively to social networks today, but the media has always been its "classic" field. It is this social institution that remains the most influential channel of intercultural communication and its state can be used to assess the degree of closeness of real processes to the ideal state of the "dialogue of cultures".

Of course, the role of the media in intercultural communication today is huge, but this role is not always associated with the harmonization of intercultural dialogue: the media are not a "neutral" technical mediator, but a mediator "with its own message". The specificity of this "message" lies both in the technical properties of the environment itself and in the institutional settings of media corporations, that form the genre formats of media messages and their content.

As for the technological properties of the media environment, the most significant for managing of communication processes are multichannel and mass character, speed of dissemination and “fragmentation” of information [4].

Under **multichannel character** is understood the variety of sensory channels through which information comes to the recipient: verbal, visual and auditory. It is known that when several channels are connected, a person's ability to control messages decreases, and, accordingly, the predisposition to manipulative influences increases [2, p. 314]. As for the property of **mass character**, the wide availability of information does not at all mean “mass access” to its production and does not guarantee freedom of informational choice in the process of its consumption. In a situation where the main information flows and their content are monopolized by large media corporations, the "average recipient" actually uses a small number of information sources, being potentially dependent on their suggestive influence. The **speed of information dissemination** creates, in the words of G. Schiller, "a false sense of urgency", "a feeling of the extraordinary importance of the subject of information, which also quickly dissipates" [4, p. 46]. The brain, which does not have time to sort and comprehend information in such a mode, G. Schiller compares with a "sieve", and considers the immediate transmission of information as one of the methods of forming consciousness, predisposed to manipulative influence. The author considers “**information fragmentation**” to be another such method. Its essence lies in the presentation of news material in the form of heterogeneous fragmentary information, the multiplicity and fragmentation of which deprive the recipient of the opportunity to form a complete picture of the phenomenon or problem [4, p. 43-45].

Thus, modern technical methods of mediating information maximally promote **the communicative asymmetry**: the “strong side” here is the sender of the information, the “weak” is its ordinary recipient. In such a situation an equal dialogue between the first and the second is very problematic, and therefore intercultural interaction in the conditions of mass communication is more often like a "monologue" of one or several cultures. The superiority of the “strong side” is fully used today by transnational media corporations oriented in the financial, political, cultural and linguistic terms towards a single “center” of the unipolar world. Modern concepts of *mediacracy*, *linguistic* and *cultural imperialism* directly indicate that the power of expansion of American culture is incommensurable with the influence of other types of cultures [1, p. 241-245].

Another factor hindering the real dialogization of intercultural communication in the world media space is the absolute dominance of the main cultural paradigm – the postmodernism. Ideological relativism, formal mosaicism, depersonalization and focusing on creating of "virtual hyperreality" penetrate the entire media space – from news to cultural and educational programs. The apparent "pluralism" of postmodernism actually allows cultural diversity only at the level of "simulacra": dialogue "according to the rules of postmodernism" presupposes a rejection of a deep national and cultural identity in favor of a "general consensus", and therefore cannot, in our opinion, be considered as a full-fledged dialogue of cultures.

So, we found out that the intercultural communication in modern conditions of mediacracy is far from an equal dialogue of cultures. The suggestively directed technical properties of the media environment, the metacommunicative intentions of media monopolies and the "monologue" of the postmodern cultural paradigm contribute to the levelling of national and cultural differences and lead to the formation of a unified global "monoculture".

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