ACTUAL PROBLEMS OF MODERN SCIENCE, EDUCATION AND TRAINING

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CONTENTS

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THE EFFECTS OF ULTRASOUND ON BLOOD VESSELS AND BLOOD CELLS

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Annotatsiya. 20 kHz dan yuqori chastotali ultratovush (UT) tibbiy diagnostika va terapiya uchun, ayniqsa qon aylanish tizimi kasalliklarini o‘rganish va davolashda muhim vositadir. Zamonaviy tadqiqotlar tahliliga asoslangan maqolada ultratovushning qon tomirlari, qon hujayralari va qon oqimiga biologik ta’siri umumlashtiriladi. Ta’sir qilishning asosiy mexanizmlari, jumladan, issiqlik ta’siri, kavitatsiya va mexanik ta’sirlar, shuningdek, ularning qon tomir endoteliysi, eritrotsitlar, trombotsitlar va leykotsitlar uchun oqibatlari ko‘rib chiqildi.

Kalit so‘zlar: *mikromassaj, eritrotsitlar, Dopplerografiya, granulotsitlar, qon tomir tonusi, qon aylanishi, eritrotsitlar gemolizga.*

Аннотация. Ультразвук (УЗ) с частотой выше 20 кГц является важным инструментом медицинской диагностики и терапии, особенно при изучении и лечении заболеваний системы кровообращения. В статье на основе анализа современных исследований обобщены биологические эффекты ультразвука на кровеносные сосуды, клетки крови и кровоток. Рассмотрены основные механизмы действия, включая тепловые эффекты, кавитацию и механические воздействия, а также их последствия для эндотелия сосудов, эритроцитов, тромбоцитов и лейкоцитов.

Ключевые слова: *микромассаж, эритроциты, допплерография, гранулоциты, сосудистый тонус, кровообращение, эритроциты к гемолизу.*

Abstract. Ultrasound (US) with a frequency above 20 kHz is an important tool for medical diagnostics and therapy, especially in the study and treatment of diseases of the circulatory system. Based on an analysis of modern research, this article summarizes the biological effects of ultrasound on blood vessels, blood cells, and blood flow. The main mechanisms of action are considered, including

thermal effects, cavitation, and mechanical influences, as well as their consequences for the vascular endothelium, erythrocytes, platelets, and leukocytes.

Keywords: *micromassage, red blood cells, Doppler ultrasound, granulocytes, vascular tone, blood circulation, red blood cells to hemolysis.*

Introduction

Ultrasound (US) began to be used in medicine in the 20th century thanks to the discovery of the piezoelectric effect, which made it possible to develop diagnostics and therapy for vascular pathologies [1-17]. Conventionally, ultrasound is divided into three ranges: low-frequency (10^4–10^5 Hz), mid-frequency (10^5–10^7 Hz), and high-frequency (10^7–10^{10} Hz) [1]. These waves are capable of penetrating biological tissues, interacting with them through thermal, mechanical, and cavitation effects, which makes ultrasound an indispensable tool in medical practice, but requires careful use to minimize risks. Medical ultrasound uses frequencies from 0.5 to 10 MHz, penetrating tissues and interacting with them [1].

Literature Review

The mechanical effects of ultrasound (US) on the circulatory system are due to its ability to induce acoustic pressure and vibrations in biological tissues, including blood vessels, blood cells, and plasma. These effects occur at the cellular and subcellular levels, influencing the structure and function of components in the circulatory system. The main aspects of the mechanical effects include variable acoustic pressure, tissue micromassage, acoustic currents, and changes in the permeability of cell membranes. These effects can be both beneficial (e.g., in blood flow diagnostics) and potentially harmful when safe parameters are exceeded, which requires strict control in clinical practice. The acoustic pressure of US causes micromassage of the endothelium due to depolymerization of hyaluronic acid [2, 21]. This property is used in ultrasound drug delivery, but at intensities above 0.5 W/cm^2, vibrations can damage the endothelium, causing local inflammation [3]. Acoustic currents are another important aspect of the mechanical effects. These streams arise when ultrasound propagates in liquid media such as blood and can reach velocities of up to 10 m/s, depending on the frequency and intensity of the waves [5]. Acoustic streaming (2 MHz, 0.3 W/cm), mechanical action also affects blood cells. Red blood cells exposed to ultrasound can be deformed by acoustic pressure, especially at frequencies above 1 MHz. Although red blood cells are relatively stable, intensities above 1 W/cm²) create turbulence useful for Doppler ultrasound, but can disrupt laminar blood flow and increase blood viscosity [6, 20]. Platelets are more sensitive: even short-term exposure to ultrasound with a frequency of 880 kHz and an intensity of 0.2 W/cm^2 leads to their activation and aggregation, increasing the risk of thrombosis [9]. Leukocytes, especially granulocytes, exhibit membrane damage when exposed to modulated US in the range of 10–100 Hz, which is associated with resonant vibrations of their cytoplasm [10]. In addition, the mechanical effects of US alter the conductivity of ion channels in the membranes of endothelial cells and blood cells. This leads to the activation of signaling pathways such as the release of nitric oxide (NO) by the endothelium, which can temporarily improve vascular tone [11]. However, excessive vibrations can disrupt the integrity of

the membranes, causing the release of inflammatory mediators such as histamine from mast cells located near the vessels [12]. The mechanical effects of ultrasound on the circulatory system depend on the parameters of the waves, including frequency, intensity, and duration of exposure. Studies show that the safe range for diagnostic US is 0.1–0.3 W/cm^2 at frequencies of 1–3 MHz [13]. Understanding these mechanisms is necessary to develop protocols that minimize potential harm while maintaining diagnostic and therapeutic efficacy.

Research Methodology

The study is based on a systematic literature review of modern research on the biological effects, a comprehensive, evidence-based analysis of ultrasound's impact on the circulatory system.

Analysis and Results

The mechanical action of ultrasound (US) causes vibrations and acoustic flows in blood vessels. At the same time, the absorption of wave energy leads to thermal effects, which also significantly affect the circulatory system. These thermal changes affect the endothelium, rheological properties of blood, and vascular tone, which can be useful for stimulating blood circulation, but when safe parameters are exceeded, they lead to risks such as inflammation or thrombus formation. Understanding these processes is necessary to optimize the use of ultrasound in medical practice. Thermal effects depend on the frequency, intensity, and duration of ultrasound exposure, as well as on tissue characteristics. According to studies, vascular tissues, including the endothelium and smooth muscle cells, absorb more energy than blood due to their high density and collagen content. At diagnostic frequencies of 1–3 MHz and intensities of 0.1–0.3 W/cm^2, the temperature in vessels can increase by 1–2 °C in a few seconds. This increase is usually safe, but at an intensity of 0.5 W/cm² and higher, heating reaches 3°C, which disrupts the endothelial barrier function, causing vascular permeability and the release of inflammatory mediators such as interleukin-6 [13]. Blood, as a liquid medium, is less susceptible to heating, but thermal effects affect its cells and rheology. Ultrasound (US) with a frequency of 2 MHz and an intensity of 0.7 W/cm^2 heats plasma to 40 °C in 10–15 seconds, which changes blood viscosity and activates coagulation factors. According to studies, in vitro experiments show that red blood cells begin to aggregate at temperatures above 41 °C, and platelets demonstrate increased adhesion, increasing the risk of microthrombosis. It was also found that heat stress reduces the resistance of red blood cells to hemolysis, especially with prolonged exposure, which can be critical in conditions of therapeutic ultrasound, for example, during thrombolysis [14]. These changes emphasize the need to limit exposure time to minimize the thermal effect on the blood. The particular importance is thermal effects at interfaces of media, such as blood–endothelium or vessel–surrounding tissue, where wave reflection enhances heating. The effect of boundary surfaces leads to a local increase in temperature by 2–4 °C above the average in tissue at an intensity of 1 W/cm^2. Their studies on animals showed that in capillaries, where blood flow is minimal, heating causes vasoconstriction, reducing microcirculation. It has also been found that in clinical settings such as ultrasound angiography, heating can be minimized by using a pulsed mode with pauses for heat dissipation [15]. Effect of

thermal effects on leukocytes. Heating blood to 40 °C reduces the phagocytic activity of leukocytes, weakening the immune system [16]. Taking these factors into account, the thermal effects of ultrasound exposure on the circulatory system require strict parameter control. Recommendations emphasize that the safe intensity for diagnostic ultrasound should not exceed 0.3 W/cm^2, and the exposure time should be limited to 1–2 minutes to prevent heat accumulation. Therapeutic applications such as high-intensity focused ultrasound can increase temperatures by up to 5 °C, requiring real-time monitoring to protect vessels and blood [17]. These data emphasize the importance of balancing clinical efficacy and safety, especially when working with sensitive structures of the circulatory system.

The thermal effects of ultrasound (US), discussed earlier, significantly affect the circulatory system, changing the temperature of blood vessels and blood, but an important mechanism is cavitation associated with the formation and dynamics of microbubbles in liquid media. In the circulatory system, cavitation occurs when high-intensity ultrasound is applied, causing local mechanical and chemical changes that can affect the vascular endothelium, blood cells, and blood flow. This process has a dual nature: under controlled conditions, it is used to destroy blood clots or deliver drugs, but under inadequate parameters, it can cause tissue damage and activate inflammatory processes. Cavitation occurs when ultrasound creates low-pressure zones in the blood. In these zones, microbubbles containing liquid vapor or gases are formed. Upon subsequent compression, these bubbles collapse, generating shock waves and local hydraulic shocks. According to research, cavitation in blood is most likely at frequencies of 0.5–2 MHz and intensities above 0.5 W/cm^2. It has been established that the collapse of bubbles creates pressure of up to 1000 atm in microscopic areas, which is sufficient to rupture red blood cells or damage the endothelium. According to experimental data in vitro, where 1 W/cm^2 ultrasound caused hemolysis of 5–10% of red blood cells in 10 seconds, highlighting the highly destructive power of cavitation. He also notes that in the circulatory system, cavitation most often occurs near the vessel walls, where bubbles interact with the endothelium, increasing local stress [14]. Cavitation shock waves cause microcracks in the endothelium, increasing its permeability and releasing von Willebrand factor, which increases the risk of thrombus formation [15]. It is also noted that cavitation in blood is accompanied by the formation of free radicals such as hydroxyl groups, which oxidize membrane lipids, increasing cell damage [16]. The chemical consequences of cavitation add another layer of complexity. Bubble collapse creates local temperatures up to 5000 K and causes sonolysis - the splitting of water molecules to form reactive oxygen species (ROS). In the circulatory system, ROS interact with endothelial and plasma proteins, changing their structure and function. Cavitation at 0.5–2 MHz damages the endothelium [4]. According to the examples given, ultrasound with an intensity of 1.5 W/cm^2 increased the level of lipid peroxidation in plasma by 20% in 30 seconds, which contributes to inflammation and vascular dysfunction. It was also noted that these effects are more pronounced in small-diameter vessels, where the blood flow dissipates the chemical products of cavitation less effectively [13]. These recommendations emphasize the importance of balancing the clinical benefits and potential harm of cavitation effects in the circulatory system.

Cavitation creates local shock waves that have a particularly strong effect on blood cells, changing their structure and functions. The effect of ultrasound on blood cells depends on wave parameters such as frequency, intensity, and exposure mode, and can vary from reversible changes that improve metabolism to destructive processes such as hemolysis or aggregation. Understanding these effects is necessary for the safe use of ultrasound in diagnostics and therapy to minimize risks to the circulatory system.

Red blood cells. Red blood cells that carry oxygen are relatively resistant to low-intensity ultrasound, but are subject to change when the exposure parameters increase. It has been established that mechanical pressure and cavitation shock waves at a frequency of 1–2 MHz and an intensity of 0.5 W/cm^2 cause deformation of red blood cell membranes. Results in In vitro experiments have shown that ultrasound with an intensity of 1 W/cm^2 causes hemolysis of 5–10% of erythrocytes in 10 seconds [14]. Hemolysis of erythrocytes has been confirmed in vitro [8]. However, some studies indicate a smaller effect in the pulsed mode, which emphasizes the need to clarify the parameters of the effect [21]. The thermal component of the effect also increases the damage: heating to 41 °C reduces the elasticity of the membranes, increasing the likelihood of their rupture. However, with diagnostic parameters (0.1–0.3 W/cm^2), erythrocytes usually maintain integrity, and moderate vibrations can stimulate their metabolism, improving oxygen transport [14]. These data emphasize the importance of intensity control to prevent irreversible damage to erythrocytes.

Platelets. Platelets, which are responsible for blood clotting, exhibit high sensitivity to ultrasound, making them a key object of study. Studies show that even short-term exposure to ultrasound at a frequency of 880 kHz and an intensity of 0.2 W/cm^2 causes platelet activation within 5–10 seconds due to mechanical stress from acoustic streaming and cavitation. Ultrasound at an intensity of 0.5 W/cm^2 increased platelet aggregation by 30%, increasing the risk of microthrombosis , especially in vessels with low blood flow. Thermal heating to 40 °C enhances platelet adhesion to the endothelium, stimulating the release of thromboxane A2, which further promotes clotting. Experiments have shown that these effects are reversible in diagnostic settings, but therapeutic applications such as thrombolysis require strict monitoring to avoid thrombosis [16]. These observations demonstrate the dual role of ultrasound in platelet manipulation: from thrombus destruction to potential thrombus formation.

Leukocytes. Leukocytes, especially granulocytes, respond to ultrasound by changing membrane integrity and functional activity. Ultrasound with a frequency of 1 MHz and an intensity of 0.5 W/cm^2 causes damage to the cytoplasmic membranes of granulocytes in 12–20 seconds, which is associated with cavitation microjets and free radicals. Studies show that such changes reduce phagocytic activity by 20–30%, weakening the local immune response. Unlike granulocytes, small lymphocytes are more resistant, demonstrating degenerative changes only after 50–90 seconds at an intensity of 0.7 W/cm^2. It was also noted that heat stress when heated to 40 °C increases leukocyte apoptosis, disrupting their ability to migrate and chemotaxis. The pulsed ultrasound mode reduces these effects, allowing leukocytes to restore function between pulses [15]. To protect leukocytes, the ultrasound exposure time should not exceed 10–15 s at an intensity of 0.5 W/cm^2. The effect of ultrasound on blood cells has both clinical benefits and potential risks. For example, diagnostic ultrasound with an

intensity of up to 0.3 W/cm^2 and a pulsed mode has a minimal effect on blood cells, ensuring the safety of procedures such as Doppler ultrasonography. However, in therapeutic applications, where the intensity reaches 1–2 W/cm^2, the risk of damage to red blood cells, activation of platelets, and suppression of leukocytes increases. A number of recommendations emphasize the need to limit the time of exposure to high-intensity ultrasound to 10–20 seconds to minimize side effects [17]. Additionally, it is noted that the use of contrast agents can enhance cavitation effects, requiring additional precautions [17]. These findings emphasize the importance of fine-tuning ultrasound parameters to protect blood cells.

Ultrasound has a significant impact on the vascular endothelium, vascular walls and blood flow dynamics, causing both physiological and potentially pathological changes. Understanding these processes is necessary to optimize the use of ultrasound in diagnostics, such as Doppler sonography, and therapy, minimizing risks to the vascular system.

Vascular endothelium. The endothelium, which lines the inner surface of blood vessels, is the primary target for ultrasound due to its location at the border with the blood. Mechanical action of ultrasound with a frequency of 1 MHz and an intensity of 0.3 W/cm^2 causes vibrations of endothelial cells, changing the permeability of their membranes. In animal experiments, it was found that ultrasound with an intensity of 0.7 W/cm^2 for 20 seconds increases the release of nitric oxide (NO), temporarily relaxing blood vessels, which is useful for improving blood flow. Although ultrasound stimulates the release of NO, data on its effect on chronic endothelial dysfunction are contradictory [4], which requires further research. However, when exceeding 1 W/cm^2, cavitation Microjets damage the endothelium by causing microcracks and the release of von Willebrand factor, which increases the risk of thrombus formation. Thermal heating to 41 °C enhances these effects by stimulating the production of cytokines such as interleukin-8, which can lead to local inflammation. Pulsed US mode reduces endothelial damage by allowing cells to recover between pulses [15]. These data highlight the need for fine-tuning of parameters to protect the endothelium.

Vascular walls. Vascular walls, consisting of collagen, elastin and smooth muscle cells, actively absorb ultrasound energy due to their dense structure. Studies have shown that at frequencies of 1–3 MHz, vessel walls, especially arteries, heat up by 1–3 °C at an intensity of 0.5 W/cm^2, which can impair their elasticity. In experiments, heating to 43 °C for 5 minutes caused denaturation of collagen in the vascular walls, weakening their mechanical strength, which is especially dangerous for atherosclerotic vessels prone to rupture. Cavitation near the walls creates local shock waves that damage smooth muscle cells, reducing vascular tone. Small-diameter vessels, such as capillaries, are more vulnerable due to the high energy density per unit area, which can lead to microhemorrhages [13]. These effects require careful application of ultrasound in areas with thin or pathologically altered vessels.

Blood flow. Blood flow dynamics are changed under the influence of ultrasound through acoustic currents and changes in vascular tone. Acoustic currents reaching speeds of up to 10 m/s at an intensity of 0.5 W/cm^2 create turbulence in the blood flow, which improves visualization during Dopplerography. However, according to experimental data, it has been established that long-term exposure with an intensity of

1 W/cm^2 causes local vortices, increasing blood friction against the vessel walls and increasing the risk of endothelial stress. It was also noted that thermal effects, heating the blood to 40 °C, reduce its viscosity by 5–10%, which temporarily accelerates blood flow, but can provoke vasoconstriction when overheated. In experiments on blood flow models, ultrasound with a frequency of 2 MHz increased platelet aggregation in turbulent zones, increasing the risk of thrombosis [14]. These observations emphasize the importance of short-term exposure to maintain normal blood flow dynamics. Clinical use of ultrasound requires consideration of its effects on vessels and blood flow. According to a number of studies, diagnostic ultrasound with an intensity of 0.1–0.3 W/cm^2 minimally changes vascular function, ensuring the safety of procedures such as ultrasound angiography. However, therapeutic methods using an intensity of up to 2 W/cm^2 can damage the endothelium and vessel walls, especially with prolonged exposure. It is noted that the use of contrast agents enhances cavitation effects, but allows for a decrease in intensity, protecting vessels. To prevent the development of turbulent flows and tissue trauma, real-time blood flow monitoring is recommended to prevent turbulence and thrombus formation [16]. These recommendations emphasize the need to adapt ultrasound parameters to the patient's vascular condition.

Conclusion

Ultrasound has a multifaceted effect on the circulatory system, including mechanical, thermal, and cavitation effects that alter endothelial, blood cell, and blood flow functions. Diagnostic ultrasound with an intensity of 0.1–0.3 W/cm^2 is safe for short-term use, while therapeutic modes (above 0.5 W/cm²) can cause hemolysis, thrombus formation, and inflammation. Optimization of clinical ultrasound use requires strict control of frequency, intensity, and duration of exposure, as well as further research to clarify long-term effects and develop personalized protocols.

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QUALITY AND ECOLOGICAL STABILITY OF WATER RESERVOIRS OF KHORAZM REGION

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Annatatsiya. Ushbu tadqiqotda Xorazm viloyatidagi suv havzalarining suv sifati va ekologik barqarorligi, antropogen ta’sirlar va iqlimiy omillarni hisobga olgan holda baholanadi. Metodika asosiy tabiiy va sun’iy suv havzalaridan dala namunalarini olish, fizik-kimyoviy ko‘rsatkichlarni (pH, mineral tarkib, erigan kislorod, BOD, nitratlar, fosfatlar) laboratoriya tahlili, fitoplankton va zooplankton tarkibi va ko‘pligidan foydalangan holda bioindikatsiyani o‘z ichiga olgan. Natijalar asosan agrokimyoviy ifloslanish va suv oqimining kamayishi tufayli bir qancha suv omborlarida suv sifati yomonlashganini ko‘rsatadi. Ekotizim tahlili gidrobiotsenozlarda biologik xilma-xillikning pasayishi va tarkibiy o‘zgarishlarni ko‘rsatadi.

Kalit so‘zlar: *suv havzalari, suv sifati, ekologik barqarorlik, Xorazm viloyati, gidrobiotsenoz, antropogen ta’sir, bioindikatsiya, ifloslanish, bioxilma-xillik, barqaror boshqaruv.*

Аннотация. В этом исследовании оценивается качество воды и экологическая устойчивость водохранилищ Хорезмской области с учетом антропогенного воздействия и климатических факторов. Методология включала полевой отбор проб воды из крупных естественных и искусственных водохранилищ, лабораторный анализ физико-химических параметров (pH, содержание минералов, растворенный кислород, БПК, нитраты, фосфаты) и биоиндикацию с использованием состава и численности фитопланктона и зоопланктона. Результаты показывают ухудшение качества воды в нескольких водохранилищах, в основном из-за агрохимического загрязнения и сокращения расхода воды. Экосистемный анализ указывает на снижение биоразнообразия и структурные изменения в гидробиоценозах.

Ключевые слова: *водохранилища, качество воды, экологическая устойчивость, Хорезмская область, гидробиоценоз, антропогенное воздействие, биоиндикация, загрязнение, биоразнообразие, устойчивое управление.*

Abstract. This study aassesses the water quality and ecological stability of water reservoirs in the Khorezm region, considering anthropogenic impacts and climatic factors. The methodology involved field sampling of water from major natural and artificial reservoirs, laboratory analysis of physicochemical parameters (pH, mineral content, dissolved oxygen, BOD, nitrates, phosphates), and bioindication using phytoplankton and zooplankton composition and abundance. Results show deteriorating water quality in several reservoirs, mainly due to agrochemical pollution and reduced water flow. Ecosystem analysis indicates biodiversity decline and structural changes in hydrobiocenoses.

Keywords: *water reservoirs, water quality, ecological stability, Khorezm region, hydrobiocenosis, anthropogenic impact, bioindication, pollution, biodiversity, sustainable management.*

Introduction

The reduction in water bodies in the Khorezm region is closely linked to the desiccation of the Aral Sea, which drastically declined starting in the 1960s due to industrial expansion. In recent years, local communities have begun leasing lakes for fish farming, which has helped improve livelihoods but placed new pressures on aquatic ecosystems.

In 2009-2010, the ZEF-UNESCO project mapped over 450 small lakes in the region. Since then, artificial lakes have increased in number due to aquaculture, while natural reservoirs have declined-from 250 to 74 by 2020. According to the Khorezm Regional Department of Nature Protection (2019-2020), artificial reservoirs have grown to over 700, reflecting environmental and socioeconomic changes.

Literature Review

Several studies (Mambetullaeva, 2021; Amatjanova, 2020; Sattarova & Mambetullaeva, 2024) have explored water quality and ecosystem dynamics in Khorezm lakes. These works highlight the effects of anthropogenic activities, the rise of artificial lakes, and ecological degradation linked to climate shifts and water scarcity.

Research Methodology

Research objects:

- Gauk Lake (Khiva District)
- Adjali lake (Khazarasp District)
- Shur Lake (Koshkupir District)

Sampling and Laboratory Analysis:

Water samples were collected in 2019–2021 from eight locations per lake, following proper protocols (e.g., rinsing sampling beakers with 10% HCl). Physical (temperature, odor), chemical (pH, mineral content), and biological (plankton, benthos) parameters were analyzed.

Odor Analysis:

Conducted in two phases: (1) at room temperature, and (2) heated to 40°C. Results indicated swamp and hydrocarbon odors—signs of eutrophication and organic pollution.

pH Testing:

Universal indicator paper revealed pH levels below 7, indicating acidic conditions in many samples.

Hydrobiological Methods:

Zoobenthos and periphyton samples were collected and analyzed at the Tashkent Hydrometeorological Laboratory. Zoobenthos species included Diptera larvae, mollusks, beetles, and oligochaetes. Vegetation was composed of halophytic species such as *Chara vulgaris*, *Najas marina*, and *Ruppia maritima*.

Analysis and Results

Purpose of studying natural lakes of khorezm region:

Study and determination of hydrochemistry, hydrobiology of natural ash in the region. I was brought from the experimental field to test the (physical) odor of water and the (pH chemical) properties of water in the laboratory. Before sampling, the beaker is rinsed thoroughly with a 10% HCl solution. The sample was taken according to the depth of the lake, i.e, every 1 meter from a depth of 3 meters.

Figure 1. Water sampling from the lake.

Figure 2. The process of measuring water temperature in an ES 300 apparatus.

During the sampling process, the water temperature was determined using the ES 300 device. When the water sample was taken in March, it was 18 °C. The sample was conducted and tested in the chemistry laboratory of Urgench State University together with specialists and students.

Hydrochemistry:

Lab tests showed elevated concentrations of nitrates and phosphates in several lakes, indicating pollution from agricultural runoff. The odor detection process of the sample was carried out in 2 ways, the first of which is to shake 100 g in a closed container at room temperature and sniff immediately. This process is done twice. The first is carried out in the natural state, the second in the state heated to 40 °C. The laboratory determines the odor of water bodies on the basis of the following samples [4, 5].

As a result of the first experiment came the smell of stinking swamp water. The second experiment resulted in a hydrocarbon odor [6, 7].

Figure 3. Water odor detection process.

Figure 4. The process of determining the water identifier.

Table 1. Example of water odor detection indicator.

Features	Sources of odor origin
Chemical	Industry in the chemical treatment of sewages or waters
Medicinal	Phenol and iodoform
Hydrocarbons	In oil refining
Bad, swampy	In stagnant sewage
Chlorine	Free chlorine

In the next experiment, I determined the pH by means of an indicator. The amount of free hydrogen (pH) depends on the chemical properties of the particles in the water and the amount of particles. Depending on the amount of pH, the reactivity of water can be determined:

pH <7 - acid reaction
pH-7 is a neutral (normal) reaction
pH> 7- alkaline reaction

A universal indicator paper is immersed in the water being tested, and depending on the change in the color of this paper, we determine the reactivity of water using the following table. As a result of our analysis, the indicator turned yellow. Samples are given for color identification. I used this sample to determine the chemical properties of water, which is a sour reaction.

Table 2. Sample indicators

The color of the indicator	pH quantity
Red	2.0
Reddish-yellow	4.0
Yellow	6.0
Green	7.0
Blue-green	8.0
Blue	10.0

The results of hydrochemistry were determined at the Tashkent Hydrometeorological Research Laboratory. Samples were sent to the laboratory from 8 locations on the lake for hydrochemical testing. The results of these inspections are presented in the table below.

Table 3. Results of hydrochemical analysis of Gauk lake.

Name	1	1,2	1,3	2	2,2	2,3	3	4
Sulfates, mg/l	1585	1441	1441	1297	1537	1345	1681	1969
Chlorides, mg/l	1062	950	1003	950	1009	1226	1231	1217
Phophates, mg R /l	0,01	0	0,001	0	0,002	0,012	0,007	0,01
BOD3, mg O / l	1,29	1,98	3,35	3,09	4,46	2,38	5,93	3,71
Nitrate, mg / l	0,036	0,075	0,009	0,059	0,019	0,006	0	0
Nitrates, mg / l	1,37	1,06	1,55	0,62	0,39	0,53	0,22	0,35

Hydrobiology was determined at the Tashkent Hydrometeorology Laboratory (Zoobenthos). As a result of hydrobiological examination of the lake. Gaukkul dissected and analyzed 8 samples of zoobenthos, samples were taken from the shoreline and the middle of the lake [1, 2, 3].

On the shore of the lake, samples were taken of soil composed of dark gray mud, fine sand, and swamp-smelling detritus; where samples were taken in the middle of the lake. Among the macrophytes, saline species of higher aquatic plants were found in the specimens: hara (Chara vulgaris L.), sea urchin (Najas marina L.), and sea ruppia (Ruppia maritima L.) [8, 9].

Figure 5. Zoobenthosis sampling process.

Table 4. Taxonomic structure of zoobenthos from the Gaukkul lake.

Taxonomic	Diptera	Coleoptera	Mollusca	Oligochaeta	Nematoda	Total
Number of zoobenthos	9	3	5	3	1	21

21 species of organisms were found in Gaukkul Lake zoobenthos: Diptera larvae - 7 species, mollusks-5 species, beetles and oligochaetes - 3 species each, nematodes – 1 species. The taxonomic structure of Lake Gaukkul is shown in Figure 6.

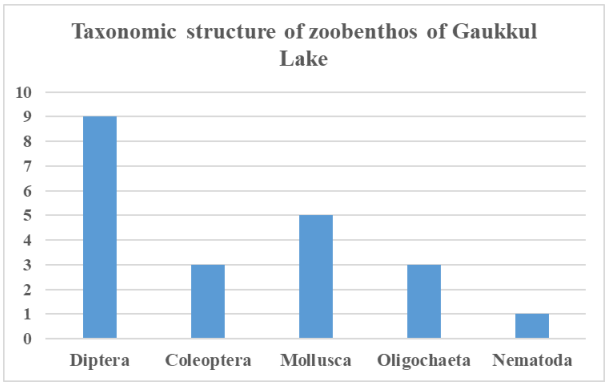

Figure 6. Taxonomic structure of zoobenthos from the Gaukkul lake.

Zoobenthos Composition:

Gauk Lake exhibited 21 species, including:

- Diptera larvae (7 species)
- Mollusks (5 species)
- Oligochaetes and beetles (3 each)
- Nematodes (1 species)

The benthos community reflected a high trophic level and organic matter accumulation, suggesting ecosystem stress. Presence of *Caspiohydrobia conica* shells-typical of mesohaline environments-suggested historical fluctuations in salinity and water volume.

Periphyton Analysis:

Algal communities were dominated by beta-mesosaprobic and mesohaline diatoms like *Navicula*, *Mastogloia*, and *Amphora*. These findings confirmed eutrophic to mesoeutrophic conditions.

Figure 7. Prephyton sampling process.

Conclusions

The lakes studied, especially Gauk, show signs of moderate pollution, eutrophication, and changing biocenotic structure. These conditions are linked to reduced hydrological input, pollution, and climate variability.

- The ecological status is conditionally satisfactory.
- The lakes exhibit mesoeutrophic characteristics.
- Bioindicator species suggest degradation trends.
- Continued water withdrawal and pollution threaten long-term ecological stability.
- Maintain favorable hydrological regimes.
- Implement monitoring and conservation of biodiversity.
- Regulate agrochemical use in surrounding areas.
- Support sustainable aquaculture practices.

Acknowledgments:

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THE INFLUENCE OF FOREST PLANTATIONS ON THE MICROCLIMATE IN THE SOUTHEASTERN KYZYLKUM

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Annotatsiya. Ishning maqsadi yo‘lakli himoya o‘rmonlarining yon-atrofdagi hududlarning mikroiqlim elementlariga ta’sirini o‘rganish. Aniqlanishicha, o‘rmon yolaklari shamol oqimining o‘tishiga to‘siq bo‘lib xizmat qiladi va uning kinetik energiyasini 40-50% ga kamaytiradi, bu esa mikroiqlimning havo harorati va namligi, bug‘lanish, qishda qorning to‘planishi kabi muhim elementlarini yaxshilashga ijobiy ta’sir qiladi. Himoya o‘rmonlari ostidagi o‘simliklar yaxshi o‘sadi va rivojlanadi, buning ta’sirida yalpi yem-xashak zaxirasining 29,8-64,4% ga ko‘payishiga olib keladi. Shu bilan birga ularning yem-xashak sifati yaxshilanadi.

Kalit so‘zlar: *mikroiqlim, ekish, Qizilqum, cho‘l, namlik, harorat, shamol rejimi, o‘simliklar, shamol ta’sirida uchish.*

Аннотация. Целью работы являлось – изучение влияния полосных пастбище защитных лесных насаждений на элементы микроклимата прилегающей территории. Установлено, что лесные полосы служат преградой на пути прохождения ветрового потока и снижают его кинетическую энергию на 40-50%, что положительно сказывается на улучшении таких важных элементов микроклимата как температура и влажность воздуха, испарение, а в зимний период и на снегоотложение. Растения под защитой лесных полос лучше растут и развиваются, что в конечном итоге приводит к увеличению валового запаса кормов на 29.8 – 64.4% и при этом улучшаются их кормовые качества.

Ключевые слова: *микроклимат, насаждения, Кызылкум, пустыня, влажность, температура, ветровой режим, растения, продуваемость.*

Abstract. The aim of this study was to investigate the influence of linear shelterbelt forest plantations on the microclimatic parameters of adjacent pasture areas. It was established that shelterbelts act as a barrier to wind flow, reducing its kinetic energy by 40–50%, which positively improves key microclimatic elements such as air temperature, humidity, evaporation rates, and snow accumulation in winter. Plants protected by shelterbelts exhibit enhanced growth

and development, ultimately increasing total forage yield by 29.8–64.4% while also improving its nutritional quality.

Keywords: *microclimate, plantations, Kyzylkum, desert, humidity, temperature, wind regime, vegetation, wind permeability.*

Introduction

Forest plantations play a threefold role in the life of humans and humanity as a whole. On the one hand, forests, being one of the main components of the human environment, significantly influence the climate, the availability of clean water and air, protect agricultural lands, provide comfortable living and recreational spaces, and preserve biodiversity. On the other hand, forests are a source of numerous material resources that humanity still heavily depends on and is unlikely to do without in the foreseeable future such as timber for construction, paper, and furniture production, firewood, and various edible and medicinal plants. Thirdly, forests form an integral part of the cultural and historical environment, under the influence of which the traditions and customs of entire nations are shaped. They serve as a source of livelihood, independence, and economic stability for a significant portion of the population, particularly in rural communities such as the villages of Uzbekistan's desert regions.

The different roles of forests are closely interconnected, and it is not always possible to draw a clear boundary between them, and their names are quite conditional. For example, protective forests in agricultural areas and desert zones primarily play a role in shaping the environment (protecting agricultural lands, pastures, settlements, and water bodies from adverse weather conditions). Shelterbelts and even individual trees play a significant role in protecting and preserving the fertility of adjacent lands, safeguarding the soil from the harmful effects of strong winds, late frosts and drying out.

Forestry in our country significantly contributes to employment by involving the cultivation of planting material (seedlings), the creation of forest plantations through seedling planting, and their subsequent care. Forest plantations, in turn, have a positive impact on the microclimatic elements of the adjacent area, which, in turn, creates favorable conditions for the local population's living environment.

Literature review

Studies by many scientists working in desert areas have shown that the microclimate of territories adjacent to forest plantations depends on wind speed. The physical explanation of the wind's influence on microclimatic elements is that when a wind flow meets a shelterbelt, acting as a turbulent aerodynamic grid, it breaks into numerous smaller streams, reducing its speed. As the air passes through the forest belt, it loses significant kinetic energy. In young *black saxaul (Haloxylon aphyllum)* shelterbelts in desert areas, the wind permeability in the lower profile is lower than in the middle and upper profiles, which is explained by the larger number of lateral branches of the saxaul in the lower profile. This is a distinguishing feature of pasture-protective forest belts compared to windbreaks in irrigated lands [1, 2]. The most effective impact of pasture-protective forest belts on the wind regime and, consequently, on the overall

microclimate is observed during the spring period, that is, during the vegetation period of the grass cover [3].

Studies conducted in the southeastern Kyzylkum, where natural pastures are found, have shown that the aerodynamic properties of pasture-protective forest belts, such as their wind permeability and porosity across the entire vertical profile, have a significant impact on the microclimatic elements of inter-belt spaces [4]. Research by authors conducting scientific work in desert zones of other regions confirms the experimental data obtained by us, indicating that changes in microclimatic elements are directly related to the wind permeability of forest belts [5, 6, 7].

Research Methodology

The influence of pasture-protective forest belts on microclimatic elements was studied in the southeastern Kyzylkum, specifically examining the wind regime, air temperature and humidity, soil temperature, evaporation, and snow retention. The wind regime was studied by recording wind speed at different distances from the pasture-protective forest belts. Observation points were established at distances of 5, 10, 15, and 20 heights from the forest plantations and on the open pasture (control). In the system of belt action, the observation points were placed along the leeward and windward sides. Wind speed was measured with a hand-held anemometer model MS-13, positioned at heights of 20, 50, 100, 150, and 200 cm above the ground from April to September, during morning, afternoon, and evening hours. Wind direction was determined using wind vanes. The windbreak efficiency of pasture-protective forest belts was primarily studied for winds perpendicular to them.

The extent of the influence of forest belts was studied by installing anemometers behind the forest belt at distances of 5, 10, 20, 30, 40, and 50 tree heights, measured from the trees growing in the belt and at the control site (distance is measured in tree heights. For example, if the height of the trees in the forest belt is 15 m, then a distance of 10 tree heights would be 150 m). Air temperature and humidity were recorded using a large model Assmann aspiration psychrometer. The instruments were placed on the ground surface and at a height of 1 meter above it. Observations were conducted from 7 AM to 7 PM with a 2-hour interval.

Evaporation (evaporability) was studied using glass containers with a capacity of 4 liters at different distances from the forest belts. The water level in the containers was measured in the morning and evening using a metal ruler.

Snow retention was studied during the snowy period at various distances from the forest belts and within the belts themselves. Measurements were taken with a ruler, and snow density was determined using a snow density gauge.

The influence of pasture-protective forest belts on pasture productivity was studied at the same distances from the forest belts as the other microclimatic parameters. The range of herbaceous vegetation, its condition, and biotechnical indicators were determined by size categories and seasons of the year. Zootechnical analysis was conducted, and the number of feed units and total forage reserves of the protected area were determined.

Analysis and results

The studies were conducted in pasture-protective forest belts consisting of black saxaul *(Haloxylon aphyllum)*, which were in a dense state. To improve their porosity and wind permeability, thinning cuts were made, meaning weak, suppressed, and diseased trees were removed.

Table 1. Aerodynamic properties of pasture protective forest belts.

Experimental options	Permeability, %				Difference in wind permeability between winter and summer, %
	Winter		Summer		
	Beneath the canopy	Throughout the vertical profile	Beneath the canopy	Throughout the vertical profile	
3-row belt untouched by cutting	35±1,4	44±1,6	17±0,6	27±0,9	17
3-row belt passed through cutting	45±1,2	54±1,7	35±1,1	42±1,3	12
2-row belt untouched by cutting	50±2,1	50±2,0	28±1,3	36±1,2	14
2-row belt passed through cutting	60±1,7	61±1,4	48±1,5	54±1,7	7

The study of wind speed at a height of 1.5 meters above the ground showed that under the protection of a belt with 27% permeability, wind speed ranged from 2.4 to 3.1 m/s, while with 54% permeability, it ranged from 3.0 to 3.6 m/s. In comparison, wind speed on open pastures was 4.4–6.0 m/s. The greatest reduction in wind speed was observed under the protection of a belt with 42% permeability, where the wind speed was 2.3–2.9 m/s, which was 48.8–52.6% lower than on open pastures. Our long-term studies have confirmed that the greatest reduction in wind speed occurs at a distance of 5 tree heights from the forest belt with 27% permeability, and the least reduction occurs with 54% permeability [8]. The meliorative effect of pasture-protective forest belts is directly dependent on their aerodynamic properties. During the winter period, the greatest reduction in wind speed is observed under the protection of pasture-protective forest belts with 44% permeability at a distance of 5 tree heights from the forest belts. As the distance from the belts increases, wind speed rises, but it remains lower than under the protection of belts with high permeability. To determine the optimal inter-belt distance on pastures, the extent of the influence of the belts was studied at heights of 0.50 and 1.50 meters above the ground.

Table 2. The range of influence of pasture protective forest strips on the wind regime.

Distance from the forest strip in heights (H)	**Wind speed (m/s) at height from the ground, m**		**Percentage of wind speed reduction at height, m**	
	0,50	**1,50**	**0,50**	**1,50**
5	0,9	1,6	62,5	56,8
10	1,4	2,1	41,7	43,3
15	1,6	2,6	33,3	29,7
20	1,8	2,8	25,0	24,3
30	2,1	3,1	12,5	16,2
40	2,4	3,7	-	-
50	2,4	3,7	-	-

The influence of pasture-protective forest belts on microclimatic elements extends up to a distance of 30-35 tree heights, which allows for the conclusion that it is advisable to place the belts 120-150 meters apart, as the height of the saxaul is 4.0 meters.

Depending on the permeability of the forest belts, air temperature and humidity undergo changes, which are influenced by the following factors: wind shelter, which reduces the exchange between the lower heated layers of air during the day and the cooled layers at night with the upper layers; the shading of the crowns, which lowers the air temperature during the day and raises it at night; and the density of the protected grass cover. Under the protection of the belts, air temperature also increases during the winter period. This phenomenon is of particular importance when inter-belt spaces are used as winter pastures. Winter snowstorms and piercing cold winds, as often occurs in desert conditions, create significant difficulties in livestock development, reduce productivity, and often lead to substantial losses in sheep and lamb populations. It has been established that in areas where protective plantations exist, these negative natural phenomena are minimized.

In January, the average daily air temperature on the pastures protected by forest belts with 44%, 50%, 54%, and 61% permeability was higher than on the open pastures by 1.0–1.5 °C, 1.0–1.2 °C, 0.8–1.0 °C, and 0.4–0.6 °C, respectively. Meanwhile, in the middle of the forest belts themselves, the temperature was higher by 2.6 °C, 2.5 °C, 2.4 °C, and 2.1 °C. This increase in air temperature under the protection of forest belts during the winter period is very important, as animals can shelter from the intense cold.

In the spring period, the effect of improving the microclimate in inter-belt spaces, particularly the temperature regime, profoundly affects biochemical processes in plants, generally causing positive physiological shifts. During this period, the air temperature on protected pastures increases by 2.5–3.2 °C.

In desert conditions, where the total annual precipitation does not exceed 200 mm, air humidity plays an especially important role. In the spring period, when the grass cover on pastures develops rapidly, relative air humidity is of crucial importance and mainly depends on wind speed and evaporation intensity. Our studies showed that the greatest increase in air humidity occurs in the morning (12.6% higher) and evening hours (18.9% higher) compared to open pastures.

In the desert, the lack of moisture is the main factor limiting the growth of herbaceous vegetation. Accumulating, conserving, and using water wisely is an important task for foresters. A significant amount of water is used for evaporation. This is a complex physical process that mainly depends on wind speed, the humidity deficit in the air, and the temperature of the evaporating surface. In May, forest belts reduce daytime evaporation by 25.4% and nighttime evaporation by 30.4%. Pasture-protective forest belts with 42% permeability reduce wind speed by 48.8-52.6% during the spring-summer period, lower air and soil surface temperatures, increase relative air humidity, and reduce the moisture deficit. They provide daily moisture savings of 5.8 mm in April, 6.7 mm in May, and 11.3 mm in June. On average, evaporation in these months was lower by 39.3%, 27.9%, and 38.7%, compared to open pastures.

The presence of pasture-protective forest belts, which reduce wind speed by 40-50%, contributes to snow retention [9]. With a belt permeability of 45%, the snow cover

thickness was 4.6 cm, and with 70% permeability, it was 3.5 cm, while on open spaces, it was 2.5 cm.

Pasture-protective forest belts, by improving microclimatic elements, contribute to better growth and development of herbaceous vegetation, which is also influenced by their permeability. We found that the forage yield depends on the permeability of the forest belts, as it reduces wind speed, which positively affects all microclimatic parameters. Under the protection of forest belts with 27%, 36%, 42%, and 54% permeability, the total forage yield was 2568 kg/ha, 2240 kg/ha, 2444 kg/ha, and 1888 kg/ha, respectively, while on open pastures, it was 2088 kg/ha.

The most nutritious plants in the Southeastern Kyzylkum are *Cynosurus cristatus* (279.84–342.96 feed units per ha), *Poa bulbosa* (174.30–224.70), and *Carex pachystylis* (29.38–53.56), while in open spaces, the number of feed units was as follows: 193.68, 160.30, and 17.16, respectively. On all the studied pastures protected by forest belts, the increase in herbaceous vegetation yield compared to open pastures ranged from 29.8% to 64.4%. Thus, the creation of pasture-protective forest belts will significantly increase the amount of forage on protected pastures and substantially raise the number of grazing animals.

Zoot technical analysis of Artemisia showed that on protected pastures, the plants are more nutritious, with 0.32-5.16% less fiber compared to open pastures. A similar pattern is observed in other desert plants.

Conclusion

The studies conducted in the Southeastern Kyzylkum on pastures protected by shelterbelt forest plantations showed that the forest belts, by reducing wind flow, contribute to the improvement of microclimatic elements, which positively affects the growth and development of herbaceous vegetation, leading to an increase in their total yield and even improving their forage value.

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UDC: 581.6, 631.5, 633.88

INFLUENCE OF THE NUTRIENT SUBSTANCE “PLANTASTIM” ON THE GROWTH AND DEVELOPMENT OF *EUODIA DANIELL II* AND MELIA AZEDARACH TREE SPECIES

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Annotatsiya. Ushbu ilmiy maqolada Euodia va Melia daraxt turlarining o‘sishi va rivojlanishining biometrik ko‘rsatkichlarining har tomonlama tahlili keltirilgan. Tadqiqot 70-80% namlik sifatida belgilangan ushbu turlar uchun optimal dala namlik sig‘im chegarasini o‘rganadi. Bu chegara Toshkent viloyatining sug‘oriladigan tipik bo‘z tuproqlari sharoitida baholanadi. Tahlil shuningdek, kuzatilgan ijobiy ta’sirlarni ham qamrab oladi, bu zotlarning tabiiy yashash joylarida o‘sishi va rivojlanishi haqida qimmatli ma’lumotlarni taqdim etadi.

Kalit so‘zlar: *Euodia, Melia, qishloq xo‘jaligi texnologiyasi, tuproq, dala namligi, biometrik o‘lchovlar, etishtirish, o‘sish va rivojlanish tezligi.*

Аннотация. В данной научной статье представлен комплексный анализ биометрических показателей роста и развития древесных пород Euodia и

Melia. В исследовании изучается оптимальный предел полевой влагоемкости для этих пород, который определяется как 70–80% влажности. Этот предел оценивается в условиях орошаемых типичных сероземных почв Ташкентской области. Анализ также охватывает наблюдаемые положительные эффекты, предлагая ценную информацию о росте и развитии этих пород в их естественной среде обитания.

Ключевые слова: *Euodia, Melia, агротехника, почва, полевая влагоемкость, биометрические измерения, возделывание, скорость роста и развития.*

Abstract. This scientific article provides a comprehensive analysis of the biometric indicators of growth and development for the Euodia and Melia tree species. The study investigates the optimal field capacity limit for these species, which is determined to be 70–80% moisture content. This limit is assessed under the conditions of irrigated typical sierozem soils of the Tashkent region. The analysis also encompasses the positive effects observed, offering valuable insights into the growth and development of these species in their natural habitat.

Keywords: *Euodia, Melia, agrotechnology, soil, field moisture capacity, biometric measurement, cultivation, growth and development rate.*

Introduction

Presently, 112 species of medicinal plants are sanctioned for utilization in official medicine within the Republic of Uzbekistan, with 80% of these being of natural provenance. The raw material reserves of naturally growing medicinal plants are also limited, and their protection, the study of their bioecological properties, the development of scientifically based methods for the proper use of raw material reserves and their propagation is one of the urgent problems.

According to Section VIII, Resolution No. PP-174 of the President of the Republic of Uzbekistan, dated May 31, 2023, the development of agricultural technologies for the cultivation of ornamental and medicinal Evodia daniellii and Melia seedlings in the Burchmulla State Forestry of the Tashkent region is delineated [1].

This serves, to a certain extent, in implementing the tasks defined in the Decree of the President of the Republic of Uzbekistan No. PP-251 dated May 20, 2022, "On measures for the cultivation and processing of medicinal plants, as well as the organization of their widespread use in medical treatment," and other regulatory legal acts in this field [2].

Research on the Melia azedarach (Melia azedarach L.) tree is of great importance, particularly in the context of Uzbekistan. The studies conducted by K. Jalolov and Kh. Tuychiev provide various insights into the biological characteristics and climatic adaptations of this tree. The following text is intended to provide a comprehensive overview of the subject matter. An understanding of the flowering period of Melia azedarach and its fruit seeds is essential for comprehending the impact of this particular plant species on the existing ecosystem and climate. The fact that the flowering period of this tree lasts 15 days, which is significantly influenced by air temperature and humidity, demonstrates the plant's adaptability to the climate. It is worth noting that the plant's capacity to thrive in any area of the Fergana Valley, in conjunction with its

resilience to extreme temperatures and aridity, facilitates its successful cultivation in diverse ecological conditions. This resilience makes it potentially useful for large-scale landscaping and application in landscape design. The research results also underscore the significance of Melia azedarach in the study of various aspects of plant-environment interactions over an extensive period of time. Such research will contribute to achieving successful outcomes in implementing projects aimed at ensuring environmental sustainability and protecting various elements of the ecosystem [3].

The flowering and seed production of introduced species in new conditions serve as important indicators. This phenomenon can be attributed to the observation that flowering and fruiting processes are only observed in plants if their requirements for new environmental factors are met. Consequently, the successful propagation of offspring is contingent upon the acclimatization of the plants. This state of affairs gives rise to the necessity of conducting exhaustive scientific research [4, 5].

According to the research conducted by M.A. Mamadjanova and N.N. Mamanova, the initial development, morphogenesis and growth characteristics of seedlings, biomorphological structure, seed germination, and morphological parameters of leaves of the ornamental plant *Tetradium daniellii* were determined under the conditions of the Andijan region. Based on the analysis of the research results, it was found that the successful growth and development of seedlings of the introduced species in temperate climate conditions depend on the formation of the above-ground parts, root system, climate, soil factors, and agrotechnical treatment. The germination rate of *Tetradium daniellii* seeds is very low, with only 10% of seedlings obtained when sown in the ground, while the remaining seeds germinate in subsequent years. To address this issue, it is recommended to utilize biostimulants and transfer the seeds to biohumus. Moreover, it has been documented that the root system of this specimen is notably robust, constituting approximately two-thirds of its total body mass. This attribute enhances its viability [6].

Research Methodology

Field experiments, phenological observations, biometric measurements, and soil and plant sampling were conducted using B.A. Dospekhov's “Methodology of Field Experiments” manual [7]. The seasonal development of plants was studied using I.N. Beydeman's “Methodology for Studying Plant Phenology” [8], and biometric calculations were performed using G.N. Zaitsev's “Methodology of Biometric Calculations” [9]. The objects of the research were the tree species Evodia *(Evodia daniellii)* and Melia *(Melia azedarach)* under typical sierozem soil conditions.

Analysis and Results

Studies were conducted on the influence of "Plantastim" (a growth and development regulator) on the biometric parameters of Evodia and Melia trees. The research examined the effects of applying "Plantastim," which regulates the growth and development of Evodia and Melia trees, in the soil and climatic conditions of the Darkhan experimental farm on irrigated typical sierozem soils in the Tashkent region. The substance "Plantastim" was primarily applied through root feeding twice during periods of vigorous growth and budding. In the studies, 100, 200, 300, and 400 ml of

the microbiological biostimulator Plantastim were used per 10 liters of water. Regular water was used as a control.

The research results obtained at the experimental plot of the Darkhan experimental farm in the Tashkent region showed the influence of the substance "Plantastim" on the biometric indicators of the growth and development of Evodia seedlings. Specifically, in the control group, the height was 128.1 cm and the stem diameter was 16.5 mm; in the second variant, 151.6 cm and 20.3 mm; in the third variant, 174.5 cm and 25.4 mm; in the fourth variant, 213.3 cm and 33.4 mm; in the fifth variant, 191.2 cm and 29.1 mm respectively. The optimal variant with the application of 10 l/300 ml, compared to the control, increased the height of the seedlings by 166% and the stem diameter by 201% (Table 1 and Figure 1).

Figure 1. Biometric indicators of the growth and development of Evodia seedlings.

Table 1. Biometric indicators of the growth and development of Evodia seedlings *(Darkhan Experimental Farm).*

Variants	Average, M±n H-height, cm D-diameter, mm	Σ	V	n	Compared to control %	t	p
Control	H 128.1±0.63	4.43	3.46	50	100	18.1	0.5
	D 16.5±0.27	1.91	11.53	50	100	2.3	1.6
100 ml	H 151.6±0.63	4.43	3.46	50	118.36	21.4	0.4
	D 20.3±0.44	3.13	18.96	50	122.87	2.9	2.2
200 ml	H 174.5±1.85	13.07	10.21	50	136.23	24.7	1.1
	D 25.4±0.32	2.26	13.69	50	153.44	3.6	1.3
300 ml	H 213.3±1.15	8.14	6.36	50	166.33	30.1	0.5
	D 33.4±0.52	3.69	22.30	50	201.63	4.7	1.6
400 ml	H 191.2±0.83	5.89	4.60	50	149.27	27.0	0.4
	D 29.1±0.69	4.87	29.44	50	175.80	4.1	2.4

When observing the influence of the substance “Plantastim” on the biometric indicators of the growth and development of melia seedlings, the height in the control was 118.3 cm, the stem diameter 13.3 mm; in the second variant 137.2 cm, diameter 16.5 mm; in the third variant 168.7 cm, 20.3 mm; in the fourth variant 196.4 cm, 25.1 mm; in the fifth variant the height was 174.1 cm, diameter 24.3 mm.

Table 2. Biometric indicators of growth and development of melia seedlings *(Darkhan Experimental Farm)*

Variants	Average, M±n H-height, cm D-diameter, mm	Σ	V	n	Relative to control %	t	p
Control	H 118.3±0.55	3.88	3.28	50	100	16.7	0.5
	D 13.3±0.21	1.50	11.23	50	100	1.9	1.6
100 ml	H 137.2±0.81	5.72	4.84	50	115.97	19.4	0.6
	D 16.5±0.23	1.61	12.05	50	123.85	2.3	1.4
200 ml	H 168.7±1.69	11.96	10.11	50	142.63	23.9	1.0
	D 20.3±0.37	2.58	19.37	50	152.03	2.9	1.8
300 ml	H 196.4±0.53	3.76	3.18	50	166.03	27.8	0.3
	D 25.1±0.80	5.69	42.61	50	188.46	3.6	3.2
400 ml	H 174.1±1.39	9.80	8.28	50	147.18	24.6	0.8
	D 22.3±0.25	1.80	13.50	50	166.95	3.2	1.1

The optimal variant with the application of 10 l/300 ml, compared to the control, increased the height of the seedlings by 1.6 times and the stem diameter by 1.8 times (Table 2 and Figure 2).

Figure 2. Biometric indicators of the growth and development of melia seedlings.

Conclusions

1. An investigation was conducted to ascertain the impact of the application of the optimal “Plantastim” substance on the biometric indicators of the growth and development of melia seedlings in irrigated typical sierozem soils of the Tashkent region. The experimental design involved the comparison of the results obtained with the traditional method and those obtained with the application of 10 l/300 ml of the “Plantastim” substance. The results showed a significant increase in the height of the seedlings, with an average increase of 166%, and a substantial increase in the stem diameter, with an average increase of 201%.

2. The present study investigated the influence of the substance “Plantastim” on the biometric indicators of Melia seedlings' growth and development. When employed

at a rate of 10 liters per 300 milliliters in comparison to the conventional approach, it resulted in an augmentation of seedling height by 166% and an increase in stem diameter by 188%.

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SOCIAL ASPECTS OF ENHANCING READING MOTIVATION

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Annatatsiya. Mazkur maqolada mutola motivasiyasining ijtimoiy xususiyatlari, uning tarkibiy jixatlari sosiologik tahlil nuqtaiy nazaridan ochib berilgan. Shuningdek, unda mutola motivasiyasi tushunchasi, uning turli darajalari konseptual tahlil qilingan. Qolaversa, mutola qiziqishlari kitobxonlik didi, matn tanlash kabi xususiyatlarga ham diqqat qaratilgan. Bundan tashqari maqolada, mutola motivasiyasi tahliliga bag‘ishlangan sosiologik, psixologik nazariyalar o‘zaro qiyosiy tarzda keltirib o‘tilgan.

Kalit so‘zlar: *mutolaa, motivasiya, kitobxon qiziqishi, ijtimoiy funksiya, sosial status, ijtimoiy nufuz, kitobxon extiyoji, shaxs faoliyati.*

Аннотация. В данной статье раскрываются социальные особенности мотивации к чтению и её составные элементы с социологической точки зрения. Также дано концептуальное объяснение понятия мотивации к чтению и её различных уровней. Кроме того, внимание уделено таким аспектам, как читательские интересы, вкус к чтению и выбор текста. Помимо этого, в статье в сравнительном плане рассматриваются социологические и психологические теории, посвящённые анализу мотивации к чтению.

Ключевые слова: *Чтение, мотивация, читательский интерес, социальная функция, социальный статус, социальный престиж, потребность читателя, деятельность личности.*

Abstract. This article reveals the social aspects of reading motivation and its structural components from a sociological analytical perspective. It also provides a conceptual analysis of the notion of reading motivation and its various levels. Furthermore, attention is given to aspects such as reading interests, readers' taste, and text selection. In addition, the article presents a comparative overview of sociological and psychological theories related to the analysis of reading motivation.

Keywords: *Reading, motivation, reader interest, social function, social status, social prestige, reader's need, personal activity.*

Introduction

The demands, interests, value orientations, and motives that define a person’s inner world are manifested not only through individual cultural activity but also through social groups and associations. The ways in which these are expressed can vary. They

are needs shaped by cultural values and are satisfied in the processes of expressing, preserving, disseminating, and assimilating these needs. The demands and interests reflected in human consciousness become concrete internal stimuli-activity motives-that drive behavior. A motive refers to the human thoughts, aspirations, and emotions associated with understanding a need and prompting action. This feature is closely linked to the reading process, where a person selects a particular text based on their needs.

Literature Review

The theoretical and methodological basis of this article includes the works of foreign scholars such as A.N. Vaneev (“Reader’s Taste and Needs”), L. Gudkov (“The Crisis of Intelligentsia and Mass Reading”), and G. Dubin (“Mass Literature and Mass Reading”), as well as Uzbek scholars like A.A. Umarov (“The Formation of Reading Culture in Society and Library Issues”) and M. Rasulov and N. Roziboeva (“Librarianship – A Dynamic Force”). The article also employs general scientific philosophical methods such as comparative analysis, synthesis, and others.

Research Methodology

1) Aspiration for Results: At this stage, the means of achieving the result are not fully considered yet. For example, the activity of a student striving to acquire knowledge and skills in a particular field.

2) Aspiration to Engage in the Activity Itself: Here, full attention is not given to the ultimate result, but rather to engaging in the activity itself. At this stage, a person derives certain satisfaction from demonstrating their activity. For example, the habit of reading books during leisure time.

3) Engaging in Activity for Unrelated Purposes: This involves performing an activity not for its direct goal, but for other unrelated reasons. For example, reading not to acquire knowledge, but simply to pass the time.

4) Aspiration for Social Recognition: The desire for one’s activity and, through it, oneself to be evaluated by society (for example, striving to be seen as a “cultured” or “well-read” person).

Analysis and Results

As a result of the interaction of cultural demands, value orientations, and conscious interests, the psychological and spiritual mechanism of motivation for any social activity is formed [1]. The mechanism of motivation essentially expresses a person’s specific activity toward achieving a certain goal. Demand transforms into interest, and interest into a goal. All of these, together with value orientations, become the internal drivers, motivating forces, and motives of activity. For example, aesthetic demands or scientific-production needs lead to an interest in reading, which in turn creates a specific, planned goal-such as going to the library; value orientations determine the type of book chosen: science fiction, detective, classical or modern literature, as well as monographs, textbooks, or scientific articles. As a result, the desire to engage in activity arises, prompting the individual to read the literature they have chosen.

The motives that drive people to engage in the same activity, such as reading, may differ from person to person. Motives are shaped under the influence of various

objective and subjective factors, and before engaging in any activity, every individual experiences a stage of conflict between motives. This conflict of motives is often a process of internal collisions between “I want” and “I don’t want,” “I should” and “I shouldn’t,” etc.

The need for reading is the relationship of a social subject (individual, group, society) to reading as a vital, necessary activity. The historical need for reading arose simultaneously with the emergence of writing and developed in line with the spread of printed books; it has also found its place in the thinking of people in the new era as they consume printed information.

The formation of the need for reading begins in childhood, from preschool age, under the influence of cognitive activity and the social environment (for example, adults reading aloud). However, learning to read, consolidating the skill, or reading as part of preparing lessons, does not in itself form a need for reading. Only when reading becomes a regular activity that meets spiritual needs and personal interests does it become an independent need with the potential for self-development. The need for reading is particularly noticeable when a person cannot satisfy their demand due to a shortage of published information. A person whose cultural needs are regularly met may not feel their need for reading. However, a reader who faces a shortage of published information feels the lack of satisfaction of their cultural demand more acutely. Thus, the inability to satisfy the need for reading due to objective factors is felt more strongly than not reading due to subjective reasons, such as the reader’s own lack of initiative.

The awareness of the need for reading motivates the reader to be active, to try to compensate for the lack of published information. The differential content of the need for reading is determined by the interaction of people’s social roles and types of activity. It depends on a person’s level of education, general culture, including reading culture, and many other personal and psychological factors.

The importance of the need for reading varies. The most significant needs for society and the individual arise in the processes of forming a scientific worldview, increasing general, political, and professional knowledge, in scientific, technical, and artistic creativity, and in aesthetic enjoyment. The need for reading also includes the necessity of alternating types of activity, the desire for active rest, or the need for psychological relief.

Motives and stimuli that play an important role in human activity have been widely studied in psychology and pedagogy. In particular, there are various definitions of reading motives and stimuli. For example, the book “Working with Readers” defines reading motives as “the internal experiences based on how well possible situations, norms, levels, and qualities in the reader’s imagination correspond to reality” [2].

Summarizing the available definitions, reading motives can be described as the internal desires and inclinations of the reader, based on their preliminary ideas about how well the content and quality of a particular book meet their needs.

A consciously formed interest, as a personal characteristic of the reader (for example, “I chose this book because I like science fiction and adventure works”), is also a motive for reading. For a librarian, the main thing is not the external forms of reading motives, but their content, i.e., the expected result by the reader. What result

does the reader expect from reading the selected work, and does the book, by its qualities and characteristics, meet the reader's expectations? The answer to this question reveals the reader's attitude toward a particular piece of literature and the criteria by which they evaluate the book.

Some scholars divide reading motives related to consulting literature in a particular field into business and self-improvement motives. Business motives arising from professional needs are manifested in fulfilling public assignments, completing tasks given at school, college, or similar institutions. However, it is more appropriate to call such motives personal interests. Because motives directly related to interest in a specific subject, topic, or event cannot be called "self-improvement" motives. Only when the process of reading is accompanied by business motives, and there is orderliness, regularity, and continuity in achieving the set goal, can we talk about the motive of self-improvement. Personal interests do not always rise to the level of the motive for self-improvement in the reader.

Levels of motivation have been deeply studied in scientific literature [3]. In particular, B.G. Umnov organized readers' responses about reading motivation using scales as follows [4]:

0 – Does not read.

Reads:

1 – Due to obligation;

2 – Sometimes due to interest;

3 – Due to obligation and sometimes interest;

4 – Always due to interest;

5 – Due to obligation and always due to interest.

This scale defines different levels of motivation. They can be described as follows:

Due to obligation. The motives at this level include duty, task, listening to someone's advice, external necessity, expectation of reward or public approval, and others. Reading activity may have a compulsory nature, be difficult, and require willpower.

Sometimes due to interest. The motives at this level are the desire to satisfy curiosity or interests that arise from a particular situation or are unstable. Reading activity is characterized by a positive and emotional attitude toward reading and a desire to explore a particular issue.

Here is the English translation of your text:

If a reader does not develop a strong desire to deeply familiarize themselves with an object, event, or similar, their unstable interest gradually fades. Despite some alleviation of psychological tension, the reading activity cannot become regular.

Due to obligation and sometimes interest. In this case, the motives of the first and second levels combine.

Always due to interest. The motives at this level include the aspiration for intellectual activity, the desire to enhance one's spiritual capabilities, and the ability to express one's own thoughts. Interest becomes a constant activator of the thinking mechanism. Reading takes on the character of increasing one's knowledge and self-improvement, becoming a source of pleasure and enthusiasm. The reading process itself is distinguished by a high level of organization. Interests that arise based on the desire to

learn and acquire knowledge in a particular field or activity stabilize and become more active. During the development process, a person's active attitude toward their subject, science, or passion can become a strong personal need.

Due to obligation and always due to interest. The motives of the third and fourth levels combine. The optimal combination of business motives and reading interest gradually becomes a personal, regular (stable) characteristic and an integral part of the process of personal orientation. This type of reading can be evaluated simultaneously as both reading for business purposes and reading for self-improvement.

1. Practice shows that a reader's interest is a strong supportive factor in the ability to use a book. Under conditions where the same mental and volitional effort is expended, the possibility of understanding an interesting book is greater than that of a boring book, and the level of assimilation of an interesting book is higher. When a book is read with interest, comprehension of its content becomes easier.

2. Creating a certain positive emotional environment in this process is very important for making reading interesting. Such reading gives pleasure to the reader, and the stronger the interest in the book, the greater the enjoyment derived from reading it.

Interest activates and directs processes such as assimilation, memory retention, imagination, thinking, and willpower, ensuring the stability of attention and emotional strength. Genuine interest leads to the development of a person's abilities and talents and defines many of their character traits. Therefore, studying readers' interests is extremely important to make working with readers in the library a continuous and uninterrupted educational process.

Studying all types of reader interest is necessary to anticipate the content of reading and to shape the development of readers' interests in an optimal direction.

A reader's direct interest in a book is reflected in the positive emotions experienced during the reading process, the stability of unconscious attention to the book's content, and a strong desire and aspiration to continue reading. If a reader enjoys following the author's line of thought while assimilating new information in a scientific work or feels pleasure under the influence of images in a literary work, it indicates that they are deeply engaged in reading and have entered a state of interest.

To understand the laws governing the formation of reader interest, the following should be considered collectively:

a) The objective aspect of interest (external influence on the desire to read, a person's genuine, real needs for reading);

b) The level of awareness of the need for reading by the individual;

v) The subjective aspect of interest (the goals and motives of reading as internal desires and wishes of the person);

g) The manifestation of interest in the regular content and nature of reading.

Every person expresses the attitude of their social group and the entire society toward books to some extent, but at the same time, they also manifest personal interests that do not always align with those of the group or community. If we can distinguish the characteristics typical of the entire group within a reader's personal interests, we can gain an understanding of the content of social interest.

Conclusion

1. A motive is a human thought, aspiration, and emotion related to the understanding of a certain need and that stimulates the execution of an activity.

2. In the process of human activity, it is possible to emphasize reading motives that strive for results, aim to acquire knowledge and skills, dedicate free time to reading, and aspire to be cultured.

3. The motivation mechanism essentially expresses a person's specific activity aimed at achieving a certain goal. In this process, a need turns into interest, and interest becomes a goal. The more work is done carefully and through practice during the reading process, the more skills, abilities, and knowledge expand in that activity.

4. By its nature, reading is a voluntary activity. Certain motives are embodied in the factors of pursuing socially useful goals, deeply understanding their social value, and showing strong aspiration, persistence, and determination to achieve these goals.

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CHARISMATIC TRAITS AND OPPORTUNITIES IN MODERN MANAGEMENT

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Annotatsiya. Maqolada xarizmatik rahbarning boshqaruv jarayonidagi qadamlari va motivatsiyasi ko‘rib chiqildi. Hozirgi vaqtda xarizmaga ijtimoiy-psixologik hodisa sifatida qaraladi, uni shaxsning o‘z sa’y-harakatlari bilan, hamda jamiyat vakillari tomonidan ham shakllantirish va rivojlantirish mumkin. Muallif etakchilikning mohiyati va samaradorligi muammosiga bir qator ilmiy yondashuvlarni taqdim etdi. Maqolada ilmiy nazariylar asosida etakchilik tushunchalari tahlil qilinadi va guruhlarga bo‘linadi. Xarizmatik boshqaruvning afzalliklari tasvirlangan, shuningdek, xarizmatik rahbarning tashkilot maqsadlariga erishishdagi asosiy fazilatlari tasvirlangan. Tashkilotda xodimlarni rag‘batlantirish uchun xarizmatik boshqaruv yo‘llari taqdim etiladi.

Kalit so‘zlar: *xarizma, menejment, rahbar, etakchilik tushunchalari, samarali etakchilik, boshqaruv sotsiologiyasi.*

Аннотация. В статье рассматривается шаги и мотивация хоризматичного руководителя в процессе управления. В настоящее время харизма рассматривается как социально-психологический феномен, который может быть сформирован и развит как усилиями собственной личности, так и представителями того сообщества, в которую она реально включена. Автором представлен ряд научных подходов к проблеме сущности и эффективности лидерства. В статье проанализированы и разделены на группы концепции лидерства в зависимости от их теоретических оснований. Описаны преимущества харизматического управления, а также дано описание основных качеств харизматичного лидера в достижение целей организации. Представлены пути харизматического управления для мотивации сотрудников в организации.

Ключевые слова: *харизма, управление, руководитель, концепции лидерства, эффективное руководство, социология управления.*

Abstract. The article examines the steps and motivation of a charismatic leader in the management process. Currently, charisma is considered a socio-psychological phenomenon that can be formed and developed both by the efforts of one’s own personality and by representatives of the community in which it is actually included. The author presents a number of scientific approaches to the problem of the essence and effectiveness of leadership. Leadership concepts are analyzed and divided into groups depending on their theoretical foundations. The advantages of charismatic management are described, as well as a description of the main qualities of a charismatic leader in achieving the goals of the

organization. The ways of charismatic management to motivate employees in the organization are presented.

Keywords: *charisma, management, leader, leadership concepts, effective leadership, sociology of management.*

Introduction

To date, there is little doubt that the issue of charisma holds a marginal status, i.e., it is explored across a range of disciplines: philosophy, sociology, political science, and others. In psychology, there is no unambiguous interpretation of the phenomenon of charisma, although it is increasingly addressed by researchers studying personality, leadership, interpersonal relationships, career success, the psychology of freedom, and the psychology of success [1].

Every enterprise or organization faces the task of increasing the efficiency of its activities. The successful resolution of this task largely depends on the quality of personnel management. Accordingly, there arises the need to improve management and align it with the conditions and goals of the organization. A charismatic leader must understand that the better their relationship with subordinates, the more effective the production will be. The main characteristic of the relationship between a charismatic leader and subordinates is their direct communication. Therefore, business communication ethics in management is fundamental.

Literature Review

The works of Weber M., Fromm E., and several other foreign psychologists, such as Kretschmer E. and Sosland A., formed the theoretical construct of charisma as a socio-psychological phenomenon. At the beginning of the twentieth century, Weber M. described charisma as an extraordinary quality of an individual, due to which they are perceived as possessing supernatural, superhuman, or at least exceptional powers. Such a person has abilities and traits inaccessible to others and is seen as a role model, worthy of being a “leader.” According to Weber, charisma is, above all, a product of the imagination of others. He noted that the concept of charisma applies to a certain personal quality that distinguishes an individual from ordinary people and causes them to be regarded as possessing exceptional abilities [2]. Describing the process of decision-making and motivation of a charismatic leader, Enkelmann N. states that their success greatly depends on the ability to express thoughts correctly and positively. It is important to form a personal vision, communicate it to others, and convince them of its significance. “This vision or concept must affect not only the mind but must deeply resonate with the essence of a person, touching on feelings, needs, and desires. At the same time, persuasion is just the first step. It’s not enough. People must identify with this vision, internalize it, and be inspired by a shared goal. This is only possible if they see meaning in the vision for themselves” [3]. Analyzing the qualities of a modern leader, Bekmuradov M. notes: “A leader is not someone who simply possesses typical traits or thinking patterns. A leader is someone who is always a few steps ahead of others, more hardworking, more dedicated to their work, more loyal, more knowledgeable, and smarter than others” [4].

Research Methodology

The analysis of domestic and foreign studies aimed at exploring charisma as a socio-psychological phenomenon allowed for the identification of its spatial and temporal characteristics and its relationship to the social context. Today, charisma is viewed as a socio-psychological phenomenon that can be formed and developed both through an individual's own efforts and by the communities to which they belong. This is especially relevant to professional groups, where a charismatic individual can manifest and represent themselves appropriately.

Analysis and Results

Studies show that a charismatic leader spends up to 80% of their working time on managerial communication. Therefore, only a charismatic leader who can organize effective business communication can be productive. This task cannot be solved without knowledge of the psychological foundations of communication and business communication ethics. The main condition for effective communication is the leader's awareness that the achievement of organizational goals increases with the proper organization of communication and the creation of an atmosphere of mutual understanding, trust, and cooperation. Considering feedback features, using psychological insights to overcome communication barriers, choosing the appropriate type of communicative influence, and applying ethical communication advice will significantly reduce time costs for both the charismatic leader and subordinates. Throughout life, a person intuitively learns the norms and rules of communication. But for a leader, this is clearly not enough. Therefore, systematic training in aspects of business communication with a reliable scientific basis is necessary. An important task is the scientific development of communication issues specific to managerial activity. John D. Rockefeller, having achieved the pinnacle of success, once said: "The ability to deal with people is as purchasable a commodity as sugar or coffee. And I will pay more for that ability than for any other under the sun" [5].

The problem of leadership and management is one of the fundamental problems in the psychology of management, as these processes not only relate to the integration of group activities but also psychologically describe the subject of this integration. When the issue is framed as a "leadership problem," this merely pays tribute to the social tradition of studying the phenomenon. Today, the problem should be more broadly addressed as the problem of group management. Therefore, it is crucial to define and differentiate the terms "leader" and "charismatic leader."

Leadership and management exist wherever there is power and organization. Effective management must always be combined with leadership. Leadership is the ability to influence individuals or groups by directing efforts toward achieving organizational goals. There are many ways to influence others and lead people.

Sociology and psychology of management not only define leadership along with other humanities but also develop leadership theories from the perspective of influence effectiveness and behavioral styles for directing people's efforts toward organizational goals. It is worth highlighting a number of scientific approaches to the essence and effectiveness of leadership. Among them is the trait-based approach or personality theory of leadership. Leadership is one of the unique phenomena of social life,

associated with the exercise of authority. It is inevitable in any civilized society and permeates all spheres of activity.

Since Weber's time, three forms of charisma have been distinguished: charisma as a symbolic solution to internal problems; as protection against external power through aggression; and as an attribution of traits to a leader that satisfy the interests of others [6].

All charismatic leaders possess authority. To build their image, a leader uses language that the public can respect, admire, and obey. Weber A. suggested distinguishing between positional, professional, and personal authority. Positional and professional authority are components of personal authority; they may enhance it, but cannot replace it. A person with natural authority influences others through personal qualities. Charismatic individuals can achieve high results and simultaneously inspire others to do the same [7]. A charismatic leader is someone who leads a particular social group due to their exceptional personal qualities—charisma. They live and act fearlessly, as if protected by fate. The successes of their followers are attributed to them, while failures are often reinterpreted or glorified (e.g., retreat as salvation, losses as necessary sacrifices, even absurd statements as profound wisdom). Such a leader is seen as a visionary, a colossal historical figure fulfilling a "historic mission" and opening new horizons. The relationship between a charismatic leader and their group implies complete dedication and blind faith.

A charismatic manager does not strictly control employees and paradoxically does not materially reward them either. Nevertheless, subordinates work well-driven by respect or love for the leader. Charismatic management is the only truly effective way to lead a business-or, arguably, people in general. The advantage of charismatic management is that it allows many managers to step away from routine tasks and focus on strategic development and implementation-becoming a leader in the truest sense. With charismatic management, you don't need to spend extra money or energy on motivating employees. A simple word of praise from the leader can boost productivity. Continuous self-development, acquiring new skills and knowledge, engaging in extreme or unusual hobbies, knowing rare languages, traveling to exotic places-all these contribute to maintaining or even enhancing charisma in the eyes of others.

Conclusion

Leadership theories can be categorized into three groups based on their theoretical foundations:

1.Those that view leadership as a universal human activity with consistent patterns across all areas of society.

2.Those that equate leadership with management, considering formal authority a sufficient condition for leadership, and describing leadership activities primarily in legal and administrative terms.

3.Those that regard leadership as a specific social phenomenon that cannot be reduced to psychological, economic, or legal principles. Leadership, in this view, is implemented through a concrete mechanism—one of the essential political institutions.

The image of a charismatic leader consists of a set of qualities associated with a certain individuality. Within an organization, the ethical standards of the top leadership

significantly influence the moral climate. Their behavior serves as an example, shaping a cultural context more impactful than ethics trainings, formal norms, or codes of conduct adopted by many organizations.

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TELECOMMUNICATIONS IN UZBEKISTAN IN 2017-2021: THE HISTORY OF THE RISE OF THE SYSTEM

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Annotatsiya. Mazkur maqolada 2017-2021 yillarda mamlakatimizda telekommunikatsiya tarmog‘ini rivojlantirishning asosiy yo‘nalishlari belgilab olingan. Shu bilan bir qatorda magistral raqamli transport tarmog‘ini tashkil etish, raqamlashtirish darajasini oshirish va mahalliy telefon tarmog‘ini rivojlantirish hamda xizmatlarining yangi turlarini joriy etish borasida tizmda olib borilgan islohotlar telekommunikatsiya xizmatlarining yangi turlarini joriy etish borasida amalga oshirilgan ishlar ko‘rsatib o‘tilgan.

Kalit so‘zlar: *Telekommunikatsiya, optik tola, internet, uzmobayl, provayder, operator, mobil aloqa.*

Аннотация. В статье обозначены основные направления развития телекоммуникационной сети нашей страны в 2017-2021 годах. При этом был особо отмечен перечень реформ, проводимых в сфере организации магистральной цифровой транспортной сети, повышения уровня цифровизации и развития местной телефонной сети, а также внедрения новых видов услуг, а также проведенная работа по внедрению новых видов услуг электросвязи.

Ключивые слова: *Телекоммуникации, оптоволокно, интернет, Uzmobile, провайдер, оператор, мобильная связь.*

Abstract. The article outlines - the main directions of development of the telecommunications network of our country in 2017-2021. At the same time, a list of reforms carried out in the field of organizing the backbone digital transport network, raising the level of digitalization and development of the local telephone network, as well as the introduction of new types of services, as well as the work carried out to introduction new types of telecommunications services was especially noted.

Keywords: *Telecommunications, fiber optics, internet, Uzmobile, provider, operator, mobile communications.*

Introduction

During the years of Independence, new infrastructures related to the industry were created in Uzbekistan at the time of fundamental changes in the communication system. Over the past time, the role and role of the means of telecommunications in the life of society has increased immeasurably. A large number of communication channels, like an invisible and huge network, covered the territory of our republic. Such updates are important in the process of development of the communication system and in the socio-cultural life of the population. In the conditions of liberalization of the life of the state and society in our republic, the development of the system of Telecommunications has become an important direction of deepening and reviving democratic reforms. The process of their activities in the system in our country, their material and technical condition, training of personnel, coverage with them has not been systematically studied. Such updates call for the development of the telecommunication system to study the process and its place in the socio-cultural life of the population within a separate topic.

Literature review

General information on the history of the development of the telecommunication system in our country during the years of independence Zhurayev L.N., Mamatqulov G.R., Khudoyberdiyev R.F., Akhtamov B.I., Yusupov I.S., Kamolitdinov R.Z., Gultoorayeva N.X., Khojaev N.S., Normurodov A.D., Isayev R.I., Atametov R.K.

Some historical information also appears in the books of experts such as Rajapova. In parallel, the directions of development of the field of telecomunication indicate the

need to bring into scientific circulation and draw scientific conclusions given articles on the topic in newspapers, magazines, and websites that provide information on it.

Research Methodology

This study examines the development of Uzbekistan's telecommunications network from 2017 to 2021 using qualitative and quantitative analysis of industry reports, government documents, and statistical data. Key sources include official publications from Uzbektelecom JSC, regulatory bodies, and international reports on telecommunications infrastructure.

Analysis and Results

Since September 10, 2018, the telecommunications network of the Republic of Uzbekistan has switched to a 9-digit telephone digital system. Since October 1 of this year, only 9-digit telephone numbers have been valid for subscribers of the city of Tashkent and the Tashkent region. By the end of the year, other areas had also undergone a transition to a 9-digit telephone digital system on a separate schedule. In 2018, the total length of fiber optic networks was 26.6 thousand kilometers[1]. In the fall of 2019, COVID-19, which began in Wuhan, China, began to spread rapidly around the world. On March 16, 2020, the first patient with this disease was identified in our country. As a result, quarantine rules were tightened in our country, among many countries, educational institutions, enterprises, and organizations were transferred to remote work in home conditions [2].

In 2019, the total bandwidth of the international Internet connection was 1,200 Gbit/s, enabling Internet access through the switching center at 750 Gbit/s, and the network load rate was 76.6 percent. From January 1, 2020, the tariff for internet services to operators and providers was reduced by 34% compared to the same period last year, at 56.0 thousand rubles per 1 Mbit/s. The number of Internet service users is 22 mln. increased from, of which the number of mobile internet users is 19 mln. founded. In 237 facilities in the Republic, the main telecommunication networks were expanded, telecommunication equipment was modernized, the bandwidth of the main telecommunication networks was increased to 200 Gbit/s at the inter-provincial level, and 40 Gbit/s at the inter-district level.

In 2020, the total length of fiber optic networks was up to 68.6 thousand kilometers, and in 2020, 1 million broadband internet connection ports were installed, bringing the total number to 3 million. As a result of the work on the modernization of the available production capacity, the total bandwidth of the connection to the International Internet network increased by 10 times, to 1,200 Gbit/s. up to. The bandwidth of the data transmission network increased by 2 times at the level of regional centers, and by 4 times at the level of district centers. Mobile communication has also been intensively worked on the development of networks. As of 2020, there are more than 31.7 thousand mobile base stations in the Republic, with mobile coverage of settlements reaching up to 98 percent. In 2020, a total of 12,867 kilometers of fiber optic communication lines were pulled to 7,150 (70 percent) public education facilities, 4,581 (80 percent) preschools, and 2,747 (78 percent) health facilities, and high-speed Internet connectivity [3].

The digital economy, first of all, assumes the creation of broadband internet ports, the laying of fiber-optic communication lines. With this in mind, serious attention has been paid to this task over the past five years. In 2020 alone, almost 800 thousand broadband internet ports were created and 12 thousand kilometers of fiber-optic communication lines were laid[4]. 50,000 km in the direction of the development of telecommunication infrastructure by the end of 2021. Fiber-optic communication lines were built, and it was envisaged that they would be brought to a total length of 118.6 thousand kilometers. In order to develop an international and inter-city telecommunication network, the total bandwidth of the connection to the international internet network will be brought to 1200 Gbit/s. An additional 24 thousand km in the Republic for the first six months of 2021. Fiber optic communication lines were built and put into operation. In the direction of developing telecommunications infrastructure, it was planned that by the end of 2021, 50 thousand kilometers of fiber optic communication lines would be constructed, bringing the total length to 118.6 thousand kilometers. In order to develop international and intercity telecommunications networks, the total international internet bandwidth was to be increased to 1,200 Gbit/s. During the first six months of 2021, an additional 24 thousand kilometers of fiber optic communication lines were built and put into operation across the Republic.

In previous years, 2,100 kilometers of fiber optic communication lines were laid in 2018, 10,000 kilometers in 2019, and 32,000 kilometers in 2020. At the same time, the installation of an additional 200 thousand broadband ports enabled 2.9 million households, business entities, and social sector facilities to gain access to broadband internet [5].

In 2020 alone, 490 thousand broadband internet ports were installed, increasing their total number to 2.5 million. Additionally, approximately 9 thousand kilometers of fiber optic communication lines were laid. The bandwidth of the data transmission network doubled at the level of regional centers and quadrupled at the level of district centers.

To expand the scale of services, 1,375 mobile communication base stations were installed, increasing their total number to 27.4 thousand, while mobile network coverage in settlements reached 97 percent, and high-speed internet coverage reached 78 percent.

To meet the population’s demand for broadband mobile services, more than 1,000 base stations were modernized by the UzMobile branch of Uzbektelecom JSC. Furthermore, tariff rates for telecommunication services were reduced.

Throughout 2019, the cost of external channel connection tariffs for providers and operators decreased by 17 percent per 1 Mbit/s. As of January 1, 2020, the tariffs for internet services for operators and providers were reduced by 34 percent compared to the same period of the previous year [6].

In 2020, “Uzbektelecom” JSC launched base stations at more than 160 sites across the country. Most of these new base stations were put into operation in rural and remote areas. The installation of new antenna towers, base stations, and modern equipment contributed to improving the quality of services provided, expanding coverage areas, and introducing fast mobile Internet technologies. By the end of that year, modernization efforts were completed in Tashkent city, Syrdarya, Andijan, Tashkent,

Namangan, Fergana, Khorezm regions, and the Republic of Karakalpakstan. As a result of these efforts, most of the UZTELECOM mobile communication network's base stations supported 4G LTE technology.

In 2021, the throughput capacity of the data transmission network increased by 1.5 times at both the regional and district center levels. To develop the telecommunications network further, an additional 50,000 kilometers of fiber-optic communication lines were constructed, raising their total length to 118,000 kilometers. As a result, 67% of populated areas were covered by this network. It was determined that the expansion of the fiber-optic network would continue at the same pace in the coming years.

The total capacity of devices providing high-speed Internet services to the population was brought to 3.6 million. To develop mobile communication services, mobile Internet speed was increased by 1.5 times, and in 2021, 14,150 additional base stations were installed, bringing the total number to 45,890. In 2021, the tariff for Internet services provided to operators and providers was reduced by 42.9% compared to the same period of the previous year, amounting to 30,000 UZS per 1 Mbit/s. That year, 95% of populated areas were covered with mobile Internet, and 54% of households were provided with access to high-speed Internet [8].

In 2021, the transmission capacity of the data communication network increased 1.5 times at the regional and district center levels. The tariffs for internet services for operators and providers were reduced by 42.9% compared to the same period of the previous year, and 95% of populated areas were covered with mobile internet. Additionally, 54% of households were provided with access to high-speed internet. The total capacity of devices providing high-speed internet services to the population reached 3.6 million. In 2022, the total bandwidth capacity for connection to the international internet network reached 1800 gigabits per second. The tariff for internet services for operators and providers was reduced by 42.9% compared to the same period of the previous year, amounting to 30,000 UZS per 1 Mbit/s. As of today, 95% of populated areas are covered with mobile internet, and 54% of households have access to high-speed internet. To develop mobile communication services, mobile internet speed was increased by 1.5 times, and in 2021, 14,150 additional base stations were installed, bringing the total number to 45,890. During 2021, the connection speed to the international information and communication network was increased up to 1800 Gbit/s, and this year the figure has reached 3200 Gbit/s. Over 50,000 kilometers of fiber-optic communication lines were laid during 2021, bringing the total length of the system to 130,000 kilometers. Additionally, 902 new base stations were installed in 2021, bringing the total number to 19,233. On September 15-16, 2022, the city of Samarkand hosted a prestigious summit of great political importance. The transport network capacity of the Samarkand region's center was expanded. A 69 km fiber-optic communication system was built for the tourist center, 22 mobile communication base stations were commissioned, and 6 base stations were modernized. Seventeen mobile communication base stations were built along the Tashkent–Samarkand route. To ensure broader coverage of the communication signal throughout the city and to allow seamless connectivity to the new tourist center, 5 base stations based on modern 5G technology were launched.

The current stage of societal development is directly characterized by the advancement of technologies. Modern technological processes, just as they influence every field, are increasingly bringing changes to the information transmission system as well. Efforts to increase the volume of telecommunication services in Uzbekistan, to meet the growing demand for modern means of communication, to create opportunities for the transition to digital transmission systems across the entire network, to reduce operating costs, and to establish an automated communication system have all been made.

Conclusion

Between 2017 and 2021, the main directions for the development of the telecommunications network in our country were determined. Along with the introduction of new types of telecommunication services, innovative solutions oriented toward advanced technologies have been shaping the country's policy. Currently, the process of laying fiber-optic communication lines to every household in Uzbekistan continues. Modern internet (Wi-Fi) technologies have been introduced in public places, hotels, airports, and railway stations, which contributes to the increase in the flow of tourists to Uzbekistan.

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YOUTH POLICY AND SOCIAL ACTIVISM: THE EXPERIENCE OF UZBEKISTAN IN 2017–2024

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Annotatsiya. Ushbu maqolada 2017-2024 yillar oralig‘ida O‘zbekiston Respublikasida olib borilgan yoshlar siyosati va uning natijasida yoshlarning ijtimoiy faolligida yuzaga kelgan o‘zgarishlar tahlil qilinadi. “Yoshlar - kelajagimiz”, “Yangi O‘zbekiston - yangi imkoniyatlar mamlakati” tamoyillari asosida shakllangan davlat siyosati doirasida yoshlarga oid qabul qilingan farmon va qarorlar, ularning amaliy natijalari, yoshlar bilan ishlashda samarali tashkil etilgan institutlar - Yoshlar ishlari agentligi, Yoshlar parlamenti, “Yoshlar daftari” kabi tashabbuslarning ijtimoiy hayotga ta’siri yoritiladi. Shuningdek, yoshlarning bandligi, ta’limi, ijtimoiy himoyasi, huquqiy madaniyati va siyosiy jarayonlardagi ishtirokini kuchaytirishga qaratilgan strategiyalar chuqur tahlil qilinadi. Maqolada yoshlar ijtimoiy faolligining mezonlari, O‘zbekiston tajribasining dolzarbligi hamda xalqaro standartlarga mos keladigan innovatsion yondashuvlar asosida baholashga urinish qilinadi.

Kalit so‘zlar: *Yoshlar siyosati, ijtimoiy faollik, davlat dasturlari, Yoshlar ishlari agentligi, huquqiy madaniyat, yoshlarga oid qarorlar, bandlik, ta’lim, Yoshlar parlamenti, fuqarolik pozitsiyasi, innovatsion tashabbuslar, Yangi O‘zbekiston, ijtimoiy himoya.*

Аннотация. В данной статье анализируются изменения, произошедшие в социальной активности молодежи в результате реализации молодежной политики в Республике Узбекистан в период с 2017 по 2024 годы. Освещаются принятые указы и постановления, реализованные в рамках государственной политики, сформированной на основе принципов «Молодежь - наше будущее» и «Новый Узбекистан - страна новых возможностей», а также их практические результаты. В частности, рассматривается влияние таких эффективно функционирующих институтов, как Агентство по делам молодежи, Молодежный парламент и «Молодёжная тетрадь» на общественную жизнь. Также проводится глубокий анализ стратегий, направленных на повышение занятости, образования, социальной защиты, правовой культуры молодежи и ее участия в политических процессах. В статье рассматриваются критерии социальной активности молодежи, актуальность узбекского опыта и проводится попытка оценки на основе инновационных подходов, соответствующих международным стандартам.

Ключевые слова: *Молодёжная политика, социальная активность, государственные программы, Агентство по делам молодежи, правовая культура, решения по вопросам молодежи, занятость, образование,*

Молодёжный парламент, гражданская позиция, инновационные инициативы, Новый Узбекистан, социальная защита.

Abstract. This article analyzes the changes in youth social activism resulting from the implementation of youth policy in the Republic of Uzbekistan during the period 2017–2024. It highlights the decrees and resolutions adopted within the framework of state policy formed under the principles of "Youth is our future" and "New Uzbekistan - a country of new opportunities," as well as their practical outcomes. The paper examines the impact of effectively established institutions such as the Youth Affairs Agency, Youth Parliament, and the "Youth Notebook" initiative on public life. Additionally, it provides an in-depth analysis of strategies aimed at enhancing youth employment, education, social protection, legal culture, and participation in political processes. The article also explores the criteria for youth social activism, the relevance of Uzbekistan's experience, and attempts to evaluate it based on innovative approaches aligned with international standards.

Keywords: *Youth policy, social activism, state programs, Youth Affairs Agency, legal culture, youth-related decisions, employment, education, Youth Parliament, civic engagement, innovative initiatives, New Uzbekistan, social protection.*

Introduction

In recent years, the Republic of Uzbekistan has undergone profound social, economic, and political transformations aimed at modernizing the country and creating a more inclusive and youth-oriented society. One of the core pillars of these transformations has been the advancement of youth policy, driven by the strategic vision of building a "New Uzbekistan." Since 2017, under the leadership of President Shavkat Mirziyoyev, substantial attention has been devoted to empowering young people as key agents of societal development and innovation. Youth policy has shifted from symbolic declarations to concrete programs and institutional mechanisms designed to engage, support, and elevate the role of the younger generation in national progress.

Uzbekistan, where more than 60% of the population is under the age of 30, faces both challenges and opportunities related to youth development. The demographic dynamics necessitate the formulation of a comprehensive, responsive, and forward-looking youth policy. In response, the government has implemented a wide range of reforms, laws, and initiatives targeting education, employment, entrepreneurship, civic participation, and social protection. The youth of Uzbekistan have increasingly become a strategic priority, not only in national planning but also in the legislative and executive agendas.

One of the most notable developments in this period was the creation of the Youth Affairs Agency, which functions as a key coordinator of youth-focused initiatives. Additionally, the establishment of the Youth Parliament under the Oliy Majlis (Parliament) and the "Youth Notebook" (Yoshlar daftari) system illustrates a commitment to institutionalizing youth participation and ensuring that the voices of young citizens are reflected in policymaking. These innovations aim to identify and

support vulnerable youth, foster civic engagement, and increase access to resources in education and employment.

The presidential initiative "Youth – Our Future" (Yoshlar – kelajagimiz) launched in 2018 stands out as a milestone in youth empowerment. It provides financial support and capacity-building opportunities to young entrepreneurs and innovators, helping thousands launch small and medium-sized enterprises. Furthermore, the State Program on Youth Policy Implementation, as part of the broader national development strategies, outlines specific objectives to improve the quality of life, education standards, and cultural involvement of youth.

At the same time, international cooperation and alignment with global standards have become central to Uzbekistan's youth policy. Uzbekistan has partnered with several international organizations, such as the UNDP, UNICEF, and OSCE, to develop youth strategies rooted in human rights, participation, and inclusivity. These partnerships have facilitated capacity building, research, and pilot programs across various regions, ensuring that youth policy is evidence-based and adaptive to the needs of a diverse population.

However, the journey has not been without obstacles. The country continues to face systemic issues such as regional disparities, limited access to higher education in remote areas, youth unemployment, and a need for greater legal awareness among youth. Moreover, enhancing youth participation in political processes and governance structures remains an ongoing task. While the creation of youth councils and civic platforms is promising, their actual influence on decision-making is still evolving.

The years between 2017 and 2024 serve as a critical period for assessing the effectiveness of youth policies in Uzbekistan. These years have witnessed a transition from centralized, top-down youth programs to more participatory, needs-based approaches. The emphasis has increasingly shifted towards inclusive governance, where youth are not merely beneficiaries but active contributors to nation-building. In this light, youth activism, volunteerism, and civic engagement have grown substantially, particularly with the rise of digital platforms and social media which have provided new avenues for expression and mobilization.

This research aims to explore the mechanisms, achievements, and challenges of youth policy in Uzbekistan during the 2017–2024 period. It will examine key legislative developments, institutional frameworks, and social programs implemented to enhance youth inclusion. Additionally, it will analyze the impact of these efforts on youth social activism and their integration into the broader processes of democratic development. By reflecting on both the achievements and gaps in youth policy, the study seeks to provide insights into how Uzbekistan's experience aligns with global trends and what lessons can be drawn for the future.

Research Methodology

This study employs a qualitative research methodology with elements of content analysis and policy review to investigate the structure, implementation, and impact of youth policy in Uzbekistan from 2017 to 2024. The research is based on the examination of official state documents, presidential decrees, national strategies, government reports, and legal frameworks that outline and regulate youth policy

initiatives during the specified period. These include key strategic documents such as the "Youth - Our Future" program, the Development Strategy of New Uzbekistan, and resolutions issued by the Cabinet of Ministers and the Oliy Majlis.

Data collection was conducted through a comprehensive review of both primary and secondary sources. Primary sources included legislative texts, state programs, official speeches, and statistical bulletins published by the State Committee on Statistics and the Ministry of Youth Policy and Sports. Secondary sources involved academic journal articles, international development reports (UNDP, UNICEF, OSCE), and media publications that analyze the societal impact of youth policies.

The content analysis method was applied to identify key trends, recurring themes, and shifts in discourse surrounding youth policy over time. Attention was paid to how policies evolved from top-down directives to more participatory and inclusive approaches. This included evaluating the extent to which young people were consulted or represented in policy development and how responsive the system was to their needs.

Comparative analysis was also employed to benchmark Uzbekistan's youth policies against international standards, particularly the UN Youth Strategy (2030 Agenda), to assess how national practices reflect global commitments to youth empowerment. Furthermore, institutional capacity and the sustainability of reforms were assessed based on official performance indicators and third-party evaluations.

Ethical considerations were observed by relying solely on publicly accessible data and documents, ensuring that no personal or sensitive information was disclosed. The study was designed to offer a critical yet constructive perspective on policy processes and outcomes without partisan bias.

The methodological approach is thus interdisciplinary in nature, combining elements of political science, public policy, sociology, and development studies. This integrated approach enables a holistic understanding of how youth policy in Uzbekistan has been conceptualized, executed, and evaluated during a pivotal era of national reform.

Analysis and Results

The analysis of youth policy initiatives in Uzbekistan during the 2017–2024 period reveals substantial progress in institutional development, youth engagement, and social inclusion. One of the most significant outcomes was the establishment of the Youth Affairs Agency in 2020, which became a central coordinating body for youth-related initiatives across ministries and regions. According to official reports, by 2023, the Agency had implemented over 150 nationwide programs, reaching more than 2.5 million young people.

The introduction of the "Youth Notebook" (Yoshlar daftari) mechanism marked a pivotal moment in targeted social support for disadvantaged youth. Government data indicate that between 2020 and 2024, over 1 million youths were registered in this system. Of these, approximately 420,000 individuals received educational grants, job placement assistance, housing support, or startup funding. This demonstrates the state's commitment to reducing inequality and enhancing youth access to opportunities.

In the sphere of employment, the "Youth is Our Future" program, launched in 2018, provided financial and training support for young entrepreneurs. As of 2024, official

statistics show that the program financed more than 50,000 startup projects, contributing to the creation of over 110,000 jobs in rural and urban areas. According to a report from the Ministry of Economy and Finance, youth unemployment among graduates declined from 17.1% in 2018 to 11.6% in 2023, reflecting the effectiveness of economic empowerment policies.

Educational access and engagement also improved significantly. Investments in digital education platforms and vocational training programs allowed more than 250,000 youths to gain professional certifications through state-sponsored initiatives. Furthermore, the number of students enrolled in higher education increased dramatically, from about 20% of high school graduates in 2017 to 42% by 2023, following the expansion of state grants and the opening of international university branches.

Youth participation in governance and civic life also expanded. The Youth Parliament became an official consultative structure under the Oliy Majlis, comprising over 250 elected members from different regions and social backgrounds. This institution contributed to the drafting of several youth-related legislative proposals, including amendments to the Law on State Youth Policy (2021) and the national strategy on youth digital literacy.

Moreover, the inclusion of youth in social and volunteer movements gained momentum. The number of officially registered youth NGOs increased by 65% between 2017 and 2024, and more than 500,000 youths took part in volunteer campaigns, particularly in public health, environmental cleanup, and digital literacy drives. These figures reflect a tangible rise in civic consciousness and social activism among young citizens.

Digital engagement also emerged as a critical platform for youth participation. The launch of the “Yoshlar ovozi” (Youth Voice) online portal and mobile app provided an interactive channel for youth to express their opinions, propose initiatives, and communicate directly with authorities. By 2024, the platform had received over 180,000 proposals, with 23% implemented at the regional or national level.

On the international front, Uzbekistan’s youth policy initiatives received increasing recognition. In 2022, the country was acknowledged by the United Nations Economic and Social Council (ECOSOC) as a regional example for youth inclusion mechanisms. Collaborative projects with UNDP, UNICEF, and GIZ further reinforced institutional capacity and knowledge transfer for sustainable youth development.

The findings presented in this study underscore a period of rapid advancement and institutional innovation in Uzbekistan’s youth policy landscape between 2017 and 2024. The government’s strategic focus on empowering young people has resulted in notable improvements in employment, education, social protection, and civic engagement. These developments reflect a paradigm shift from symbolic youth outreach to structured, data-driven, and inclusive policy implementation.

One of the most striking elements in Uzbekistan’s experience is the institutionalization of youth participation. Structures such as the Youth Affairs Agency and the Youth Parliament represent a formal recognition of the political and social value of youth voices. While their establishment is commendable, questions remain regarding the depth of youth influence on decision-making processes. Although young

people are increasingly represented in consultative bodies, the extent to which their input shapes national legislation or budget allocations still appears limited. Further empirical research is needed to assess the effectiveness of these structures in policy responsiveness.

The “Youth Notebook” mechanism has proven to be an effective model for social targeting and inclusion. It demonstrates a government-led effort to shift from blanket policies to individualized assistance based on socio-economic vulnerability. However, the mechanism’s long-term sustainability, funding sources, and regional implementation disparities merit critical review. There is also a need to integrate feedback loops, allowing beneficiaries to evaluate the quality and relevance of the support they receive.

The successes of entrepreneurship support programs, such as “Youth is Our Future,” reflect a broader policy ambition to stimulate economic self-sufficiency among youth. The decrease in youth unemployment rates is a promising sign, but this trend should be interpreted with caution. The quality of jobs created, particularly in informal or seasonal sectors, may not always meet decent work standards as defined by the International Labour Organization. Furthermore, without robust monitoring and follow-up mechanisms, it is difficult to determine whether these start-ups have long-term viability or are short-term responses to funding opportunities.

The expansion of digital platforms, especially tools like “Yoshlar ovozi,” signals progress toward e-governance and digital civic engagement. This aligns with international trends of digital democracy, where youth increasingly interact with governance structures via technology. However, digital literacy and internet access remain uneven, particularly in rural and economically disadvantaged areas. Thus, the state must prioritize bridging the digital divide to ensure equal access to participatory opportunities.

Another area that deserves greater attention is gender inclusivity in youth policy. While both male and female youths benefit from national programs, leadership roles and decision-making platforms remain disproportionately occupied by males. A gender-sensitive approach, including targeted programs for young women and girls, is necessary to foster truly equitable social and political engagement.

Internationally, Uzbekistan’s youth strategy aligns with several components of the UN Youth Strategy (Youth 2030), especially in the domains of education, civic engagement, and social inclusion. Nevertheless, monitoring and evaluation systems are still in early stages. Many programs report quantitative outputs (e.g., number of participants) rather than qualitative outcomes (e.g., increased political literacy or sense of civic agency). Developing comprehensive evaluation frameworks with outcome-based indicators would allow for a more accurate measurement of policy impact.

The case of Uzbekistan also raises broader questions about youth policy in transitional societies. As a post-Soviet state undergoing democratic reform, Uzbekistan provides a unique model of centralized policy initiatives aimed at inclusive modernization. The political will demonstrated through presidential decrees and national programs is a key enabler of youth development, but it must be matched by institutional independence, local accountability, and genuine youth empowerment from the grassroots level.

Conclusion

The period from 2017 to 2024 marks a transformative era in the development of youth policy in Uzbekistan. During these years, the country made significant strides toward constructing a comprehensive and inclusive framework for youth engagement, empowerment, and protection. Through the establishment of dedicated institutions such as the Youth Affairs Agency, the implementation of targeted initiatives like the Youth Notebook, and the introduction of economic and educational support programs, Uzbekistan took a firm step toward positioning youth as active participants in nation-building.

In conclusion, Uzbekistan's experience in youth policy development between 2017 and 2024 serves as a compelling example of how state-driven reforms can catalyze youth engagement in transitional societies. With a young and dynamic population, the country holds immense potential for sustainable development, provided that youth remain at the center of national policy and progress. The future of Uzbekistan will depend not only on its ability to support its youth but to empower them as full partners in shaping the nation's democratic, social, and economic future.

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THEORY OF ECOLOGICAL CULTURE IN ETHNOGRAPHIC RESEARCH

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Annotatsiya. Mazkur maqolada etnografik tadqiqotlar doirasida ekologik madaniyat nazariyasining o‘rni va ahamiyati tahlil qilinadi. An’anaviy qadriyatlar va urf-odatlar asosida shakllangan ekologik madaniyat namunalari o‘rganilib, ularning zamonaviy ekologik muammolarni hal etishdagi ro‘li ko‘rsatiladi.

Kalit so‘zlar: *ekologik madaniyat, ekologik muammolar, etnoekologiya, qadriyat, urf-odat, etnik jamoa, F. Ratsel.*

Аннотация. В данной статье анализируется значение и роль теории экологической культуры в рамках этнографических исследований. Изучаются образцы экологической культуры, сформированные на основе традиционных ценностей и обычаев, а также раскрывается их роль в решении современных экологических проблем.

Ключевые слова: *экологическая культура, экологические проблемы, этноэкология, ценности, обычаи, этническая община, Ф. Ратцель.*

Abstract. This article analyzes the role and significance of the theory of ecological culture within the framework of ethnographic research. It explores examples of ecological culture formed on the basis of traditional values and customs, highlighting their role in addressing modern environmental issues.

Keywords: *ecological culture, environmental issues, ethnoecology, values, customs, ethnic community, F. Ratzel.*

Introduction

Ethnographic research serves as a critical tool for understanding the intricate relationships between human communities and their natural environment through an in-depth analysis of their culture, traditions, lifestyles, and social structures. By examining the daily practices, historical heritage, worldview, and long-preserved values of ethnic groups, such research not only documents cultural diversity but also explores the adaptive functions of culture in response to environmental conditions.

At the heart of this interdisciplinary inquiry lies the theory of ecological culture, which emerges at the intersection of ethnography, ecology, and cultural studies. This theoretical framework investigates how traditional knowledge systems and practices influence ecological sustainability and shape communities’ interactions with their surroundings. As global environmental challenges-such as climate change, biodiversity loss, and overconsumption of natural resources-intensify in the 21st century, the relevance of ethnoecological insights becomes increasingly evident.

Recent studies underscore the importance of traditional ecological knowledge (TEK) in formulating sustainable development strategies. For instance, Fikret Berkes,

in his seminal work *Sacred Ecology* (2018), emphasizes the integration of TEK into modern environmental governance and resource management frameworks. These insights highlight the necessity of recognizing indigenous and local ecological practices as viable responses to contemporary environmental threats [1].

This article explores the theoretical foundations and historical evolution of ecological culture theory, its application within ethnographic studies, and its significance in current academic discourse. Through practical examples and a review of recent literature, the study aims to assess the potential of ethnoecology in enhancing our understanding of human–nature relations and addressing both global and localized ecological issues.

Literature Review

Although ethnocultural ecology (ethnoecology) and environmental culture are interrelated, they differ significantly in their objectives and methodological approaches. Ethnoecology primarily focuses on adaptive strategies developed by ethnic communities in response to specific environmental conditions. For instance, Yamskov A.N. defines ethnoecology as "a practical and theoretical discipline aimed at analyzing processes of adaptation of ethnic groups to their ecological surroundings" [2].

In contrast, the theory of environmental culture emphasizes the cultural dimensions of human interaction with nature, including reverence for the environment and sustainable resource use. It examines how cultural norms, values, and rituals shape ecological behavior and environmental ethics.

The historical evolution of ethnoecological thought can be traced back to classical antiquity, where scholars like Herodotus and Strabo proposed early ideas about the influence of geography and climate on ethnic characteristics. Later, in the 14th century, Arab historian Ibn Khaldun, in his seminal work *Muqaddimah*, discussed the impact of environmental and climatic conditions on human character and societal development.

These preliminary notions gained scientific structure in the 18th century through the concept of geographical determinism. According to this framework, natural conditions significantly influence the material and spiritual culture, psychological traits, and socio-political organization of peoples. This theoretical stance laid the foundation for ethnoecology as a field, by asserting the primary role of the physical environment in shaping human societies.

In the 19th century, German anthropologist and geographer Friedrich Ratzel (1844–1904), a foundational figure in anthropogeography and political geography, advanced the concept of geographical determinism. Ratzel argued that human societies evolve in direct connection with their physical environment, which plays a critical role in shaping their development, while acknowledging that humans are also active agents capable of modifying their surroundings [3].

He emphasized that while nature offers certain opportunities, the extent and manner of their utilization are determined by cultural variables. This era saw an expansion in environment-focused studies, though their limitations-particularly a lack of attention

to sociocultural factors-led to the emergence of more integrative approaches by the end of the 19th century.

In the mid-20th century, the American anthropologist Julian Steward (1902–1972) developed the concept of "cultural ecology," emphasizing that the "core" of culture-namely, its technological base-is the primary factor in adaptation to the environment [4]. This theory is based on analyzing the relationship between culture and the environment and plays an important role in developing ecological approaches within anthropology.

The initial ideas of the economic-cultural type concept were developed in the 1920s and 1930s by Soviet ethnographers around the notion of the ethnogeographic zone (area, region). An ethnogeographic zone refers to a territory inhabited by population groups characterized by distinct ethnic, economic, and cultural traits within specific natural-geographical conditions. The term economic-cultural type denotes the cultural features that correspond to a particular type of economic activity. For instance, nomadic pastoralists living in deserts and hunters inhabiting forested regions exhibit different economic and cultural types. This approach in Soviet ethnography was utilized to understand the connection of peoples with their natural environment and to classify them accordingly [5].

Research Methodology

This paper adopts a comparative and interdisciplinary lens, combining theoretical insights from cultural anthropology, environmental sociology, and human geography. Textual analysis of classical and modern ethnoecological literature is employed to trace the evolution of key concepts, supported by contextual interpretation of cultural and environmental interdependencies within ethnic communities.

Analysis and Results

The theoretical approaches and scientific paradigms discussed above illustrate that the theory of ecological culture is grounded in a diverse array of conceptual frameworks. Each of these frameworks contributes to the systematic understanding of how ethnic communities interact with their natural surroundings. The analysis reveals several distinctive theoretical strands, which can be classified as follows:

1. *Adaptation Framework:* This paradigm emphasizes the dynamic interaction between ethnic groups and their natural environment, focusing on both biological and cultural adaptation mechanisms. Within Julian Steward's framework of *cultural ecology*, adaptation is understood not merely in physiological terms but as a multifaceted process involving socio-economic and technological dimensions.

2. *Ethno-ecosystem Perspective:* Rooted in Vladimir Vernadsky's biosphere theory, this concept perceives ethnic communities as integral components of ecological systems. It posits that human activity and natural ecosystems are interconnected in a complex network, contributing to overall ecological equilibrium. This systems-based view facilitates holistic investigation into community-environment interactions.

3. *Subsistence Theory:* Introduced by Viktor Kozlov, this theory explores the material (e.g., food, shelter) and intangible (e.g., traditions, spiritual beliefs) aspects of ethnic group survival. It underscores the ways in which communities prioritize and manage resources to ensure long-term ecological sustainability.

4. *Traditional Ecological Knowledge (TEK):* As highlighted by Fikret Berkes, TEK comprises the cumulative body of knowledge, practices, and beliefs developed by indigenous communities through prolonged interaction with their local environments. Often transmitted orally across generations, this knowledge plays a crucial role in sustainable resource use and ecosystem stewardship.

5. *Ecological Niche Concept:* Initially articulated by Joseph Grinnell and further developed by Charles Elton and G.E. Hutchinson, this framework recognizes that each ethnic group occupies a unique ecological role—or niche—within its environment. These niches represent specific strategies for resource utilization and adaptation, offering insight into the ecological diversity of human cultures.

6. *Sustainability-Oriented Approach:* Ethnoecology plays a critical role in shaping the scientific foundation of sustainable development. Anna Tsing's recent contributions underscore the importance of integrating local community knowledge into global ecological governance to address environmental challenges effectively.

7. *Cultural Ecology Function:* Clifford Geertz's research in Indonesia distinguishes between *ecophilic* (environmentally friendly) and *ecophobic* (environmentally destructive) cultural traits. This perspective examines how cultural norms and values influence ecological behaviors and perceptions.

8. *Economic-Cultural Typologies:* Developed by M. Levin and N. Cheboksarov, this conceptual model investigates the livelihood systems of ethnic groups through both economic (modes of subsistence) and cultural (values, rituals) dimensions. It enables the classification of environmental adaptation strategies across diverse cultural settings.

9. *Comparative Methodology:* As demonstrated in Emilio Moran's Amazonian research, this methodology facilitates the cross-cultural comparison of ecological adaptation strategies. It helps identify common patterns and distinct differences in how ethnic groups respond to diverse environmental contexts.

In summary, the ecological culture of ethnic communities is a multidimensional phenomenon, influenced by historical, environmental, and socio-cultural factors. The theoretical pluralism outlined here reflects the complexity of human-environment interactions and provides a robust analytical lens for examining cultural sustainability. These insights pave the way for further interdisciplinary research and policy development aimed at reinforcing the role of traditional knowledge systems in global environmental discourse.

Conclusion

The analysis of various theoretical frameworks reveals that ecological culture is not a singular concept, but rather a multifaceted phenomenon shaped by diverse cultural, environmental, and historical influences. The integration of approaches such as adaptation theory, ethno-ecosystem models, traditional ecological knowledge, and ecological niche theory provides a comprehensive understanding of how ethnic communities interact with their natural environment. These conceptual lenses highlight the importance of viewing indigenous and local practices not merely as cultural artifacts but as vital systems of environmental management and sustainability. They demonstrate that ethnic groups possess deep-rooted knowledge and strategies that

contribute to ecological balance, resource conservation, and long-term community resilience.

Furthermore, the recognition of traditional ecological knowledge and cultural adaptation in policy-making and sustainable development planning can strengthen global efforts to address environmental challenges. By acknowledging the ecological functions of culture and supporting comparative methodologies, scholars and practitioners can better understand the diversity of human-environment relationships and promote inclusive, culturally grounded environmental solutions.

In essence, ecological culture serves as a bridge between humanity and nature, offering valuable insights into sustainable living rooted in tradition, experience, and adaptation.

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INTERESTING ANALYSIS OF GERMAN PHRASEOLOGICAL UNITS

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Annotatsiya. Frazeologik birliklar - bu bo'linmagan to'plam iboralarini o'rganadi. Ayrim so'zlarning ma'nolarini shunchaki umumlashtirish orqali tushunish mumkin. Nemis tili ifodasida tahlil etilgan nemis frazeologik birliklar tarixiy meros, xalq madaniyati va nutq ko'rki sifatida sharhlandi.

Kalit so'zlar: *madaniy meros, ibora, etimologiya, qiyosiy tipologiya, semantika, stilistika, madaniyat, tarix, urf-odat.*

Аннотация. Фразеологические единицы — это нерасчлененный набор словосочетаний, подлежащих изучению. Значения некоторых слов можно понять, просто обобщив их. Немецкие фразеологизмы, анализируемые в немецкоязычном выражении, интерпретируются как историческое наследие, народная культура и речевое искусство.

Ключевые слова*: культурное наследие, выражение, этимология, сравнительная типология, семантика, стилистика, культура, история, традиция.*

Abstract. Phraseological units are undivided sets of expressions. The meanings of individual words can be understood simply by generalizing. German phraseological units, analyzed in the German language, were interpreted as a historical heritage, folk culture, and a form of speech.

Keywords*: cultural heritage, idiom, etymology, comparative typology, semantics, stylistics, culture, history, tradition.*

Introduction

The scientific justification of phraseology is formed in the works and scientific research of the following famous scientists: Bergerová Hana, Burger Harald, Donalies Elke, Ettinger Stefan, Kühn P., Walter de Gruyter, Gréciano Gertrud, Vinogradov V.V., Potebnya A.A., Sreznevsky I.I., Fortunatova F.F., Shakhmatova A.A., Polivanova E.D., Emirova A.M., Shansky N.M., Kunin A.V., Nazaryan A.G., Amosova N.N., Arkhangelsky V.L., Chernysheva I.I., Vendina T.I., Stepanova Yu.S., Popova R.N., Abakumova S.I., etc. The need to distinguish phraseology as a separate section of linguistics is especially expressed in the ideas of the French linguist Sh. Balli [1]. Analyzing the richness of the phraseology of the language, it solves a number of important and complex problems, including questions related to the semantics of generally important language units, as well as the nature of the lexical meanings of words, syntactic connections between words, issues of word formation, etymology and stylistics of the language, as well as literary and other aspects of the language studied in phraseology [1].

Literature review

Analyzing the wealth of phraseology, it solves a number of important and complex problems, including questions related to the semantics of important language units, as well as the nature of the lexical meanings of words, syntactic connections between words, word formation issues, etymology and stylistics of the language, as well as literary and other aspects of the language are studied in phraseology [2].

Kunin V. defined phraseology as “the science of phraseology” [3, 4-9]. In his opinion, phraseology is not only a treasure but also a living source of linguistic wealth. Phraseological units are a network that reflects not only the history of the people, but also their uniqueness, and is deeply embedded in the essence of culture and everyday life.

As a result, in the 20th century, along with the study of paremiology, phraseology and the study of language in general were brought to a scientific level. At the same time, the most famous linguists conducted research on the important feature of historical phraseology: Babkin A.M., Gvozdarev Yu.A., Guseinov F.G., Kopylenko M.M., Mokienko V.M., Palevskaya M.F., Selivanov G.A., Fedorov A.I., and others [3];

- Phraseological etymology is a section of phraseology that studies the origin of phraseological units and their historical-semantic analysis, which distinguishes them from other phraseological units.

The issues of phraseological etymology were developed by domestic and international authors: LomonosovM.V. , Dal V.I., Potebnya A.A., Sreznevsky I.I., Fortunatov F.F., Shakhmatov A.A., Vinogradov V.V., Abakumov S.I., Bulakhovsky L.A., Gvozdarev Yu.A., Zimin V.I., Larin B.A., Medvedev F.F., Mokienko V.M., Shansky M.N., and others;

- The department of comparative phraseology studies phraseological units based on a comparative or comparative-typological analysis of the phraseology of two or more languages for the purpose of identification by the following scientists: Babkin A.M., Zimin V.I., Kunin A.V., Lixovidova T.V., Pomiguev G.P., Umarxo‘jaev M.I., Shanskiy N.M., and others [10].

Research Methodology

Among the individual methods as a methodological basis for studying the science of phraseology:

- the method of studying phraseological units in relation to their environment (Tagiev M.T.);
- the method of synchronous-comparative dual description (A.D. Reichshteyn);
- the method of antinomies (MokienkoV.M.) [11];
- the method of synchronous-comparative analysis (Gvozdarev Yu.A.) was analyzed [12].

The phraseological system of a language, which has arisen throughout its history, has determined the conditions and, along with its most important task, the study of its modern and historical context, its interrelations and relationships, on the one hand, vocabulary and word formation, and on the other hand, it is a grammatical phenomenon

that proves in facts and is an element of language in the use of methods contrary to its nature.

Intra-system and inter-system connections between phraseological units are a phenomenon of language development. It is necessary to note the connection between the development of phraseology and the development of language in general, since they reflect the core meaning.

Vedina T.I. notes that a phraseological unit is a lexically indivisible, recurring language unit, consisting of two or more affective components, a linguistic phenomenon that occurs stably in its structure [12].

According to Nazaryan G., a phraseological unit is a special form [10]. Kunin A.V. understands phraseological units as stable combinations of words [9]. Phraseological units play an important role in filling gaps in the lexical system of the language, which sometimes cannot fully cover all known aspects of reality. They help to eliminate the conflict between the needs of thinking they mold the limited lexical resources of the language [6].

Phraseological units are strengthened by figurative, emotional, and figurative-expressive, and they are designed to evoke an image, clarify the thought on the topic. Phraseologisms can lead to an increase in the volume of speech [5]. The traditions of the people, the carriers of the cultural heritage, help to understand the cultural connotations in linguistic units more deeply. They are a lexical unit that helps to broaden the worldview of each culture and enriches cultural diversity. Studying the different uses of phraseological units reveals the connection between languages in certain ways: black is negative, white is positive, and green is the harmony of nature.

Analysis and Results

From the analysis conducted, it can be seen in full and in part that phraseological units in German and Uzbek languages are compatible in expressing emotions, diversifying similarities and differences, and making them understandable to others.
In the classification of the example of Gunter de Bruyne's work "Tristan and Isolde," phraseological units were divided into the following groups:

1. Heart 14 Ph;
2. Eye 8 Ph;
3. Heart and sorrow 7 Ph;
4. Animals and insects 3 Ph;
5. Repeated pairs of words 7 Ph;
7. Life 5 Ph;
8. Nature 2 Ph;

Phraseologisms taken from the text with the word heart:

1. My God grant you a rich heart. Page- 12	- My God make your verb wide, my toram. Page 12
2. The pain turned her heart to stone. Page-11	- The pain turned her heart to stone. Page-16
3. His heart beat with joy. Page-22	- His heart beat with joy. Page-25
4. Then he took hold of his heart. Page-62	- He whispered to the girl. Page-60

The results of our research are very interesting. Based on practical comparison, the analysis explained how close the phraseological systems of both languages are to each other. A detailed and comprehensive study of phraseological units, an analysis of the richness of the phraseology of a language, is the key to solving various important and complex problems. This is due to the fact that the nature of the lexical meanings of common language units, syntactic connections between them, issues of word formation, etymology, language stylistics, as well as stable combinations of words taken as phraseological units, as the object of study of phraseology, became clearer in independent important units of both languages. Due to the similarity of views on family values and raising children, the little things in life, human emotional experiences, and natural phenomena, it is possible to find various equivalents in different cultures and find a harmony of meaning. When translating phraseological units, it is very important to understand their existence, and they represent a symbolic identity in the language and culture, the common memory of the people.

-emotional state component;
-personality;
-component of labor activity;
-family;
-love;
-a sense of homeland;
-kindness;
-falsehood;
-national traditions;
-image of nature;

Conclusion

As a result of the search for phraseological units, national and cultural features of individual activity were identified. The difficulties that may arise as a result of this search were simplified and formulated in the analysis.

Thus, the purpose of the study is to form a broad and interesting concept of the phrase in the reader's worldview, as well as to increase the cognitive potential of the historical and cultural past of peoples in the context of phraseological units based on the German language.

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AUTOMATIC EXTRACTION OF UZBEK BASIS WORDS FROM “UZBEK PRIMARY SCHOOL CORPUS”

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Annotatsiya. Yangi o‘zbek tilini o‘rganuvchilarning o‘zbek tilini bilish darajasini tasniflash, maktab o‘quvchilarining akademik bilimlarni egallashini osonlashtirish jarayonida o‘zbek tilidagi matnlardan asos so‘zlarni ajratib olish muhim vazifa hisoblanadi. Til o‘rganuvchilar, maktab o‘quvchilari va filologlar uchun asos so‘zlarni ajratib olishning bir qancha afzalliklari bor. Ushbu tadqiqotda o‘zbek tilidagi matnlardagi so‘zlar orasidan deyarli barcha so‘zlarni ifodalovchi asos so‘zlar tanlab olindi. Ushbu asosiy so‘zlarni aniqlash uchun yuqori chastotali usul ishlatilgan. Shunday qilib, bitta asosli so‘z yordamida bir nechta so‘zlar tuzilishi mumkin. Tekshiruv uchun O‘zbekiston Respublikasi Maktabgacha va maktab ta’limi vazirligi tomonidan tasdiqlangan va mualliflar tomonidan “O‘zbek boshlang‘ich maktabi korpusi” (O‘zbek boshlang‘ich maktabi korpusi) nomi berilgan 1-4-sinflar uchun 35 ta boshlang‘ich sinf darsliklarini to‘pladik. Bu jarayon natijasida 1-sinf o‘quvchisi 366 ta asos so‘z, 2-sinf o‘quvchisi 462, 3-sinf o‘quvchisi 486, 4-sinf o‘quvchisi 512 asos so‘z bilishi kerakligi aniqlandi.

Kalit so‘zlar: *lemma, chastota, maktab korpusi, dictionary of synonyms, qiyosiy lemma chiqarish usuli.*

Аннотация. Извлечение базовых слов из узбекских текстов является важной задачей в процессе классификации уровня знания узбекского языка для новых изучающих узбекский язык, облегчая получение академических знаний школьниками. Извлечение базовых слов имеет ряд преимуществ для изучающих язык, школьников и филологов. В этом исследовании базовые слова, представляющие почти все слова, были выбраны из числа слов в текстах на узбекском языке. Для выявления этих базовых слов использовался высокочастотный метод. Таким образом, с помощью одного базового слова можно построить несколько слов. Для исследования мы собрали 35 учебников для начальной школы для 1-4 классов, утвержденных Министерством дошкольного и школьного образования Республики Узбекистан и названных авторами “Узбекский корпус начальной школы” (УПШ). В результате этого процесса было определено, что ученик первого класса должен знать 366 базовых слов, ученик второго класса - 462, ученик третьего класса - 486 и ученик четвертого класса - 512 базовых слов.

Ключевые слова: *лемма, частотность, школьный корпус, словарь синонимов, сравнительный метод вывода леммы.*

Abstract. Extracting basis words from Uzbek texts is an important task in the process of classifying the level of Uzbek language knowledge for new Uzbek learners, facilitating the acquisition of academic knowledge by schoolchildren. There are several advantages to extracting basis words for language learners, schoolchildren and philologists. In this study, basis words representing almost all words were selected from among the words in Uzbek language texts. A high-frequency method was used to identify these basis words. Thus, several words can be built using a single basis word. For the investigation, we have collected 35 primary school textbooks for grades 1-4 approved by the Ministry of Preschool and School Education of the Republic of Uzbekistan and named the “Uzbek Primary School Corpus” (UPSC) by the authors. As a result of this process, it was determined that a first-grade student should know 366 basis words, a second-grade student 462, a third-grade student 486, and a fourth-grade student 512 basis words.

Keywords: *lemma, frequency, school corpus, dictionary of synonyms, comparative lemma extraction method.*

Introduction

This article presents a step-by-step methodology for extracting basis words from a given Uzbek text. A basis word is a set of words in which several words can be formed from a single word. Usually, such words are also often used in the colloquial process and are among the active words. We suggest that people learning Uzbek should divide the language into levels. If you want to learn a language, it’s a good idea to have a dictionary with the words you need to know at each level. If you learn simple words at the first level, you can choose and read suitable and interesting books, write about them, and understand and respond when you hear them. For example, if it is necessary to define the word “book(kitob)” to a 2nd-grade student, he should be told “An

educational tool consisting of sheets; There are types such as textbooks and fairytales (varaqlardan iborat o'quv vositasi; darslik, ertak kabi turlari mavjud)". In higher classes, it is defined as "a printed work (also an ancient manuscript) consisting of pages with certain text, sewn together, bound, not less than 48 pages in size (ma'lum matnli varaqlardan iborat, juzlab tikilgan, muqovalangan, hajmi 48 sahifadan kam bo'lmagan bosma (qadim qo'lyozma ham) asar)" [https://izoh.uz/word/yaproq]. This helps students to learn new and different words. However, if you try to learn words that are too hard for you, you will get bored. This means that the learner cannot learn the language well. But children who read a lot can lose interest in books. This can make them not want to read as much. Another important thing to remember is that we need basic words to build the foundations of WordNet. WordNet is a lexical database of semantic relations between words that links words into semantic relations, including synonyms, hyponyms, etc.

Literature Review

To date, several scientific studies have been conducted by both foreign and local researchers on the analysis of Uzbek and other languages. This paper [1] explores the creation of an educational corpus tailored to the intellectual potential of primary school students, crucial for improving education quality. When textbooks are mismatched with students' intellectual abilities, it hampers understanding and reduces interest in learning. By using a corpus to assess students' intellectual capacity, appropriate educational materials can be integrated into the learning process, enhancing engagement. The study focuses on a corpus developed from 35 Uzbek-language textbooks approved by the Ministry of Preschool and School Education of Uzbekistan to address this issue effectively.

The stop words do not contribute to the informational content of a query; nevertheless, they contribute to the overall complexity of the query. It is evident that the extant mathematical models employed to address this issue are not universally applicable to all categories of natural languages [2]. In natural language processing, it is necessary to know stop words in the process of data acquisition and text analysis. This method is applied to languages with agglutinative properties. The Uzbek language is also considered an agglutinative language. The work [3], is devoted to determining the method of evaluating stop words or the majority of stop words in Uzbek texts. In today's era of information exchange and rapid increase in information, we do not have the opportunity to read all the information about various fields. It also takes a lot of time to read and analyze information about a particular industry. As a solution to this problem, text summarization is proposed in the article [4]. It contains a summarization task as an experiment for the Uzbek language; the methodology was based on text abstracting based on the TF-IDF algorithm. In the context of related work and resources for the Uzbek language, it is important to acknowledge that, despite its status as a low-resource language from a natural language processing (NLP) perspective, the pace of research activities has been rapid in recent times. This has created lots of new tools for NLP in Uzbek, like transliteration tools [5], sentiment analysis tools [6], and an algorithm for summarizing Uzbek texts [4].

In the work [7], we have tried to fill this gap by developing a set of "Part of Speech" (POS) and syntactic tags to create a syntactically and morphologically tagged corpus of the Uzbek language [8]. It is very important to use technology that processes natural language well so that people who don't have much access to resources can also use it. It is worth saying that there are no publicly available, well-created linguistic resources for building specific Aspect-Based Sentiment Analysis (ABSA) tools for the Uzbek language. In the article [9], the authors consider the issue of developing a tool for identifying named entities. The work is special because it is both original and well-planned. The authors created a custom dictionary and marked sentences using the BIOS scheme. This makes it easy to see the start and end of named things in texts. Moreover, the authors collected more than 1,500 sentences or more than 11 thousand words in their corpus, which undoubtedly indicates much work. In addition, the Python library (Spacey) was chosen to identify named entities, particularly a multilingual empty model, which the authors trained from scratch. As a result of testing, the model achieved such accuracy and recall indicators as 92% and 98%, respectively. The article [10], states the need to examine significant qualitative differences between word frequencies and the semantic diversity of words, as well as to consider the degree of word prevalence. A good sight word list should be found frequently in elementary school students' materials and in more difficult grade materials. A good sight word list should be found frequently in elementary school students' materials and in more difficult grade materials. The purpose of the article [11] is to form a list of such words. They have checked this list with all classes from 3rd to 9th class, and with other available lists. In the article [12], two dictionaries are used to start the reading process. The first is a vocabulary for speaking techniques for kindergarten and school children. In this group of more than a million words, the word "nature" appeared 191 times and was in 500th place. The word that was used 69,971 times came first. Many experiments have shown that common words (ones that are used a lot) are processed differently by the brain than uncommon words. The individuals remember the commonly used terms faster and perceive them faster. In addition, popular words have a shorter form than rare terms and are easily pronounced. As a result, frequent words and rarely used words have different levels.

In this work, the following problems are given:

- *Creation of the Uzbek Language Primary School Corpus:* A corpus was established by incorporating 35 school textbooks, manually compiled and analyzed using the TF-IDF method to determine word frequencies.
- *Synonym Dictionary and UPSC Comparison Method:* The synonym dictionary and UPSC were compared using the high-frequency method to extract basis words.

Research Methodology

In this section, we provide information on the methodology of finding high-frequency words and extracting basis words using an explanatory dictionary of synonyms of the Uzbek language, and the Uzbek Primary School Corpus (UPSC) [5].

A. Data Description and Collection

Uzbek, like many Turkic languages, exhibits a rich morphology with a wide vocabulary. Since Uzbek is among the agglutinative languages, it is formed by adding prefixes and suffixes when making a word. In this article, Azim Hajiyev's book "O'zbek tili sinonimlarining izohli lug'ati (An explanatory dictionary of synonyms of the Uzbek language)" was taken for building a synonym dictionary. It was manually converted to text format [https://zenodo.org/records/13132872]. Since our main goal is to extract basic words for primary school students, we needed the UPSC. The UPSC for primary grades is based on 35 school textbooks, which were approved by the Ministry of Preschool and School Education of the Republic of Uzbekistan.

B. The Algorithm for Extracting Basis Words

We can build the block diagram of the given problem as follows:

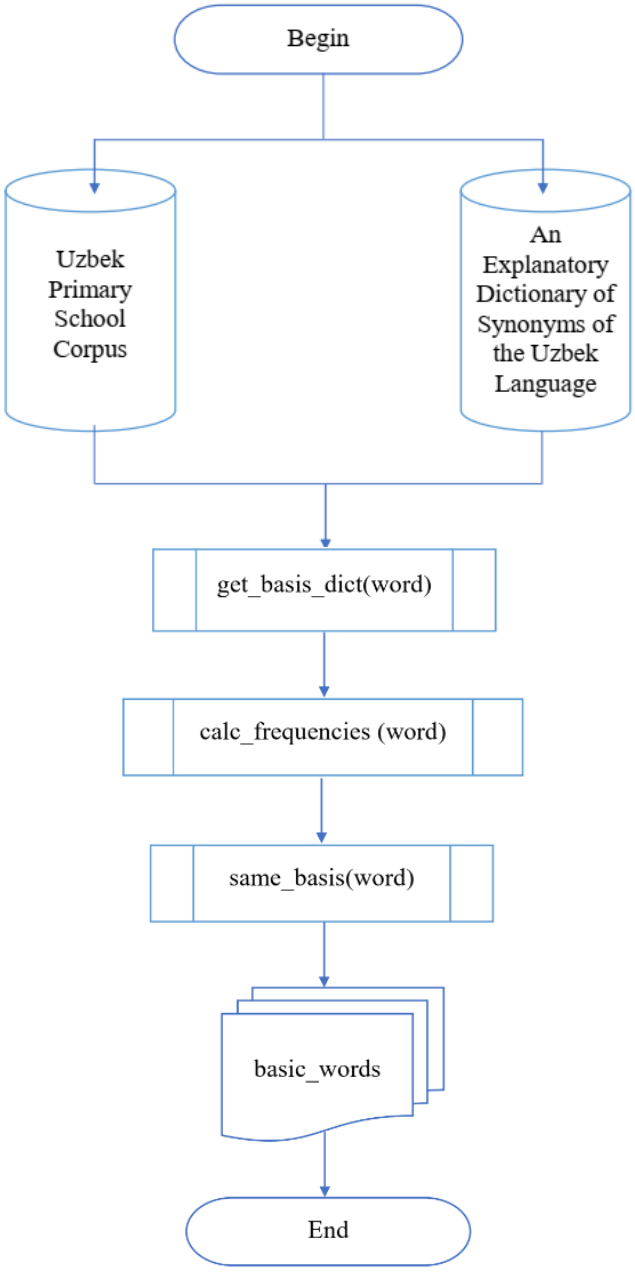

Figure 1. An algorithm for extracting basic words from UPSC and an explanatory dictionary of synonyms of the Uzbek language

Based on the above block diagram, we get UPSC and an explanatory dictionary of synonyms of the Uzbek language. By comparing these, we can extract basis words using the high-frequency method.

1) We converted the DataFrame form of 1st-4th grade textbooks to the list form
2) We converted the DataFrame form of synonym textbooks to the list form
3) We perform this process using the following 3 functions:

a) get_basis_dict: The first step is to take the synonym list and the first-to-fourth-grade textbooks and refer to the calc_frequencies function. The result with the highest frequency is selected.

b) calc_frequencies: refers to the same_basis function, which adds frequencies in order to create the total frequency of the base word. The function returns a list of the basis words.

c) *same_basis: The function determines whether the word taken from the first-fourth grade textbooks begins with the word taken from the synonym list. If true, in this case, the word, which is taken from the synonym, is called the base word and returns to the calc_frequencies function.*

Results are written in separate files for 1st -4th grade.

To solve this problem, first of all, the Uzbek Primary School Corpus and an explanatory dictionary of synonyms of the Uzbek language are transferred to the list view in the form of a DataFrame(table). The school corpus contains tokens. The dictionary of synonyms consists of a group of synonyms. That is, one group includes one word and all its synonyms. Next, we get the first group in the dictionary of synonyms. We will search for the first word in it in the 1st class UPSC, if it exists, and if other words start with it, adding their frequency to that word will be written to a new list. This found word is the base word. Takes the second word in that group. It is also searched in the 1st-grade school corpus. If it exists and other words start with it, it adds their frequency and writes that word on the next line of the new list. Among the words that belong to one group of synonyms, choose the word (or words) with the highest frequency. The list of such words is the list of the first-grade basis words. The same process is done for grades 2, 3, and 4. The results are transferred from the list view to the DataFrame view and written to a new file. As a result, we have a table of basis words for grades 1, 2, 3, and 4.

This work involved a comparison of the UPSC and an explanatory dictionary of synonyms of the Uzbek language; a table of basic words was created by extracting high-frequency words. Frequencies are important in the extraction of basis words. We only worked with words with the highest frequencies in this study. If there are several words with the same frequency in the group of synonyms, we accept all of them as basis words. Low-frequency words have not yet been studied.

The following algorithm is presented for extracting basic words.

Analysis and Results

In **Ошибка! Неверная ссылка закладки.**, the number of basis words of 1st-grade school students is derived by identifying high-frequency words. The basic word list includes common words that are encountered in daily life. As the table above shows, a first-grade student can learn to speak, listen, and understand, write an essay, and

develop reading skills if they know 2,266 basic words. It is important to note that these 2266 basis words are essential for future activities.

Table 1. Information on the total number of basis words in the textbooks of each grade

Number of Basis Words for Primary School Grades				
Grade	*1st Grade*	*2nd Grade*	*3rd Grade*	*4th Grade*
Basis Words	*2266*	*3431*	*4454*	*5065*
Total Number Words	*3177*	*5119*	*6710*	*8029*

The identification of 2266 basis words was derived by examining high-frequency words from 3,177 lemmas across grade 1 in the Uzbek Primary School Corpus. For two classes, 3431 basis words were extracted from 5,119 lemmas, 4454 basis words from 6,710 lemmas, and 5065 basis words from 8,029 lemmas, respectively. It is evident that the student's vocabulary increases with new words. Consequently, a set of fundamental words with the highest frequency is obtained [https://zenodo.org/records/13340539]. These numbers are strengthened by the alphabet, reading book, mother tongue, the world around us, music, physical education, and other school textbooks, underscoring the significance of every child attaining mastery of the fundamental word list.

Conclusion

The problem of extracting basis words from the texts of the Uzbek language is necessary to determine the level of knowledge of the language. In addition, these basic words are the main element in creating a vocabulary divided into levels for language learners and schoolchildren. This article describes the method of extracting base words and the corresponding block diagram. School teachers or language teachers can use the results obtained to determine the completion of a specific class or degree (like a basic vocabulary list for English Language proficiency levels A1-C2).

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SOME ASPECTS OF DEVELOPING STUDENTS' CREATIVITY AS AN ABILITY TO BE CREATIVE

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Annotatsiya. Maqola universitet talabalarining ijodiy fikrlashi asosida mustaqil ravishda bilim olish qobiliyatini rivojlantirish zaruriyatini asoslash maqsadida, ularning kreativligini aniqlash uchun turli xil yondashuvlarni o'rganishga bag'ishlangan. O'tkazilgan tadqiqotlar shuni ko'rsatadiki, talabalar yutuqlari darajasining kreativlikka bog'liqligi mavjud.

Kalit so'zlar: *kreativlik, ijodkorlik, fikrlashning moslashuvchanligi, qarama-qarshiliklarni hal qilish, intuitsiya, o'ziga xoslik.*

Аннотация. Статья посвящена изучению разных подходов к определению креативности с целью обоснования необходимости развития у студентов технических вузов способности к самостоятельному получению знаний, основанной на креативном мышлении. Проведенное исследование позволяет утверждать, что существует зависимость уровня достижений студентов от креативности.

Ключевые слова: *креативность, творчество, гибкость мышления, разрешение противоречий, интуиция, оригинальность.*

Abstract. The article is devoted to the study of different approaches to the definition of creativity in order to substantiate the need for students of technical universities to develop the ability to independently acquire knowledge based on creative thinking. The conducted research suggests that there is a dependence of the level of achievements of students on creativity.

Keywords: *creativity, creativity, flexibility of thinking, resolution of contradictions, intuition, originality.*

Introduction

In the context of modern advances in science and technology, the most significant outcomes of engineering work, as is well known, consist in the discovery and practical implementation of new technical solutions with progressive socio-economic orientation. Only specialists with a high level of creativity can achieve such outcomes. These students are more capable of effectively responding to the challenges of contemporary society. In turn, the modern labor market increasingly seeks highly qualified professionals who are able to adapt to rapidly changing environments and integrate innovation into business processes. Current trends in higher education emphasize this issue, as creativity has become a skill that significantly enhances graduates' competitiveness.

Moreover, against the backdrop of rapid development in information technologies and digital transformation, skills related to creativity are becoming increasingly in demand - including design, content development, and artificial intelligence applications - all of which require creative thinking from students. It is worth noting that despite the relatively limited number of studies in the past, the issue of fostering creativity in university environments has recently attracted growing attention from scholars, indicating increased interest in the topic and the need for its deeper examination. Today, a number of works have been devoted to the discussion of methods and approaches for developing creativity among students in technical universities. Considerable attention is also being paid to its role in interdisciplinary fields, helping to understand how creativity can be applied across different domains.
The aim of the present study is to conduct a comprehensive analysis of the role of creativity development among students of technical universities and their creative potential within the modern educational process.

Literature analysis

When addressing the theoretical analysis of the phenomenon of creativity, it is important to note that many aspects of this issue are the subject of interdisciplinary study across various fields of science. Until recently, sustained attention to the problem of individual creativity has been primarily observed in psychology, while researchers in pedagogy have examined the issue to a much lesser extent. Therefore, there is a growing need to synthesize fragmented knowledge related to the concept of "creativity."

At first glance, the concepts of "creativity" and "creative ability" may appear synonymous, which could raise doubts about the necessity of using different terms. However, it is more accurate to define creativity not merely as a specific creative ability or a set of such abilities, but rather as a capacity for creativity-concepts that are closely related but not identical.

Creativity (from the English term "creativity") is generally understood as a set of intellectual and personal characteristics of an individual that enable the independent identification of problems, the generation of a large number of original ideas, and the non-standard resolution of those problems.

The concept of creativity as a universal capacity for creative activity was introduced into science by Guilford J. He presented a new approach to creativity in terms of the "creative personality" and "creative productivity." According to his view, this approach allows for the identification and development of creativity [1].

Uzbek scholars and educators such as Jamoliddinova O., Musurmonova O., Urazova M., Egamberdieva N., Yuzlikaeva E., Sharipova Sh., and Shodmonova Sh., in their scientific research, have developed and implemented an innovation-driven educational approach to fostering students' creative and innovative competencies. This approach emphasizes motivation, engagement, and instructional support targeted at the development of students' creative skills.

The issue of creativity has also been explored in the works of scholars from the Commonwealth of Independent States (CIS) (Rubinstein S.L., Ponomarev Ya.A.,

Bogoyavlenskaya D.B., Morozov A.V.), as well as international researchers (Guilford J., Torrance E.P., Mednick S., May R., Maslow A., Rogers C.).

"In this study, we explore key challenges and strategies in fostering creativity among students in technical disciplines, aiming to assess their ability to independently acquire knowledge through creative thinking."

Research Methodology

Ensuring the reliability and validity of collected and processed information was a priority during the research. To achieve this, a number of pedagogical research methods were employed. These include:

The method of systems analysis (including morphological and functional-parametric descriptions);

Statistical methods (normative, comparative, random assessment method, change-tracking method, constructive-critical analysis, etc.);

Survey methods: interviews, questionnaires, and the sociometric method.

The analysis and interpretation of creative competence development were grounded in the fundamental works and theoretical frameworks of both domestic and foreign scholars.

The study also employed theoretical methods to systematize approaches and findings presented in scientific literature on pedagogy and educational psychology, particularly regarding the development of students' creative competence in a digital university environment. These methods included analysis, synthesis, and generalization.

Analysis and Results

Creativity is a holistic, dialectical, and value-based dimension. From a philosophical perspective, creativity is regarded as a means of transforming the world. This is reflected in the assertion that "if a fundamental creative attitude of the subject towards the world and toward oneself is truly accepted, it also implies the inclusion of an addition or completion to this being (and knowledge) in the form of a relatively new, unprecedented result" [2]. A notable idea comes from Maslow A.H., who argued that creativity has stages of development. He posited that "primary creativity is genetically embedded in each of us. It is universal and by no means unique" [3]. Thus, primary creativity is a natural inherent quality in every individual.

Morozov A.V. viewed creativity not as a singular factor, but as a set of equally significant abilities, each of which can be manifested to varying degrees [4].

Torrance E.P. defined creativity as the capacity to sensitively perceive deficiencies, gaps in knowledge, missing elements, disharmony, etc. He proposed a model of creativity that consists of three key factors: fluency (productivity), flexibility, and originality. In his approach, the criterion for creativity is not the quality of the outcome itself, but the characteristics and processes that stimulate creative productivity [5].

Harris S.R. understood creativity as a process of reconstructing elements into new combinations that meet certain criteria of usefulness and other specific requirements. He developed the Remote Associates Test (RAT), which reveals an individual's ability to form appropriate associative links [6]. In domestic psychology and pedagogy, many scholars have treated the concepts of "creativity," "creative ability," and "creative

potential" as synonymous. Their similarity arises from shared analytical approaches to the essence of these concepts:

As a specific trait or characteristic of an individual manifested in life activity (Bernstein M.S., Evladov E.B., Ponomarev Ya.L., and others);

As the intellectual foundation for creative prerequisites and activity (Bogoyavlenskaya D.B., Brushlinsky A.V., Tikhomirov O.K., and others).

Contemporary educators define the concept of the term "creative personality" in several ways:

As the dominance of the process of creating something new (Turaev A., Brushlinsky A.B., Molyako V.A.);

As the result of creative thinking (Muslimov N.A., Tikhomirov O.K.);

As a socio-psychological orientation toward non-traditional problem-solving (Usmonbaeva M., Kolesnikova E.V.);

As an individual trait that determines one's capacity for creative self-fulfillment and self-realization (Kolosova M.);

As an integrative personal quality expressed through one's attitude, position, and orientation toward creativity (Matyushkin A.M.);

As a system of personal abilities (inventiveness, imagination, critical thinking, openness to novelty), which allow individuals to optimally adapt their actions to new conditions, as well as a body of knowledge, skills, and beliefs that influence the outcomes of their activity (Rindak V.G.).

Our theoretical analysis of the characteristics of creative personality has led to several key conclusions. It is well established that there is no single, universally accepted understanding of the nature of creativity. Some researchers equate creativity with divergent thinking, considering it a function of intelligence. Others define creativity in terms of creative potential or abilities. Still others link the nature of creativity to various personal characteristics and traits, including personality structure, emotional-volitional dynamics, and socio-role components.

A number of researchers adopt an intermediate position between the functional-intellectual and personality-oriented approaches to understanding the nature of creativity. They tend to consider creativity as a personal capacity, a stance that warrants attention due to its investigation into how various conditions influence the formation of creativity.

The key techniques in the process of developing creativity include combining, drawing analogies, identifying new relationships, and transferring the function of one object to another [7]. The main operation that "works" during the creative process, according to Druzhinin V.N. [8], is comparison, a process that establishes meaningful connections between elements through reproduction, semantic synthesis, or random combinations without establishing semantic relationships.

In our opinion, teaching students critical thinking methods plays an invaluable role, as they develop the ability to identify core ideas, critically assess, compare, and systematize information. However, it is equally important to teach creative thinking techniques, such as drawing analogies and transferring knowledge from one field to another. As French psychologist Surye wrote, "to create, one must think around it." By analogy with peripheral vision, he introduced the concept of "lateral thinking,"

meaning the ability to find solutions by using external information. Thus, it is evident how crucial and valuable knowledge across diverse fields is.

Summarizing the approaches to understanding creativity outlined above, it should be noted that each approach addresses only one aspect and manifestation of this quality, leading to a somewhat one-sided understanding of this phenomenon, which has a variety of characteristics. However, simply merging all of these approaches into one unified concept is also problematic. Rather, it should be assumed that creativity is a systemic, complexly organized phenomenon with a hierarchical structure, and each of the spheres described in the approaches above is included in this system.

Conclusions

When considering the validity of using the concept of "creativity" in our study, it should be emphasized that student years are a critical period for accumulating knowledge, gaining experience, and recognizing one's own abilities. A rich potential accumulated during the student years can ensure the preparation of highly qualified and creative professionals.

One of the most essential competencies that university students must acquire is the ability to independently generate knowledge, a process fundamentally rooted in creativity. We use the term "creativity" to highlight the personal and creative nature of the educational process we envision: one in which the focus is not merely on the accumulation of knowledge, but rather on the ability to acquire it; not on memory, but on thinking as the primary mechanism of the psyche; not on passive persistence, but on active engagement in learning; not simply on comprehension, but on self-determination. This means that creativity is not manifested in the knowledge, skills, and competencies themselves, but in the dynamics of acquiring them - how quickly and easily a student masters cognitive activity. Creativity determines the quality, success, level of achievement, and the manner in which this activity is carried out.

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REMARKS ON THE THEORETICAL BASIS OF ECOTOURISM

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Annotatsiya. Ushbu maqolada ekoturizmning ilmiy-nazariy asoslariga doir fikr-mulohazalarga qaratilgan bo‘lib, ekoturistik tasniflash ilmiy tadqiqotlarni maqsadli yo‘naltirish, ekoturlarni rejalashtirish va olib borish, milliy va xalqaro miqiyosda loyiha, dastur, reja, tegishli qonuniy me’yorlarini ishlab chiqish imkoniyatini yaratish yuzasidan so‘z yuritilib, jadal suratlarda rivojlanib borayotgan turizmning mustaqil yo‘nalishi bo‘lgan ekoturizmni umume’tirof etiladigan ilmiy nazariy asoslariga to‘xtalib o‘tilgan.

Kalit so‘zlar: *Xalqaro turizm tashkilotlari, barqaror rivojlanish, turizm infratuzilmasi, ekoturizm, ekoturistik konsepsiya, ekoturizmni ilmiy-nazariy asoslari.*

Аннотация. В статье изложены размышления о научно-теоретических основах экотуризма, рассмотрены возможности создания классификации экотуризма для целенаправленного направления научных исследований, планирования и проведения экотуров, разработки проектов, программ, планов и соответствующих правовых норм в национальном и международном масштабе, затронуты общепризнанные научно-теоретические основы экотуризма как самостоятельного направления туризма, которое стремительно развивается.

Ключевые слова: *Международные туристские организации, устойчивое развитие, туристическая инфраструктура, экотуризм, концепция экотуризма, научно-теоретические основы экотуризма.*

Abstract. This article is focused on the reflections on the scientific and theoretical foundations of ecotourism, and discusses the possibility of creating an ecotourism classification for the purposeful direction of scientific research, planning and conducting ecotours, developing projects, programs, plans, and relevant legal norms on a national and international scale, and touches upon the generally recognized scientific and theoretical foundations of ecotourism, an independent direction of tourism that is developing rapidly.

Keywords*: International tourism organizations, sustainable development, tourism infrastructure, ecotourism, ecotourism concept, scientific and theoretical foundations of ecotourism.*

Introduction

Tourism is one of the fastest-growing sectors of the global economy. According to the World Tourism Organization (UNWTO), international tourism is expected to reach

1.3 billion people by 2023 [1]. This figure is expected to reach its pre-COVID-19 level in 2024, with revenues of $1.4 trillion.

One of the global challenges is achieving sustainable development at the local, national, regional, and global levels. Sustainable development can be achieved by addressing institutional (sustainable integration) and socio-economic issues, as well as environmental issues, in a single system. In his Address to the Oliy Majlis, the President of the Republic of Uzbekistan, Shavkat Mirziyoyev, noted that "tourism in our country is often limited to our ancient cities, historical and cultural monuments. However, there is great potential for the development of tourism in the unique nature of our country, national reserves, and mountainous regions. In particular, the development of medical tourism, pilgrimage tourism, and ecotourism will give a great impetus not only to the development of the economy, but also to the development of social sectors" [2]. The "Concept for the Development of the Tourism Sector in the Republic of Uzbekistan in 2019-2025", approved by Presidential Decree № 5611 of January 5, 2019, set the task of diversifying and improving the quality of tourism industry services and improving tourism infrastructure in order to develop the tourism sector. On June 3, 2024, when the President of the Republic of Uzbekistan, Mirziyoyev Sh.M., outlined the "Tasks for Improving Tourism Infrastructure," he said that the beautiful geographical and natural conditions are very favorable for the development of ecological tourism in the republic.

Literature Review

Since ecotourism is a young direction compared to other types of tourism, its educational aspects have not been sufficiently studied to date. In particular, Armand D.L. (1975), Preobrazhensky S.A. (1971, 1975, 1989), Kotlyarov Y.A. (1978), Mukhina L.I. (1974), Suprunenko Yu.P. (1979, 2007), Kozlov V.N. (1990), Dzhumaev T. (1998) Alieva A.J. (1998), Hasanov I. (2005), Soliev A. (2005), and others have revealed the economic, natural, and social aspects of tourism and recreational geography [10].

Research Methodology

The methods of scientific-theoretical analysis, historical-comparative analysis, and generalization were used during the research.

Analysis and results

The purpose of our research is to consider the scientific-theoretical foundations of ecotourism and develop a rating indicator for its assessment among countries. To solve this goal, the following tasks were set:

1) to analyze the level of study of the scientific-theoretical foundations of ecotourism;

2) to clarify the content and essence of scientifically based and practically oriented ecotourism;

3) to create a rating indicator for specially protected natural areas and objects that serve the development of ecotourism at the national level.

Analysis of the level of study of the scientific-theoretical foundations of ecotourism usually begins with clarifying a number of fundamental issues, such as its concept,

object of research, subject, methodology, principles, and classification rules [3]. In particular, Nigmatov A. and Shomuratova N. define ecotourism as the travel of people to the environment where organisms (including humans) live. In a broader sense, they define ecotourism as the ecological travel of individuals from their permanent places of residence to the surrounding nature or to certain natural objects for the purpose of recreation, sports, health improvement, educational and spiritual (general educational) activities, or other purposes [4].

Firstly, this concept uses the terms a person, a human being, and an individual. They have different meanings in different fields of science. A person, as a social category, has rights, but it is not always possible to impose ecotourism obligations on them. For example, preschool education is considered a social sphere, and in it, students have the right to receive education, but they are not imposed with certain obligations. That is why preschool education does not have educational standards, but educational requirements, and it is not formalized by relevant state regulatory documents (graduation certificates or diplomas).

A human being- in international law, a state that arises at the birth of a person and only gives rise to the right to live. A newborn baby does not have obligations and duties. In ecotourism, each of its participants, that is, its subject, is also obliged to use ecosystems rationally, restore and protect damaged ones.

A person is manifested in civil law in both physical and legal forms. It is appropriate to use both of these in defining the concept of ecotourism. Because individuals and legal entities (physical and legal persons) participating as subjects of ecotourism are assigned environmental rights and obligations [5].

Secondly, in accordance with international requirements, in order to obtain the status of a tourist, a person must spend at least 24 hours to 6 months or at least one night in tourist facilities at the place of travel [6]. Otherwise, the person will not have the status of a tourist, but rather a visitor.

Thirdly, the object of study of ecology is an ecosystem, that is, a place of residence, home or environment of living beings. Therefore, we believe that ecosystems should be taken as an ecotourism object.

Based on the three cases analyzed above, ecotourism in a narrow sense is a person's travel to certain ecosystems. Ecotourism in a broad sense is a person's travel from their permanent place of residence to ecosystems of a country or place that perform ecological functions by spending at least one night in them. In an era of increasing and conflicting environmental problems, ecotourism should be not only a source of income, but also one of the main forms of raising the ecological awareness and culture of the population. Its distinctive feature, which distinguishes it from other types of tourism, is its implementation of ecological functions. Ecotourism is one of the new directions of modern tourism, which has been developing on a large scale all over the world in the last decade. According to data, it covers 12-17% of the tourism market, and its growth rate is twice as high as the growth rate of the general tourism industry. Ecotourism is also an effective means of environmental protection and a strong key to sustainable development. Ecotourism is primarily aimed at direct communication with nature, experiencing its beauty and negative phenomena, understanding how important active recreation in the bosom of nature and the restoration of ecosystems are for

humans. The main goal of ecology - ecological security - is ensured through all its directions using various means, methods and ways. Ecotourism is one of its most popular methods.

The goal of ecotourism is the rational use of ecosystems in the tourist direction in order to ensure sustainable development and environmental safety of present and future generations. To ensure the goal of ecotourism, the international community requires the state and society to perform the following tasks:

- finding ways to increase the ecotourism rating of the state;
- organizing ecological societies on a global and regional scale and determine their legal status;
- developing a single general theoretical basis for the science, education and practice of ecotourism on a global, regional and local scale;
- raising the ecological awareness and culture of the population through ecotourism;
- training and retraining highly qualified specialists in ecotourism;
- developing special laws to form the ecotourism industry and create their legal mechanism;
- assessing the tourist potential of ecosystems and maintain a cadastral management;
- establishing touristic zoning, monitoring, and forecasting of ecosystems;
- implementation of measures to increase the number of ecotourism companies and support them legally;
- development of a mechanism for encouraging positive actions related to ecotourism in accordance with the requirements of the time, etc.

Since ecotourism is a relatively new scientific field, a well-defined theoretical foundation has not yet been established, and there is no clear consensus about its subject matter. Although ecotourism is growing quickly as a form of tourism, it still lacks a solid scientific basis. In philosophy, the object of science and tourism is considered based on specific requirements [7]. In the case of ecotourism, the object is ecosystems — the habitats, environments, and niches of organisms — where tourism activities can be developed and organized within a hierarchical structure across different scales.

The subject of ecotourism is the tourism opportunities and aspects of ecosystems. Classification of ecotourism is the expression and naming of ecosystems in a certain sequence, depending on their tourism opportunities and aspects. Erdavletov S.P. emphasized that it is expedient to implement a single hierarchical relationship in the classification of tourism types, taking into account real social, economic, legal, political, natural, and ecological conditions [8]. When classifying ecotourism based on world experience, it can be implemented according to ecotypes and divided into hierarchical parts as follows: form → class → type → view → group → level.

The highest taxonomic unit of ecotourism is a form of general tourism. Based on the subject of ecotourism, it is appropriate to divide ecotours into three types:

1. Ecotours aimed at protecting the natural environment. This includes trips to specially protected areas (wildlife sanctuaries, reserves and natural monuments) and objects [9].

2. Ecotours are aimed at the rational use of natural resources. Ecotours are conducted on ecotourism objects in human economic activities. They are often carried out in conjunction with other types of tourism (agro, religious, historical).

3. Ecotours aimed at restoring degraded natural complexes and systems. Ecotours are organized to ecotourism sites that have changed as a result of anthropogenic or natural processes and events, such as the southern states of the United States devastated by the Katrina tsunami, the Aral Sea and its coastal areas, etc.

Forms of ecotourism, in turn, are divided into classes. We distinguish three classes depending on which ecotourism object the subject of ecotourist social attitude is focused on:

1. Ecotours related to the protection of natural components, their rational use and restoration of damaged ones;

2. Ecotours related to the protection of natural systems, their rational use and restoration of damaged ones;

3. Ecotours related to the protection of natural complexes, their rational use and restoration of damaged ones.

The 3rd stage (row) in the functional classification of ecotourism is directly related to its specific type of tourism:

1. Extreme ecotours;

2. Scientific ecotours;

Depending on the means by which ecotourism is carried out, that is, it can be classified as follows:

1. Rafting ecotours;

2. Bicycle ecotours;

3. Ecotours on horses.

The content and essence of the above-mentioned taxonomic units of ecotourism are ultimately divided into groups such as age, social status, health, and interests of tourists:

1. Eco-tours for school-aged children;

2. Ecotours for students;

3. Ecotours designed for scientific researchers.

Ecotourism can also be graded according to the economic capabilities of tourists:

1. Ecotours for the population in need of social protection;

2. Ecotours for middle-income residents;

3. Ecotours for high-income residents;

4. Eco-tours for low-income population, etc.

Thus, ecotourist classification can have different classification symbols depending on the goals and tasks of ecotours. No strict criteria for dividing it into taxonomic units have yet been developed. Our classification is the first scientific experiment, but not conclusive. Ecotourism classification can take different forms and forms depending on the real opportunity, conditions, situation. It is natural for it to be revised and amended at the global, regional, national and local levels.

In conclusion, ecotourism classification creates the opportunity to target scientific research, plan and conduct ecotours, develop projects, programs, plans and even relevant legal norms on a national and international scale.

In science and practice, as a rule, when distinguishing the stages of development or formation of a certain science or system of sciences and a field of practice, the following indicators are taken into account:

1) the time of recognition of a scientific field as an independent science or field of practice and its acceptance by the public and the majority of scientists;

2) the period of advancement of science to a new level;

3) the period of transformation of science into a system of sciences;

4) the period of reconsideration of the methodological foundations of a science or system of sciences;

5) the period of scientific and technological changes in the relevant scientific field;

6) the period of changes in conceptual worldviews in science, etc.;

Analyzing the literature in the field of tourism and taking into account the above-mentioned scientific and practical indicators, we recommend, for the first time, distinguishing the following stages of ecotourism:

I. The period up to the 90s of the 20th century is the period of the emergence of ecotourism as a local and national independent tourism sector.

II. The 1990s-2000s are the period of the development of ecotourism as a tourism industry on a regional scale.

III. The stage after 2000 is the period of the development of ecotourism on a global scale.

Ecotourism concept - a system of worldviews reflecting the place, significance, content, and essence of tourism in this material world.

Ecotourism principle - a set of rules aimed at regulating ecological relations through tourism. These principles were created by combining general tourism principles with general environmental principles, and most of them are reflected in national and international legal norms. For example, the ecotourism industry, while involving large investments and resources, is an economic sector that performs educational and spiritual functions necessary for the state and society. Through it, foreign travelers get an idea of the rich and unique nature of other countries, while citizens get to know their homeland closely, creating an opportunity for them to form a sense of national values, pride, and honor for their homeland.

Conclusion

In conclusion, ecotourism is an independent direction of tourism that is developing rapidly, but its generally recognized scientific theoretical foundations have not been developed. Therefore, the adoption of educational and regulatory documents on the scientific-theoretical foundations of ecotourism, the training of relevant personnel, the improvement of their qualifications in accordance with the requirements of the time, and the retraining of non-specialists remain a very urgent problem.

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ELECTRICAL AND PHYSICAL PROPERTIES OF SOLID TUNGSTEN CARBIDE-COBALT ALLOYS

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Annotatsiya. Ishchi yuzaning yeyilish xususiyatiga qarab val va vtulka tipidagi detallarning ishlash qobiliyatini tiklashning samarali texnologiyalari ko‘rib chiqiladi. Ushbu sohada eng to‘g‘ri va ekologik toza yechimlar, ta’mirlash, ishlab chiqarish sharoitida ularni amalga oshirish imkoniyati nuqtai nazaridan aniqlandi. Ta’mirlash vaqtida val va vtulkalar resursini ko‘paytirish usullaridan biri kukunli kompozitsiyalarini elektrokontaktli qoplash orqali yuzalarni tiklash va yeyilishga qarshilik uchun yaxshi ish sharoitlarini ta’minlaydigan qulay sirt mikroprofilini shakllantirish kerak ekanligi ko‘rsatilgan.

Kalit so‘zlar: *elektrokontakt pishirish, qoplama, tok kuchi, kompozitsion material, qattiq qotishma, volfram karbidi, kobalt.*

Аннотация. Рассмотрен эффективный технология восстановления работоспособности деталей типа вал и втулка в зависимости от характера повреждения рабочей поверхности. Выявлены наиболее целесообразные и экологически безопасные решения в этой области с позиций возможности их реализации в условиях ремонтного производства. Показано, что одним из путей повышения ресурса валов и втулок при ремонте является восстановление поверхностей методом электроконтактного спекания порошковых композиций и формирование благоприятного микропрофиля поверхности, обеспечивающего лучшие условия эксплуатации трибоузла.

Ключевые слова: *electrocontact sintering, coating, current, composite material, hard alloy, tungsten carbide, cobalt*

Abstract. The effective technologies for restoring the operability of shaft and bushing type parts depending on the nature of the damage to the working surface are considered. The most appropriate and environmentally friendly solutions in this area are identified from the standpoint of the possibility of their implementation in the conditions of repair production. It is shown that one of the ways to increase the resource of shafts and bushings during repair is to restore the

surfaces by electrocontact sintering of powder compositions and form a favorable surface microprofile, providing better operating conditions for the tribo unit.

Keywords: *electrocontact* method, *coating, covering each carbide grain, current strength, composite material, tungsten carbide-cobalt hard alloys.*

Introduction

In the process of coating the working surfaces of parts using the electrocontact method, the physical, mechanical, and operational properties of the coating are formed primarily based on: the nature, chemical composition, electrophysical properties of the material selected for the coating, and the technological conditions of its coating [1]. The technological conditions of coating the part using the electrocontact method include: the geometric dimensions and shape of the part being coated, the type (grade) of its material; coating thickness; the size and material of the coating roller; the electric power during coating; the speed of coating and powder transfer [2-3]. A mathematical model of the process has been developed that allows you to select the optimal technological indicators for coating a WC-Co-based coating using the electrocontact method [4].

Literature Review

A hard alloy is a composite material consisting of a powder of a chemical compound of refractory metals (W, Ta, Ti, V, Mo, etc.) and a mechanical mixture of a binder metal (Co, Ni, or Cu) that melts at a lower temperature than the chemical compound [5]. The structure of a hard alloy is a heterogeneous structure, a composition consisting of a mixture of a chemical compound (phase) of refractory metals and a binder metal (phase) Most hard alloys used in various industries contain chemical compounds of refractory metals in the form of particles (phases), the size of which in most cases is around 0.5 - 1.5 μm. In addition, in very rare cases, a hard alloy can be made only from powders of chemical compounds of refractory metals, but their widespread use in production is limited due to their high brittleness [6]. According to the above tariff, WC-Co hard alloys consist of at least two components: the first is a chemical compound of tungsten with carbon, which is a highly hard (HV 24 GPa) and wear-resistant substance; the second is cobalt, which is used to perform the function of a binder, which is a relatively plastic metal and is located in the structure, covering each carbide grain. One of the main reasons for using cobalt as a binder in hard alloys is that it does not chemically react with tungsten carbide during the production of the hard alloy (at temperatures in the range of 1350...1400 ° C), i.e. tungsten carbide retains its original physicochemical properties in the composition [7-9].

Research Methodology

In the electro-contact method of coating, the electrophysical properties of the material used for the coating are of great importance, since the coating process occurs as a result of the passage of electric current through the material being coated.

Analysis and Results

In this case, the material being coated is heated to high temperatures under the influence of the electric current flowing through it and completely or partially passes

into a molten state and is micro-welded to the surface of the part. In this case, the value of the current flowing through the material being coated should be selected so that it does not lead to complete liquefaction of the material being coated, otherwise the coating will liquefy and flow off the roller. The use of WC-Co based hard alloys as a coating material creates a number of complications related to the electro-physical properties of tungsten carbide. The electro-physical properties of tungsten carbide are given in Table 1. Tungsten chemically combines with carbon to form two types of compounds, W 2 C and WC, which differ in their electrophysical properties and crystal structure.

Table 1. Electro- physical properties of tungsten carbide.

The name of electro-physical indicators	Modifications of tungsten carbide	
	α-W_2C	α-WC
Color	Gray	Gray
Crystal lattice	Hexagonal	Hexagonal
Grid size, nm	a = 0,2992 c = 0,4722	a = 0,2906 c = 0,2839
Density, g/cm^3	17,2	15,6
Enthalpy, kJ/mol	-47,2	-35,2
Entropy, J/(mol·K)	11,70	8,89
The specific heat of melting is 10 J/kg	1,84	1,84
Coefficient of thermal expansion, K^{-1}	$1{,}2\cdot10^{-6}$	$3{,}9\cdot10^{-6}$
Thermal conductivity, W/(m·K)	29,3	29,3
Relative electrical resistance r, Oh·mm^2/m	$7{,}6\cdot10^{-7}$	$1{,}92\cdot10^{-7}$
Relative electrical resistance, μΩ·cm (20^{o}C)	76	19,2
Relative electrical conductivity, ohm^{-1} ·cm^{-1}	-	52200
Hardness, according to Moos	9	9
Hardness according to Rockwell, MPa	800	810
Young's modulus, GPa	428	720

As can be seen from Table 1, the modifications of tungsten carbide differ from each other in their electro-physical and structural properties. The electrical resistance of tungsten carbide differs slightly from that of, for example, ordinary steels. At the same time, the melting point of tungsten carbide is 2870 °C, which is almost twice the melting point of iron. As described above, in the electrocontact method, the nature of the coating process is such that, as a result of the flow of electric current through the compacted powder coating between the roller and the surface being processed, the electrical energy is converted into thermal energy due to the resistance of the powder material. The amount of heat generated Q is expressed according to the Joule-Lenz law as follows:

$$Q = 0,86I^2 \cdot R \cdot \tau \quad (1)$$

where Q is the amount of heat, *J*; I–current flowing through the product, *A*; R–electrical resistance of the coating product, *Ohm*; t -is the time of electric current flowing through the product, second.

In turn, the electrical resistance of the coating is determined by the following formula depending on its relative electrical resistance and geometric dimensions

$$R = \frac{\Omega \cdot l}{S} \quad (2)$$

where Ω is the electrical resistance of the conductor, $Oh \cdot mm^2/m$; l – conductor length, m; S – conductor surface, mm^2;

$Q = f(R)$ depending on the electrical resistance of the material selected for the coating is presented in Figure 1.

The graph shows that the amount of heat released from the coating material is linearly related to the electrical resistance of the material $Q = f(R)$, i.e. ($I = cons$) the greater the electrical resistance of the material, the more heat is released. However, with an increase in the amount of heat, the risk of the powder reacting with oxygen in the air increases. In addition, a coating consisting only of the chemical compound WC cannot work for a long time under the influence of variable, vibrational and shock loads, therefore, a binding component is added to materials based on chemical compounds to tungsten carbide powder as a binding component, a powder mixture of tungsten carbide cobalt hard alloy is formed. In the process of coating such a mixture on the surface of the parts by the electro-contact method, the electric current begins to flow through the component with a small electrical resistance according to Kirgoff's law. Electro-physical properties of cobalt are presented in Table 2.

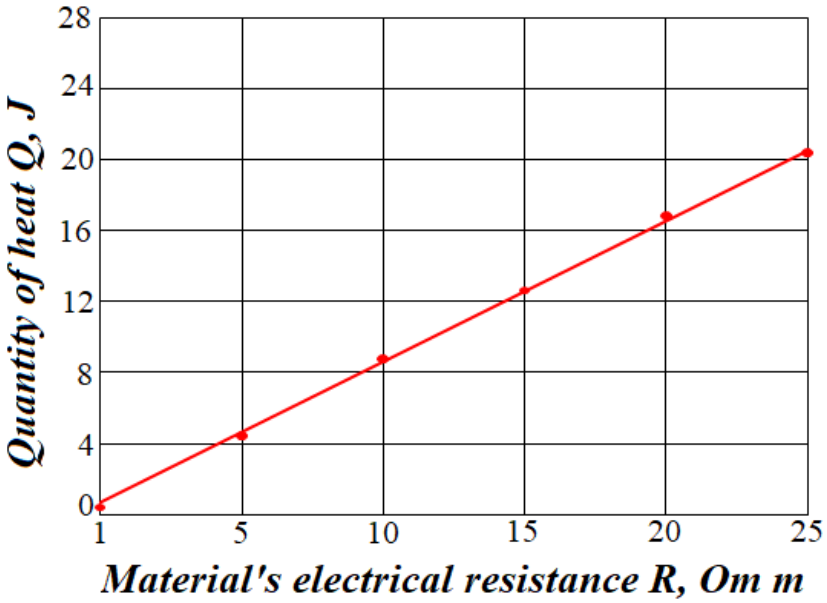

Figure 1. The dependence of heat dissipation on the electrical resistance of the coating material.

The electrical resistance of metal and alloy powders is a variable quantity that can vary depending on the chemical composition of the powder, the size and shape of the powder particles, the surface condition of the powder particles and the property of the oxide film on the surface, and the density of the powder. For example, the relative electrical resistance of a powder with the same chemical composition and properties will vary depending on its density.

Table 2. Electro-physical properties of cobalt

The name of electro-physical indicators	**Values**
Density, g/cm^3	8.9
Relative heat capacity, J/(K·mol)	0.456
Thermal conductivity, (W/(m·K))	100
Melting temperature *T er*, ºC	1498
Heat of liquefaction, kJ/mol	15.48
Molar volume *V m*, cm^3 /mol	6.7
Relative electrical resistance r, μOm·cm	6.24
Hardness, according to Moss	5.5
Hardness HB, MPa	700
Hardness HV , MPa	1043

For grinding and as heat-resistant coatings on the working surface of parts are presented in Table 3.

Table 3. Grades and some basic properties of WC+Co hard alloys.

Stamp ρ, μΩ·cm	**Physical properties**			**Mechanical properties**			
	ρ, mkOm·sm	**α,·10^6, K**	**λ, W/(m·K)**	**N s , A/m**	**σ σ , MPa**	**α, J/(m ·102^{-3})**	**E, GPa**
WC 3	19,0	4,5	-	11,9 – 15,1	4270±200	0,15±0,01	655
WC 4	19,3	4,7	5,02	10,3 – 14,3	4360±300	0,16±0,01	650
WC 6	19,2	4,9	5,02	10,3 – 15,1	4390±280	0,21±0,01	640
WC 8	18,6	5,1	-	8,0-14,3	4210±220	-	610
WC 10	18,4	5,3	5,45	6,4 – 11,1	4120±140	0,35±0,02	585

Conclusion

Literature analysis of the electrophysical properties of tungsten carbide-cobalt hard alloys shows that the properties of the hard alloy exceed the electrophysical and mechanical properties of its constituent components, which makes these hard alloys a composite material with unique properties. At the same time, it is shown that the main properties of the hard alloy vary in many respects depending on the particle size of tungsten carbide and the amount of cobalt.

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INVESTIGATION OF SPUTTERING ICE LAYERS FROM Au(111)

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Annotatsiya. Ushbu maqolada boshlang‘ich energiyasi E_0 = 200 va 400 eV bo‘lgan Ar^+ ionlari bilan bombardimon qilinganda Au (111) sirtini qoplagan muz yupqa qatlamining (olti qatlamli) changlanishi tadqiq qilinganda olingan natijalari keltirilgan. Natijalar shuni ko‘rsatadiki, E_0 = 200 eV da argon ioni muz qatlami ichida qoladi va shu bilan o‘zining energiyasini muz qatlamlarini changlanishiga sarflaydi. Aniqlanishicha, boshlang‘ich energiyaning bu qiymatida asosiy energiya yupqa qatlamda qoladi, bir qismi esa oltin kristaliga o‘tadi, bu esa oltin kristall atomlarining o‘z o‘qlari atrofida tebranishlari ko‘rinishida kuzatiladi. E_0 = 400 eV bo‘lganda argon ioni kristall ichiga kirib boradi va shu bilan uning energiyasining bir qismini kristallga o‘tkazadi. Bu oltin atomlarining kuchli tebranishlariga olib keladi. Shuningdek, suv molekulalari va ularning klasterlarining changlanishi kuchayadi. VMD dasturidan foydalanib, biz muz plyonkasining changlanish jarayonini kuzatishingiz mumkin. Natijalar metall yuzalarni har xil turdagi molekulalardan tozalashni o‘rganishda katta qiziqish uyg‘otadi.

Kalit so‘zlar: *klaster, chayqalish, kompyuter simulyatsiyasi, ion bombardimoni, molekulalar.*

Аннотация. В этой статье представлены результаты исследования распыления пленок(шести слоёв) льда, покрывающий поверхность Au(111) при бомбардировке ионами Ar^+ с начальной энергией E_0=200 и 400 эВ. Полученные результаты показывают, что при E_0=200 эВ ион аргона остаётся в пленке и тем самим передавая свою энергию приводит к распылении пленки льда. Установлено, что в этой значений начальной энергии основная энергия передается к пленке, а часть к кристаллу золото, который наблюдается в виде колебаний атомов кристалла золото вокруг своих осей. А при E_0= 400 эВ ион аргона проникает во внутрь кристалла и тем самим передавая долью свою энергию к кристаллу. И это приводит к более сильному колебанию атомов золото. А также усилении распылении водных молекул и их кластеров. С помощью VMD программы можно наблюдать процессом распыления пленки льда. Полученные результаты представляют

большой интерес при изучении очистки поверхности металлов от разных типов молекул.

Ключевые слова: *кластер, распыления, компьютерное моделирования, ионная бомбардировка, молекулы.*

Abstract. This article presents the results of a study of the sputtering of ice films (six layers) covering the surface of Au(111) when bombarded with Ar^+ ions with initial energies E_0 = 200 and 400 eV. The results show that at E_0=200 eV, the argon ion remains in the film and thus transfers its energy, leading to the sputtering of the ice film. It has been established that at this initial energy value, most of the energy is transferred to the film, and part of it to the gold crystal, which is observed in the form of vibrations of gold crystal atoms around their axes. At E_0= 400 eV, the argon ion penetrates into the crystal, thereby transferring part of its energy to the crystal. This leads to stronger vibrations of the gold atoms. It also enhances the spraying of water molecules and their clusters. Using the VMD program, it is possible to observe the process of spraying the ice film. The results obtained are of great interest in the study of cleaning metal surfaces from different types of molecules.

Keywords: *cluster, spraying, computer modelling, ion bombardment, molecules.*

Introduction

The sputtering of molecules and clusters from metal surfaces is a process in which particles (atoms, molecules, or their aggregates) are removed from the metal surface under the influence of external factors such as ion bombardment, thermal effects, or plasma processes. This mechanism plays an important role in materials science, nanotechnology, microelectronics, and other fields [1-5].

The sputtering of molecules and clusters from metal surfaces is a complex process that depends on the mechanism of action (ion, thermal, plasma) and environmental conditions (vacuum, gas atmosphere). It is used in the creation of coatings, nanomaterials, and microelectronic components. Further development of technologies is associated with improving the accuracy of cluster parameter control and optimising sputtering methods [6-7].

This work investigates the process of ice film deposition covering the surface of gold when bombarded with argon ions.

Literature Review

This study utilised molecular dynamics methods. The molecular dynamics (MD) method is actively used to model surface sputtering processes, especially under the influence of ion bombardment. This approach allows studying the mechanisms of erosion, defect formation, clustering, and secondary particle emission at the atomic level [8-9].

In the process of surface sputtering modelling, ions (Ar^+, Xe^+, etc.) with different energies (from tens of eV to several keV) are used. The ejection of target atoms, the formation of collision cascades and the formation of craters are analysed. Predictions of the energy spectra and flight angles of secondary particles (atoms, clusters) are

given. The advantages of this method are as follows: - Atomic resolution and the ability to study non-stationary processes;

- Flexibility in the choice of interaction potentials (e.g., Tersoff, EAM, ReaxFF);
- Computational cost for large systems (>1 million atoms) and long time scales (>nanoseconds);
- Dependence of results on the choice of interparticle interaction potentials.

MD simulations complement experiments, helping to optimise the parameters of material processing with ion beams. For greater accuracy, they are often combined with Monte Carlo methods (e.g., SRIM/TRIM) [11-12].

Now we will describe the interaction potentials for this target and ion. H_2O-H_2O interaction potential, we use the simple-point-charge (SPC) water potential. In the SPC model, the molecular interaction potential Uinter consists of an electrostatic component Uelectrostatic describing the charge-charge interaction between pairs of atoms in the two molecules. In order to describe the dispersion and repulsive interactions between the two oxygen sites, a Lennard-Jones function, ULJ is included. The Au-Au interactions are represented by the MD/Monte Carlo corrected effective medium (MD/MC-CEM) potential function for fcc metals. For metal-water systems, a potential developed by Spohr has been used. The Spohr potential consists of a Morse function combined with a corrugation term defining various surface sites for the oxygen-surface interaction and a repulsive term for the hydrogen–surface interaction. For our calculation, we used a modified Spohr function.

Research Methodology

The study employed molecular dynamics (MD) simulations to investigate the sputtering of a six-layer ice film on an Au(111) surface under Ar^+ ion bombardment with energies of 200 eV and 400 eV. The simulations utilized:

- ❖ Interaction Potentials:
  - H_2O-H_2O interactions: Simple Point Charge (SPC) model, combining electrostatic and Lennard-Jones potentials.
  - Au-Au interactions: MD/Monte Carlo Corrected Effective Medium (MD/MC-CEM) potential.
  - Au-H_2O interactions: Modified Spohr potential, incorporating Morse and repulsive terms.
- ❖ Simulation Setup:
  - A gold crystal (Au(111)) covered with six layers of ice.
  - Ar^+ ions bombarded the surface at 200 eV and 400 eV.
  - The VMD program visualized the sputtering dynamics.
- ❖ Analysis:
  - Tracked sputtering of water molecules and clusters.
  - Observed ion penetration depth and energy transfer.
  - Monitored atomic vibrations in the gold substrate.

This approach provided atomic-level insights into the sputtering mechanisms and energy dissipation processes.

Analysis and Results

We observed the process of sputtering of six layers of ice covered with a gold crystal surface through the VMD program. The time-varying process of the process at the target is shown in Figure 1 when the six layers of ice on the surface of Au(111) at the bombardment by Ar^+ ions with an initial energy of 200 eV. The target is quiet when t=0 fs. After T=200 fs from the collision, water molecules begin to pollinate from the ice layer. we see that when T = 2200 fs, the thin layer continues to be pollinated, and at the point where the ion is hit, the number of water molecules decreases. But we observed that when t=3000 fs, water molecules began to close the open sphere again. It should be said that at this value of the initial energy, small fluctuations in the atoms of the gold crystal were observed only.

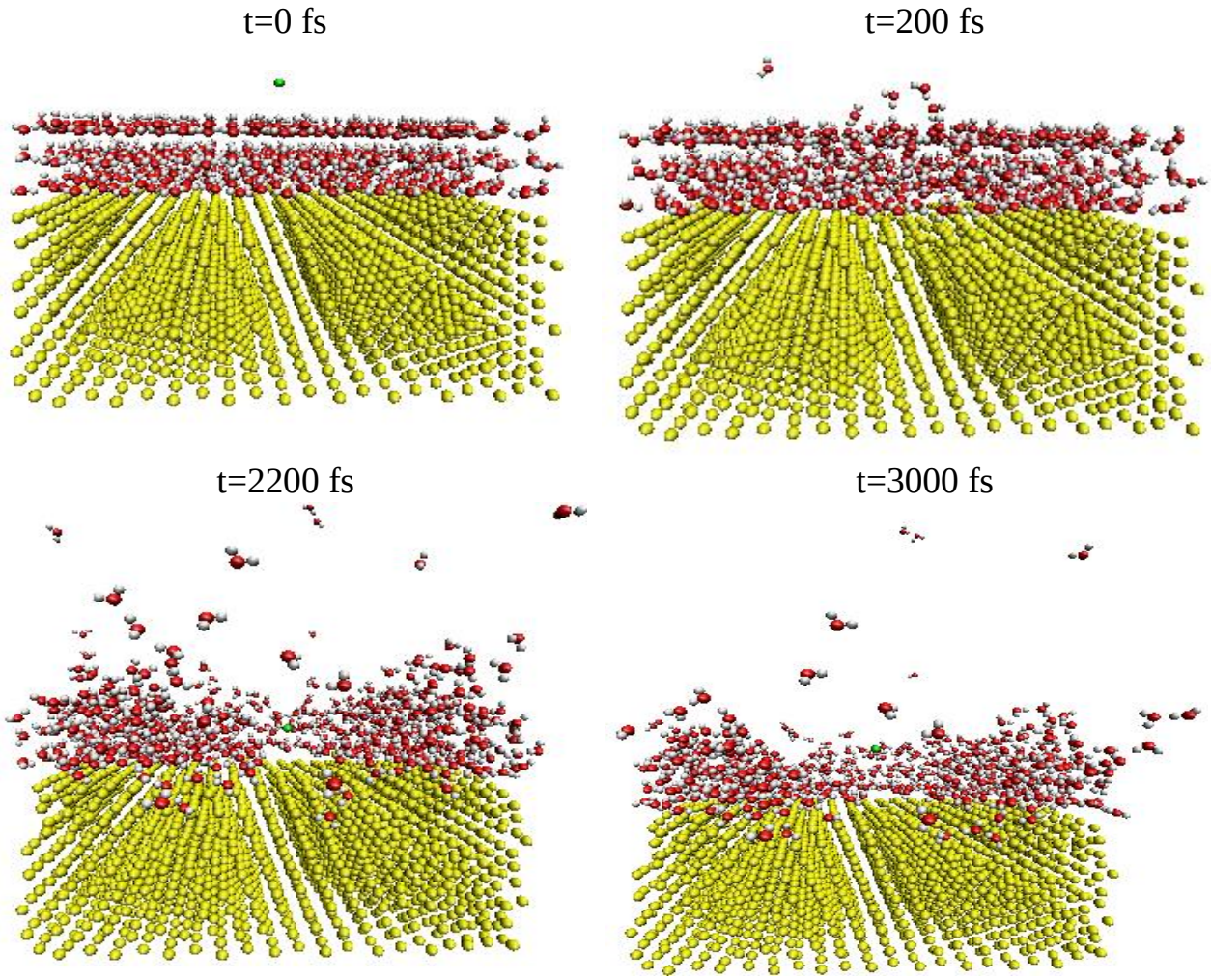

Figure 1. Time dynamics of the state of the Au(111) target with six layers of ice during bombardment with Ar^+ ions with an energy of 200 eV.

Figure 2 presents a time-varying process of the process at the target when six layers of ice on the surface of Au(111) at the bombardment by Ar^+ ions with an initial energy of 400 ev. From this picture it can be seen that the sputtering of water molecules began to be observed when t=150 fs was around. There was not much distortion observed in the ice sheets. During this time, the Ar^+ ion, which boibardimonizes the surface, penetrated 3-4 layers of the golden crystal. The ion displaces the atoms in the golden atomic row in its direction of decay. At t = 450 fs, the ice sheet of the ice sheet was broken, the molecules were advanced and circular, the center of the gold crystal began

to break, and one gold atom was knocked out from the side. The Ar^+ Ion was unable to return from within the gold crystal. As a result, the vibration of atoms in the gold crystal continues. when t=1950 fs, a small cluster made up of water molecules can be seen pollinated from the surface.

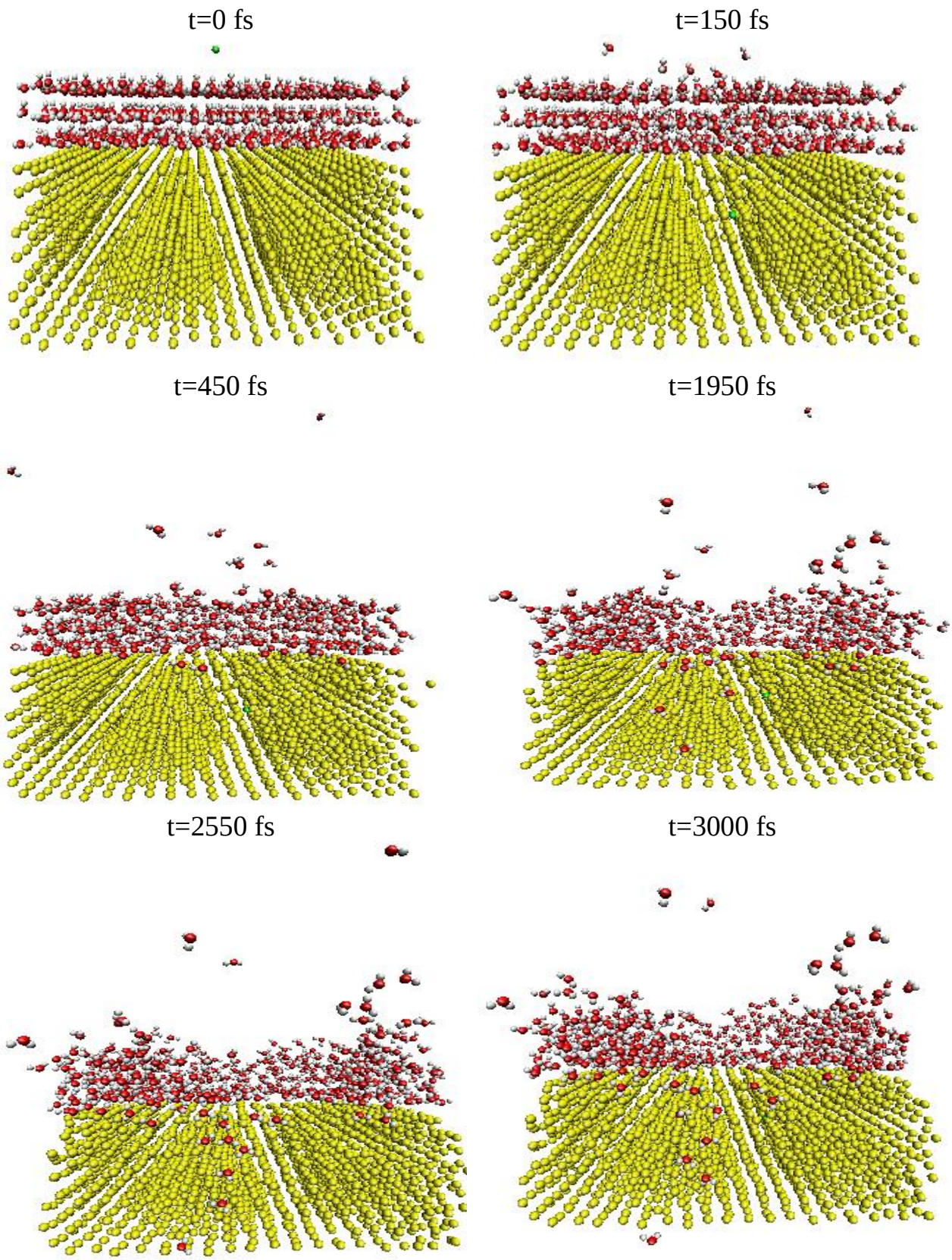

Figure 2. Time dynamics of the state of the Au(111) target with six layers of ice during bombardment with Ar^+ ions with an energy of 400 eV.

By the time, the vibration of the atoms of the gold crystal was even more intense. At the point where the Ion struck, however, a partially open space was created. At t=2550 - 3000 fs, water molecules began to decay to the point where the ion hit, and a small open area began to close. The oscillation of the atoms of the gold crystal increased, but the oscillations only occurred around their axis.

Conclusions

We investigated the sputtering of ice films covering the surface of Au(111) with six layers during bombardment with Ar^+ ions. The sputtering of ice films during bombardment with initial energies of 200 and 400 eV was obtained and analysed. It was shown that at E_0 = 200 eV, the argon ion could not penetrate into the gold crystal. It remains in the ice film. When the film is bombarded, sputtering of the ion impact site is observed, and molecules and their clusters fly off in different directions from this impact point (towards the vacuum, along the edges of the crystal target). At E_0=400 eV, the argon ion penetrates into the crystal and remains there. It should be noted that in this case, the proportion of molecular cluster sputtering increases.

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COSTUME OF SOGDIANA AND BACTRIA IN CENTRAL ASIA

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Annotatsiya. Maqolada markaziy Osiyoda So‘g‘diyona va Baqtriya kostyumi paydo bo‘lishi o‘rganilgan. O‘zbek an’anaviy liboslarining eng qadimgi mezolit davriga oid tasvirlari va Kushon davlatidan Amir Temur davri hamda XIX-XX asrgacha o‘zbek xalqining turli kiyim va matolardan foydalanish tarixi tahlil etilgan.

Kalit so‘zlar: *libos, kiyim, milliy, an’anaviy, madaniyat, madaniy meros, ijtimoiy-ig‘tisodiy, urf-odat.*

Аннотация. В статье появление Согдийского и Бактрийского костюма в средней Азии. Древнейшие мезолитические изображения узбекской традиционной одежды и Кушанского государства. Проанализирована история использования различных видов одежды и тканей узбекским народом в период Амира Тимура и до XIX-XX веков.

Ключевые слова: *платье, одежда, национальная, традиционная, культура, культурное наследие, социально-экономическая, традиция.*

Abstract. In the article, the appearance of a Sogdian and Bactrian costume in Central Asia. The earliest known depictions of Uzbek traditional robes are from the Mesolithic period and from the Kushan State. The history of the use of various clothing and fabrics of the Uzbek people was analyzed during the Amir Timur period and until the XIX-XX centuries.

Keywords: *dress, dress, National, Traditional, Culture, Cultural Heritage, socio-economic, customs.*

Introduction

From the end of the 2nd millennium BC to the beginning of the 2nd millennium BC, the major slave states of Bactria, Sogdians, and Khorezm emerged in Central Asia. Among the Afrasiabi finds, the figurines of *chakmon*, a long-sleeved boot, wearing a pointed headdress, hanging ornaments from precious mines around the neck, draw our attention [1-6].

One of the original masterpieces of the ancient cultural heritage of the peoples of Central Asia and Iran, this is the sacred book "Avesto." "Avesto" is the Holy Book of Zoroastrian religion, the buds of this religion appeared in the era of the primitive community. Zoroastrianism was prevalent in Central Asia during slavery and early feudalism as a major religious belief. Zoroastrianism survived for several years even in the early days of the introduction of Islam in these lands. "Avesto" is not only a religious book, but also a great resource in the study of the long centuries of history, socio-economic life, language, writing, and artistic culture of many countries. The essence of Zoroastrianism is based on the confrontation between good and evil, between good and evil [1, 7-10].

Literature Review

During the Kushan Empire, Buddhism was introduced to Central Asia from India. Buddhist temples erected in the cultural centers of the Empire are characterized by being decorated with contemporary art. Although Buddhism became an ideology by the Kushan state, in fact, this religion did not receive much attention.

The earliest depictions of Uzbek traditional robes can be seen in Zarautsoy rock reliefs from the Mesolithic period. The images show that the ancient people used dresses made of natural leather, in the form of a closure that was thrown over the shoulder. But the accelerated course of life freed the place of natural leather to woven fabrics. According to records, early types of clothing appeared in the 3rd –2nd millennia BC, and the robes consisted mainly of a short shirt with a collar as well as a shalwar with a mouth.

The women's dress was also unusual in that it consisted of a long and wide-sleeved shirt with a skirt decorated with silences, on which the upper part of the waist would stick. Women, like Good Men, wore sleeveless clothing on the shoulder, and a belt was worn on the waist. Soft leather was used to make women's shoes. The headdress, on the other hand, mentioned The Shape of the crown and had a long cloak on the back. Women used a variety of beads when decorating, not only in dresses, but also in hair styling. Also, bracelets made of gold from jewelry, gold earrings, and rings were counted as decorative items for women.

The introduction of the Great Alexander into Central Asia led to the development of Hellenistic art. This process can also be seen in dresses. Ellin's fashion began to manifest itself in more noble dresses. In particular, it was customary to wear floral clothes, such as khiton, gimatia [2, 11-15].

Research Methodology

By the Kushan period, several types of art could be observed, including ancient Oriental, Hellenistic, Indian art, and the inter-fusion of the cultures of Indigenous and nomadic tribes. This harmonization is also observed in male and female dresses. Now

men's jackets are sewn so that they are pinned with buttons. Almost no change is felt in the headdresses, which still look peaked, but it is penetrated by the urph of decoration of various decorations. The dresses of the representatives of the upper class are decorated with sequins. In women's dresses, it was customary to wear a cover, which they mainly threw on their shoulders or heads. The closed edges are decorated with beads. While the local people mainly used fabrics with patterns, the mountain people wore leather and wool.

The Arab invasion led not only to art and culture, but also to a whole change in the appearance of the robe. Dresses began to develop in accordance with the concepts of the Islamic religion. During this period, the dresses took on the tone of simplicity, and everything else was carried out according to the rules of the Islamic religion. White was considered the color of the dress of the inhabitants of paradise, and men were allowed to wear clothes that were mostly colorless, that is, white. Women's clothing was also considered mandatory to wear clothes typical of simplicity, giving up bashfulness and ornaments. As a result of the introduction of Islam, a turban wrapper is also included in the men's headdress.

Analysis and Results

By the time of Amir Temur, every form of art and culture had developed. He paid special attention to the types of Applied Arts, including dress culture. During this period, the demand for expensive fabrics increased even more. For the nobility in the palace, such fabrics were specially made. Dresses were formed mainly on the basis of the synthesis of Turkish, Persian, Chinese, Mongolian, and new styles of dresses were developed. In the style of new dresses, shawls, rich in *sherkhasham* and decor, floral and embossed fabrics, and belts rich in decor were included [3, 10].

The groom's dress is relatively simpler, with a white shirt and a wide-brimmed drawers made of white fabric, a cape on the head, and a turban made of white fabric. A waistband was also attached to the collar, and leather shoes or boots were worn on the legs. While this was certainly practiced as a characteristic of the townspeople, the villagers or other representatives of our nation wore special embroidered doppelgangers instead of a turban, based on subethnic and regional characteristics, and performed festivities regardless of any season of the year.

The second half of the 19th century and the beginning of the 20th century occupy a key place in the emergence of a new wave of our national clothes. Because in the second half of the XIX and early XX centuries, the textile and decorative applied art of Uzbekistan was also widely developed. There were objective and subjective reasons for such a development, of course. First, after the conquest of our territory by Tsarist Russia, tsarist officials and merchants began to establish the construction of cotton ginning plants in our country, albeit on primitive grounds, in order to further increase profits. As a result, fabrics began to be widely produced from cotton fibers, which reflected our national characteristics. On the other hand, as a result of the wide circulation of trade and social relations and the import of "farangi goods" from the markets of European and Asian countries by merchants, textile art and decorative applied art began to develop [4, 15-17].

In particular, N. Sadiqova gives the following opinion: “Russian factory owners, conspiring with merchants trading with the regions of Central Asia, diligently trying to produce gaskets to the taste of the local population, escalated the struggle to gain an advantage in the markets here.” As a result, in our local markets, along with satin, adras, silk, and immaculate, velvet, and other fabrics began to multiply, attracting the attention of the people. Of course, any fabric that appears on the market must first be molded in the EGN of our women in order to ensure its popularity, value, and reconciliation. This has been the case at all stages of socio-historical times. In this way, along with clothes made from local fabrics, clothes made from “firangi” fabrics adapted to local conditions also began to become a tradition and find a decision as an integral part of our national dress culture.

Also, according to the scientist, “it became a painting among Uzbeks at the end of the 19th and beginning of the 20th century to wear clothes made mainly of factory yarn fabrics: chit, Boz, kolenkor, raw surup. And the rich began to sew clothes from kimkhob, silk, satin, velvet, rango-colored blue” [5, 6-17].

Although a certain part of the clothing of that time was sewn at the expense of fabrics brought from foreign markets, our local dressmakers ensured the modern essence of national clothing in traditional ways passed down from generation to generation. Here, the continuity of the principles of historicism and succession became prominent in the cultural heritage, and the harmonious aspects of modernity with tradition began to manifest in our national dress culture. These facets are prominent as a contributing factor to the aspects of nationalism in our dress culture.

Conclusion

At each stage, the culture of dressing can have its own historical development, features. The level of socio–economic, spiritual, and cultural development of each period, as well as certain religious teachings, also influenced the culture of dress. The general conclusion is that every people, nation, were engaged in actions related to the elevation of the culture of dress: the production of new fabrics, decorations, and forms that serve human beauty, the invention of fashion. This process depended on the level of development of science, technology, art, and other socio–economic infrastructures in the historical development of society.

Since the culture of dress also constitutes one of the main aspects of our cultural values, it has taken an important place in promoting Uzbekistan by drawing attention to the peoples of the world as a determining factor in our national image.

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